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The Eastern Ghats

EPTRI - ENVIS Newsletter

Estuarine Ecology of Eastern Ghats


Mangroves


Coringa Mangroves


Rhizophora lamarckii, Pitchavaram


Mouths of Godavari & Krishna Rivers

Foreword

It was decided that we would bring out two issues of the Newsletter '*The Eastern Ghats*' on Estuarine Ecology. This issue, Vol.10, No.4, 2004 includes the second and final part of the article: 'Ecology and Biodiversity of Eastern Ghats – Estuaries of India' by Rajendran, N *et.al.* We are pleased to include an article: 'Coastal Follies and the Tsunami' by Ashish Kothari and Manju Menon. The issue also contains the article: 'Water Fowl Status at Coringa Wildlife Sanctuary, Andhra Pradesