

Chapter-2

Bhitarkanika: A Ramsar Wetland Site

As is well-known, Bhitarkanika does enjoy the status of Ramsar Wetland of International Significance with effect from 19th August 2002 (vide <http://www.ramsar.org/sitelist.doc>). The other Ramsar site of Orissa is the Chilika Lake, which has been declared so with effect from 1.10.1981. The Bhitarkanika is accorded with the Ramsar status for the unique features that its ecosystem possesses. The **Information Sheet on Ramsar Wetlands (RIS) dated 19th August 2002** has the following to say about Bhitarkanika-

-Name of wetland: BHITARKANIKA MANGROVES

-Geographical coordinates: 200 30' – 200 48' N Latitude and 860 45' – 870 03' E Longitude

-Elevation: (average and/or maximum and minimum): The general elevation above mean sea level is between 1.5 to 2 metres. Higher ground extends to 3-4 metres.

-Area: (in hectares): 65,000 ha.

Introduction

Located in the deltaic region of Brahmani and Baitarani on the northeastern coast of India, the Bhitarkanika Mangrove represents one of the finest remaining patches of mangrove forests along the entire Indian coast. With two and half decades of continued conservation measures this area has emerged as one of the well known wildlife sanctuaries and an important coastal wetland in the country that supports a wide variety of plants and animals. Apart from hosting the largest known sea turtle nesting beach in the world and the highest density of saltwater crocodile in the country, Bhitarkanika is a major breeding and wintering place for a multitude of resident and migratory waterbirds and is the east coast's major nursery for brackish water and estuarine fish fauna.

Justification of the criteria for Ramsar site:

* The Gahirmatha beach, which forms the eastern boundary of Bhitarkanika Wildlife Sanctuary, supports the largest known nesting beach of Olive Ridley Sea Turtle in the world. Olive Ridley Sea Turtle (*Lepidochelys olivacea*) is an endangered species according to the IUCN Red List. Nearly half a million olive ridleys nest every year at Gahirmatha. Besides, the coastal waters off Gahirmatha is a major mating area for the olive ridley sea turtle, that migrate to this coast every winter. (Dash and Kar, 1990). Bhitarkanika supports the highest density of endangered saltwater crocodile (*Crocodylus porosus*) in India. Nearly 700 Saltwater Crocodile (*Crocodylus porosus*) inhabit Bhitarkanika and its associated river systems (Kar and Patnaik, 1999). The wetland also supports Grey Pelican (*Pelecanus philippensis*) which is a vulnerable species according to IUCN Red List.

* Bhitarkanika represents one of the largest contiguous patches of mangrove forest in the country, representing the Indo-Malayan mangrove community (Banerjee and Rao, 1990). The avifauna of Bhitarkanika is diverse. Pandav (1997) reports the existence of 174 species of birds in Bhitarkanika of which 82 species have been recorded to breed here. There has been further addition to this list in recent years. The mangrove forests and its adjoining wetlands support large number of resident as well as migratory waterfowls. 57 species of waterfowls have been recorded to winter in Bhitarkanika (Pandav, 1997). One of the largest heronries in the country is located in Bhitarkanika. More than 20,000 birds consisting of 11 species nest in

this heronry in Bhitarkanika during June to November every year (Subramanya, 1996; Pandav, 1997).

* A total of 79 water bird species have been recorded from the area. According to Asian Waterfowl Census record, the Bhitarkanika area regularly supports 30,000 birds with the numbers touching a high of 50,000 in year 1995 (Pandav, 1997; Lopex and Mundkur, 1997).

* Bhitarkanika mangroves is the major breeding and nursery ground for estuarine and brackish water fish; arthropod and mollusc fauna along the east coast of India (Chadha and Kar, 1999). It provides the locals employment or revenue from tourism and its natural resources, especially fish, honey collection, other Non Timber Forest Produce and firewood (Chadha and Kar, 1999).

Features of Bhitarkanika

The Bhitarkanika Mangroves are located in the deltaic region of Brahmani and Baitarani rivers in the Kendrapara district of Orissa. The Bhitarkanika Wildlife sanctuary is situated near the former port, Chandabali, which is about 50 km from the Bhadrakh railway station.

- **Physical features:** (e.g. geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate). The Bhitarkanika mangroves are in the deltaic region of Brahmani and Baitarani river in the state of Orissa along the Bay of Bengal of which the most protected and representative area is the Bhitarkanika Wildlife Sanctuary. The natural boundaries of the sanctuary are rivers and Bay of Bengal. The sanctuary is bounded by rivers Dhamara to the north, Maipura to the south, Brahmani to the west and the Bay of Bengal in the east. The 35 km coast line from the mouth of river Maipura till Barunei forms the eastern boundary of the sanctuary. The rivers Baitarani and Brahmani after meeting together near Dangamal flow into the Bay of Bengal at Palmyra point under the name of Dhamra estuary. The river Pathsala, a tributary of river Brahmani produces two main distributaries, Kanika and Baunsagarha, and enters the sea to form the Maipura estuary in the north east part of Kendrapara district. The estuarine region of Bhitarkanika can be divided into two parts: an outer funnel shaped region known as euestuarine zone and a narrow inner region known as inner estuary or river part. The habitats of the two parts are distinctly separated with the changing effect of interacting environmental factors and degree of protection from the Bay. The sanctuary is interspersed with numerous rivers, creeks and creek lets. The area is influenced by heavy alluvial silt brought down by the rivers and deposited in the deltaic areas due to regular tidal inundation. The entire area is further influenced by high detrital content of the tidal material resulting from fallen mangrove leaves. The soil is clayey loam with sand, overlaid by rich humus layer. The mosaic of rivers and creeks are influenced twice daily both by high and low tides at approximately six hours interval. The tidal level varies from the outer estuarine part towards the inland areas according to lunar cycle and is also subjected to wide seasonal variation. The climate of the area is tropical. In general there are three main seasons prevalent in this region. Summer begins from February and extends up to June. The rainy season usually starts in June and extends upto October. November to January is the winter season. The annual rainfall ranges from 920 to 3000 mm. and the main rainy months are August and September. In winter the temperature dips down to 10° C minimum and in summer the maximum temperature reaches up to 40° C. Wind velocity becomes 40 km per hour during the monsoon which ranges between 15 to 25 km per hour in winter. The area is prone to severe cyclonic storms twice almost every year during April to May and October to November and also, there are occasional tidal bores. The humidity of the area varies between 35 to 95%.

- **Hydrological values:** (groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.)

The Bhitarkanika mangroves along the north eastern coast of India plays a key role in protecting the area and the human habitation adjoining it from devastating cyclones and tidal surges. The dense mangrove forests along the coast slows down the force of tidal surges thereby protecting life of millions of coastal inhabitants. Mangroves help in accretion of land. They stabilise newly formed mud and silt deposits near river mouth. Mangrove vegetation restricts and slows down erosion process on tidal river banks. The trees well equipped with deep root system, pneumatophores, knee and stilt roots reduce the high wave and tidal current action. Mangroves have also been useful in treating effluent, as the plants absorb excess nitrates and phosphates thereby preventing contamination of near shore waters.

- **Ecological features:** (main habitats and vegetation types)

The Bhitarkanika mangroves comprise of a wide variety of habitats ranging from the tidal rivers and creek to riverine islands, coastal wetlands and inter tidal zones. The low lying mangrove forests of Bhitarkanika is subjected to regular tidal inundation twice daily. Bhitarkanika has a wide network of tidal rivers and creeks. The riverine islands within the mangrove reserve are favourite roosting sites of wintering water fowls. The coastal wetlands along the eastern boundary hosts a large number of migratory water fowl during winter. These are open wetlands and are influenced by monsoon rain and regular tidal inundation. The intertidal zones near mouth of rivers Maipura and Dhamra hosts a wide variety of residents as well as migratory wading birds. The vegetation of Bhitarkanika is broadly classified into (i) mangrove formation and (ii) salt bush formation (Choudhury, 1990). The salt bush formation is found along the littoral tract of Satbhaya and Gahirmatha sea shore where the soil is sandy and is not subjected to inundation. The coastline here is characterised by sand dunes reaching upto 70 - 80 ft high. Principal vegetation on these dunes includes *Ipomea pescaprae*, *Hydrophylax maritima*, *Spinifex littoreus*, *Launaea sarmentosa* and *Gisekia pharnaceoides*. Another notable vegetation on these sand dunes is extensive Casuarina plantation. Mangrove formation in the sanctuary has been classified into two categories: (1) vegetation of the Euestuarine bank and (2) vegetation of the inner estuarine bank (Banerjee and Rao, 1990). The outer estuarine bank vegetation is found near the mouth of Dhamara and Maipura rivers. Plants in the outer estuarine region are subjected to high salinity and wave action. *Avicennia marina*, about 10 m tall with compact crown is very common and characteristically forms a pioneer tree stand along the lower inter tidal zone of euestuarine bank. *Sonneratia griffithii* with widest trunk is found at low gradient mud flats along the lower inter tidal zone in mixed association with *Avicennia alba*, *Bruguiera parviflora*, *B.cylindrica* and *Aegialitis rotundifolia*. These species with increased water storage mechanism in their leaves, tolerate high saline conditions and are found more commonly along the central part of the funnel shaped euestuarine bank. *Sonneratia griffithii* and *S. alba* form the top canopy in this area. The second canopy is formed by *Avicennia alba*, *Lumintzera racemosa*, *Ceriops tagal* and *Bruguiera cylindrica* and the third canopy is formed by *Aegialitis rotundifolia*, *Bruguiera parviflora* and *Phoenix paludosa* (Banerjee and Rao, 1990). The inner estuarine bank is strongly dissected by several creeks and creek lets. The force of the sea surf is broken due to the presence of several creeks and the vegetation here is subjected to moderate salinity. These conditions make favourable habitat for many mangrove species and the flora is rich and diversified in this region. The dominant mangrove species in this region are *Avicennia officinalis*, *Sonneratia apetala*, *Excoecaria agallocha*, *Heritiera fomes*, *Heritiera littoralis*, *Kandelia kandel*, *Xylocarpus granatum*, *X. molucensis*, *X. mekongensis*, *Rhizophora mucronata*, *R. apiculata*, *Aegiceras corniculatum*, *Merope angulata* and *Cerbera manghas*. Pure formations of many of these tree species occur in the inner estuarine bank

- **Noteworthy flora:** (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.)

58 species of mangroves have so far been recorded in India of which 55 are found in Bhitarkanika (Bannerjee and Rao, 1990). Compared to the Sunderbans, India's largest tract of mangrove forest, Bhitarkanika represents a wide diversity of mangrove flora. The *Heritiera* formation of Champion and Seth (Type 4B/TS-4, 1968) comprising the brackish water association of *Heritiera*, *Cynometra*, *Aglaia*, *Cerbera*, and *Intsia* is not found in the present Sunderbans of Indian territory but are well represented in Bhitarkanika. *Rhizophora stylosa*, *Sonneratia griffithii* and *Heritiera littoralis* have been recorded new for Indian mangroves from Bhitarkanika (Bannerjee and Rao, 1990). This association is unique only to Bhitarkanika mangroves. In Bhitarkanika a variety of wild rice (*Potresia coarctata*) grows abundantly in tidal mud flats. Based on the genetic strain of this wild rice several saline and flood resistant varieties of rice have been developed. This has led to a tremendous economic impact making it very important.

- **Noteworthy fauna:** (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

- Bhitarkanika harbours one of the largest populations of endangered saltwater crocodile (*Crocodylus porosus*) in India and is globally unique in that 10% of the adults exceed 6 m length. Nearly 700 saltwater crocodiles inhabit the rivers and creeks of Bhitarkanika today (Kar and Pattnaik, 1999).

- The eastern boundary of Bhitarknika supports the largest nesting ground of the endangered olive ridley sea turtle in the world (Bustard, 1976). Nearly half a million olive ridleys on an average nest every year along the Gahirmatha coast of Bhitarkanika (Dash and Kar, 1990).

- The water monitor lizard (*Varanus salvator*) otherwise rare in most part of India, commonly occurs here. Besides water monitor, two other species namely common (*V. bengalensis*) and yellow (*V. flavescens*) monitors are also sympatric here (Biswas and kar, 1981). Notable among other reptiles of Bhitarkanika are king cobra (*Ophiophagus hannah*), Burmese python (*Python molurus bivittatus*), banded krait (*Bungarus fasciatus*), common krait (*Bungarus caeruleus*) and golden tree snake (*Chrysopelia ornata*).

- Extremely high congregations of migratory waterfowls are observed in the coastal wetlands around Satbhaya village and in the Bhitarkanika forest block of the Sanctuary during December and January. The mangrove forests of Bhitarkanika harbours one of the largest congregation of breeding water birds in the country (Subramanya, 1996). Eleven species of Ciconiiformes are known to nest in this multi species nesting colony (Pandav, 1997). The breeding birds in this mixed species colony are Asian Openbill (*Anastomus oscitans*), Great Egret (*Casmerodius albus*), Intermediate Egret (*Mesophoyx intermedia*), Little Egret (*Egretta garzetta*), Cattle Egret (*Bubulcus ibis*), Grey Heron (*Ardea cinerea*), Purple Heron (*Ardea purpurea*), Black-crowned Night Heron (*Nycticorax nycticorax*), Little Cormorant (*Phalacrocorax niger*), Darter (*Anhinga melanogaster*), and Blackheaded Ibis (*Threskiornis melanocephalus*). The endangered Lesser Adjutant Stork (*Leptoptilous javanicus*) also breeds in Bhitarkanika. Six species of kingfishers, Black-capped (*Halcyon pileata*), White-breasted (*H. smirnensis*), Brownwinged (*H. amauroptera*), Collared (*Todiramphus chloris*) Common (*Alcedo atthis*) and Pied (*Ceryle rudis*) are sympatric here. Bhitarkanika Wildlife Sanctuary has recently been identified as an important bird area (IBA) of the country.

- Bhitarkanika is also home for several mammals. Five species of marine dolphins have been recorded from the area. The commonest species encountered in this area is the Indo-pacific

humpbacked dolphin (*Sousa chinensis*). The other four species of marine dolphins that are found in the coastal waters off Gahirmatha are Irrawady dolphin (*Orcaella brevirostris*), Pantropical spotted dolphin, Common dolphin (*Delphinus delphis*) and Finless black porpoise (*Neophocaena phocaenoides*). Notable among the other mammalian fauna of Bhitarkanika are Striped Hyena (*Hyaena hyaena*), Fishing cat (*Felis viverrina*), Jungle cat (*Felis chaus*), Smooth-coated otter (*Lutra perspiciliata*), Common palm civet (*Paradoxurus hermaphroditus*), Small Indian civet (*Viverricula indica*), Indian Porcupine (*Hystrix indica*), Wild boar (*Sus scrofa*), Spotted deer (*Cervus axis*) and Sambar (*Cervus unicolor*).

- **Social and cultural values:** (e.g., fisheries production, forestry, religious importance, archaeological site, etc.)

- Mangrove ecosystems have traditionally been sustainably managed by local populations for the production of food, medicines, tanins, fuel wood and construction materials. Most of the villagers living around Bhitarkanika derive benefits from the mangrove forests in one way or the other. The entire fishing industry in the area that provides employment to local communities is dependent on the rivers and the coastal waters adjoining the mangrove forests. Some of the commercially important fishes found in Bhitarkanika are *Hilsa illisha*, *Lates calcarifer*, *Mystus gulio* and *Mullet sp.* The area is also an important source of prawn such as *Penaeus indicus* and *Penaeus monodon*

- The mangrove forests of Bhitarkanika is an important source of honey. Nearly 3,000 to 5,000 kg of honey is collected from Bhitarkanika every year during February to May (Chadha and Kar, 1990). A local community in this region known as 'Dalei' are specialised honey collectors and have been collecting honey for generations.

- Several plant species found in Bhitarkanika also provide direct employment to local communities. *Myriostachia wightiana*, a species of grass (locally known as Nalia) growing in the tidal banks and *Flagellaria indica*, a climber (locally known as Bahumurga) growing inside the mangrove forest are used for basket and rope making. Co-operative societies have been established in surrounding villages to market these products.

- *Phoenix paludosa*, a species of the family Palmaceae grows abundantly in Bhitarkanika. The shoot and leaves of Phoenix are widely used in the area for thatching purpose.

- Bhitarkanika mangroves harbour wild strains of Paddy, that is tolerant of long duration saline inundation and has significant genetic research value for the staple rice-eating community of eastcoast of India.

-**Land tenure/ownership of:** (a) site (b) surrounding area

(a) Site:

In the last millennium before India got its independence, Orissa was ruled by the local kings followed by Afghans, Mughals, Marathas and the British. During this period Bhitarkanika remained part of a kingdom ruled by Raja of Kanika. After Orissa fell to British East India Company on 03 August 1803, the kingdom of Kanika was recognised as a Jamindary under Aul State. Bhitarkanika continued to be a part of Jamindary of Kanika till November 1951. After abolition of Jamindaries, the forest areas of the estate were vested with the Government up to 15 November 1957 and remained under 'Anchal' administration, under the State Revenue Department. After that it was transferred to the exclusive control of the Forest Department to be managed by Athgarh Forest Division. Later on in 1980 Chandbali Wildlife Division was created and the forests were transferred to that division till it was shifted to

Rajnagar in 1991 and renamed as Mangrove Forest Division (wildlife) for administrative convenience.

(b) Surrounding:

A total of 29 demarcated forest blocks of which six classified as Atak jungle (Class I) and 23 classified as Rakshit jungle (Class II) were transferred to the forest department while Chhada jungle areas (Class III) remained under the control of revenue department. They have neither been surveyed nor transferred to the forest department. In 1961 “Kanika Forests” were notified as “Protected Forests” under section 29 of Indian Forest Act, 1927 (Notification No. 33233 dated 04.10.61 of the then Forest Development Department). As the Chhada jungle areas were not demarcated or reserved, number of them have been encroached and settled as revenue villages or hamlets, which have depleted or destroyed the mangroves in this area. These forests, rivers, creeks, water bodies and land between rivers Dhamra and Hansua in the then Cuttack district was declared as Bhitarkanika Wildlife Sanctuary on 22.04.1975 (Notification No.6958-4F(W)-34/78 FFAH dated 22nd April 1975) mainly for the protection of estuarine crocodile. Later a portion of this sanctuary was notified as a National Park in 1998 (Notification No. 1968/F&E dated 16.09.1998).

-Current land use: (a) site (b) surroundings/catchment

(a)Site

The extensive mudflats located between Dhamra river on the north, Brahmani river on the west, Hansua river on the south and Bay of Bengal on the east has about 150 sq km of dense mangroves, open mangroves and mangroves in various states of degradation due to heavy anthropogenic pressure. There are 307 villages and hamlets within the sanctuary limits. Paddy is the main agricultural crop occupying most of the village areas. Saline embankments have been constructed all along the major rivers to check tidal inflow and in the process the mangrove vegetation has been eliminated. Development of many aquaculture farms is a recent phenomenon taking advantage of the tidal water and unclassified land-tenures. These aqua-culture farms have made the lands hyper saline and have rendered them unsuitable for any vegetation or for that matter long time use for shrimp culture. Many creeks in this area have been dyked for pisciculture and also for creek irrigation.

(b)Surroundings:

The pressure on land has increased due to migration and settlement of people from West Bengal. This has resulted in settlement of new villages, which have been carved out of forest land. This has not only depleted the forests, on which pressure had already been mounting from all sides, it has put severe strain on land and fishery resources. Even there are pressure from non resident migrants, who shuttle between their own houses in West Bengal and this place. They come before the agricultural season, stay in camp houses and leave with their harvested paddy in large boats. The fertile soil of the area is a great attraction for them, where they get bumper harvest with little labour. Besides these migrant cultivators, large chunk of cultivable land in the area is owned by absentee land lords staying in places like Pattamundai, Aul and Kendrapara.

- Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects: (a) at the site (b) around the site

(a)Site

Bhitarkanika is surrounded by thickly populated and agriculturally prosperous alluvial flat land. This part of mangrove forest surrounded by rivers and criss-crossed creeks is very rich in aquatic life. Taking advantage of this people have moved in to this area in large number resulting in creation of new settlements and increase in population of the old settlements. The

ever increasing human population has been a major threat to this wetland resulting in the following disturbances:

- a. Construction of saline embankments for aquaculture and destruction of mangroves
- b. Clearing of the mangrove forest for agriculture.
- c. Intensive fishing activities in the peripheral river systems.
- d. Exploitation of mangroves for house construction, fencing and fuel wood.
- e. Poaching of wild animals.

Nearly two and half decades of successful conservation measures have resulted in an increased crocodile population in Bhitarkanika and its associated river systems. Along with the increase in human and crocodile population, and biotic interference in and around the park, has led to an increased man-crocodile conflict. So far, there have been 35 instances of human casualties in the area because of crocodiles (Kar and Patnaik 1999). Besides these casualties, there have been numerous accounts of attack both on human beings and livestock by crocodile in the area. There is also a growing feeling of over abundance of crocodiles in the area among the local communities. Of late, this successful conservation measure is becoming a victim of its own success resulting in an increased human crocodile conflict.

(b)Surroundings:

The wetlands adjoining the mangrove forests of Bhitarkanika harbour a sizeable population of migratory waterfowl in winter. However, many of these wetlands do not come under the jurisdiction of Bhitarkanika Wildlife Sanctuary and lack protected area status. With the recent change in land use pattern (evident after 1993) all along the Orissa coast, the coastal wetlands and the agricultural fields adjoining these wetlands are increasingly being converted into brackish water prawn culture ponds. Conversion of the coastal wetlands around Bhitarkanika Wildlife Sanctuary has resulted in a loss of wintering ground for the migratory waterfowl. The Asian Openbill, which constitutes a significant percentage of breeding birds in the heronry, feeds exclusively on molluscs *Pila globosa*, in the paddy fields surrounding the sanctuary. With the conversion of these paddy fields to prawn culture ponds, the Asian Openbills are facing a loss of their feeding grounds. This, in the future, may affect the breeding behaviour of these birds in the heronry and may be detrimental for the survival of Asian Openbills in the long run.

Conservation measures taken:

(National category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented).

The very first step towards conservation of Bhitarkanika has been its declaration as a wildlife sanctuary. Bhitarkanika is one of the earliest protected areas of Orissa being declared as a wildlife sanctuary in 1975. A separate wildlife division with headquarters at Chandbali was created in 1980 to effectively manage this area. The headquarters of the division later shifted to Rajnagar in 1991. The Gahirmatha Marine (Wildlife) Sanctuary on the eastern boundary of Bhitarkanika was notified in 1997. Bhitarkanika National Park was notified in 1998. Comprehensive Management Plan involving the Protected Areas and surrounds is now under preparation. While this is being done, specific species conservation measures have been initiated and are summarised below.

• **Saltwater crocodile conservation program:** Bhitarkanika was declared as a wildlife sanctuary primarily to protect its endangered saltwater crocodile population. In 1975 and integrated Government of India and FAO/UNDP project was launched to protect and restock the saltwater crocodile population in Bhitarkanika with Dr. H. R. Bustard as its Technical

Advisor. A rearing centre was established at Dangamal for this purpose. This has achieved tremendous success in rearing and rehabilitating the species and the population of estuarine crocodile in the wild is estimated to be nearly 700 (Kar and Pattnaik, 1999). Fishing has been completely stopped in Bhitarkanika River and associated creeks and the project has resulted in rejuvenation of large tracts of mangrove forests.

- **Sea turtle project:** The Gahirmatha coast which forms the eastern boundary of Bhitarkanika Wildlife Sanctuary harbours the largest known nesting population of olive ridley sea turtle in the world. After its discovery in 1974 (Bustard, 1976), the wildlife wing of the Orissa Forest Department established Gahirmatha Marine Turtle Research and Conservation Centre at Habalikhathi-on-sea near the nesting beach and took up study on the ecology and nesting biology of sea turtles. Immediately after the nesting beach came under protected area status, egg collection was banned and through the combined efforts of Orissa and West Bengal forest departments, the road and rail transport of sea turtles from Orissa was stopped.

- The death of olive ridley sea turtle because of intense fishing activities increased during later part of nineties and concerns were expressed from various quarters over this high sea turtle mortality. In order to provide adequate protection to the sea turtles in the coastal waters the Gahirmatha Marine (Wildlife) Sanctuary was notified in 1997 taking 20 km wide coastal stretch from south of Wheeler Islands spanning 35 km to the south. The sanctuary area is patrolled by Forest Department and Coast Guards and number of fishing vessels violating the Wildlife Protection Act, 1972 are being seized and prosecuted.

- **Mangrove conservation:** Although Bhitarkanika is the 4th largest stretch of mangrove forest in mainland India, the diversity of mangrove species is at its maximum in Bhitarkanika. This area has been included in the national mangrove network and has started receiving support from Government of India for its conservation. The “Kalibhanjdia Island” has been identified to be designated as the Mangrove Genetic Research Centre. Afforestation of depleted mangrove patches have started in different pockets after removal of encroachments due to prawn culture.

Conservation measures proposed but not yet implemented

(e.g, management plan in preparation; officially proposed as a protected area, etc.)

- Most important intervention required to save this magnificent wetland is to properly delineate the boundary of the diversity rich zones. At present the mangrove area encompasses large number of villages which clearly fall out side the forested areas. However, large tracts of forest lands still remain undemarcated, which requires to be demarcated and reserved. All protected reserve forests (PRF) once demarcated in the field and final notification of these PRFs announced will benefit management of the area. All newly accreted islands and mudflats needs to be declared as Reserve Forests. Settlement of all forest blocks should be completed within a specified time frame.

- Any part of the sanctuary where the mangroves have vanished or depleted due to anthropogenic intervention and creeks have been dyked need to be freed and planted up with suitable species of mangroves.

- A shift in house construction strategy, which do not need forest products for construction or repairs needs to be promoted. They need to be trained in the new technique of construction using local nonforest materials. Social and farm forestry needs to be encouraged in the surrounding villages for meeting the need of forest material without much dependence on mangroves. Eco-development initiatives to be taken up in a big way to reduce people's

dependence on the forest and wetland. Ecofriendly aquaculture need to be encouraged in the area to reduce the fishing pressure on the surrounding rivers. A regional policy on migration of people from other areas need to be developed to prevent further growth in migrating population in the region. Political and administrative will are crucial to prevent such inflow of people.

- Recent developmental activities on the periphery of the Bhitarkanika region has put tremendous pressure on this wetland. A moratorium in construction of roads, jetties and harbours in the sanctuary or its fringes to reduce their adverse impact, needs to be considered. Wherever they exist, movement of vehicles or number of mechanised boats should be properly regulated to minimise the disturbance.
- Tourism in the sanctuary need to be regulated in order to reduce pressure on particular patches. All arrangements to accommodate the tourists should be located away from the sanctuary and a proper eco-tourism plan for the park need to be developed.

Current scientific research and facilities:

(e.g., details of current projects; existence of field station, etc.)

- Ever since its establishment as a wildlife sanctuary, Bhitarkanika is in the focus of various research activities relating to the mangrove ecosystem and its function, vegetation of the mangroves, endangered animals inhabiting the mangrove forest and peoples dependency on the mangrove forest.
- Bhitarkanika was declared as a wildlife sanctuary in April 1975 primarily to protect the endangered saltwater crocodile from the brink of extinction. Because of poaching and loss of habitat the saltwater crocodile population in Bhitarkanika was reduced to a mere 35 adult and sub-adult individuals (Kar and Bustard. 1989). In 1975 the Government of Orissa established a saltwater crocodile research and conservation centre at Dangamal. Through the rear and release program nearly 2,500 crocodiles of 1m length have been restocked in Bhitarkanika and the present population is around 700 individuals of both size classes (Kar and Patnaik, 1999). The average density of crocodiles (other than hatchlings) in Bhitarkanika has increased from 0.87 individuals/km in 1976 (Kar and Bustard, 1976 and 1991) to 5.0 individuals/km in 1998 (Kar and Patnaik, 1999). The breeding population of saltwater crocodile in Bhitarkanika is well established now and more than 40 breeding females have been recorded in the area (Pandav, 1998).
- Along with the saltwater crocodile head start program, the Government of Orissa in 1976 established the Gahirmatha marine turtle research centre at Habalikhati to study the world's largest nesting population of olive ridley sea turtles. A long term tagging program was taken up by the Orissa Forest Department in 1977 and this programme has broadened our present knowledge on the sea turtles nesting at Gahrimatha (Dash and kar, 1990). The olive ridley nesting population at Gahiramtha was monitored by the Wildlife Institute of India between 1995 and 1999. Nearly 9,000 olive ridleys were tagged during this period and several of these tagged turtles have been recovered from the western coast of Sri Lanka.
- The most detailed botanical survey of Bhitarkanika mangroves has been carried out by the Botanical Survey of India, Calcutta and the result of this survey has been published in the form of a book (Bannerjee and Rao, 1990). The study by Bannerjee and Rao (1990) revealed the presence of 55 of the 58 recorded Indian mangrove species in Bhitarkanika. The mangrove plant community in Bhitarkanika is characterised by an abundance of species flowering from February to April, during which period there is a seasonal migration of bees

into the area. The pollination biology of some of the mangrove species have been studied by Pandit (1997).

- Research and monitoring has been a regular activity of the wildlife wing of the Orissa Forest Department in Bhitarkanika Wildlife Sanctuary. Some of the regular research activities of the wildlife wing in Bhitarkanika includes the annual census of saltwater crocodile, nesting olive ridley sea turtle at Gahirmatha and census of the colonial nesting birds in the heronry.

Miscellaneous Information

-Current conservation education: (e.g., visitors centre, hides, information booklet, facilities for school visits, etc.) The Bhitarkanika Protected Area Management has produced some information booklet about the area and attempts have been made to provide Visitor Centre and Interpretation Centre for environmental education related activities keeping general visitors as target groups.

-Current recreation and tourism: (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

There is a major influx of tourists to Bhitarkanika during winter and tourism during rest part of the year is moderate. The influx of tourists to the area has generated employment for local inhabitants. For recreation and tourism facilities of rest houses and Dormitory are available at Dangmal, Ekakula & Habalikhati.

-Jurisdiction: (territorial, e.g., state/region and functional, e.g., Dept. of Agriculture/Dept. of Environment etc.)

Territorial : Indian State of Orissa

Functional : Dept. of Forest & Environment, Govt. of Orissa

-Management authority: (name and address of local body directly responsible for managing the wetland)

Divisional Forest Officer

Mangrove Forest Division (Wildlife)

Rajnagar, Orissa

Sources:

- **Ramsar Site list** (<http://www.ramsar.org/sitelist.doc>)

- The **Information Sheet on Ramsar Wetlands (RIS) dated 19th August 2002**

- **Bibliographical references:** (scientific/technical only) found in the Information Sheet:

Banerjee, L. K. and T. A. Rao (1990). Mangroves of Orissa coast and their ecology.

Bishen Singh and Mahendra Pal Singh, Dehradun. 118 pages.

Biswas, S. and S. K. Kar (1981). Some observations on nesting habits and biology of *Vasamus salvator* (Laurenti) of Bhitarkanika Wildlife Sanctuary, Orissa. J. Bombay Nat. Hist. Soc. 78 (2):303-308.

Bustard, H. R. (1976). World's largest sea turtle rookery? Tiger Paper, 3:3.

- Chadha, S. and C. S. Kar (1999). Bhitarkanika: Myth and Reality. Natraj Publishers, Dehradun. 388 pages.
- Dash, M. C. and C. S. Kar (1990). Gahirmatha: The Turtle Paradise. Interprint, New Delhi, 295 pages.
- Kar, S. K. and H. R. Bustard (1989). Status of the saltwater crocodile (*Crocodylus porosus* Schneider) in Bhitarkanika Wildlife Sanctuary, Orissa, India. J. Bombay nat. Hist. Soc. 86 (2):141-150.
- Kar, S. K. and H. R. Bustard (1991). Rehabilitation of saltwater crocodile (*Crocodylus porosus* Schneider) in Bhitarkanika Wildlife Sanctuary, Orissa, India. J. Bombay nat. Hist. Soc. 88 (3): 395-399.
- Kar, S. K. and S. K. Patnaik (1999). Status, conservation and future of saltwater crocodile in Orissa. ENVIS (Wildlife and Protected Areas) 2 (1):24-28. Wildlife Institute of India, Dehradun.
- Lopez, A. and Mundkur, T. (eds.) 1997. The Asian Waterfowl Census 1994-1996. Results of the Coordinated Waterbird Census and an Overview of the status of Wetlands in Asia. Wetlands International, Kuala Lumpur.
- Pandav, B. (1997). Birds of Bhitarkanika mangroves, eastern India. Forktail 12: 7-17.
- Pandav, B. (1998). A survey of saltwater crocodile (*Crocodylus porosus*) nests in Bhitarkanika Wildlife Sanctuary, Orissa. Cobra 33:35-40.
- Pandit, S. (1997). Pollinator visitation and reproductive success in two species of mangrove plants, in Bhitarkanika Wildlife Sanctuary, Orissa. Dissertation submitted to Saurashtra University, Rajkot, in partial fulfilment of the Masters degree in Wildlife Science. Wildlife Institute of India, Dehradun.
- Subramanya, S. (1996). Distribution, status and conservation of Indian heronries. J. Bombay Nat. Hist. Soc. 93: 459-486.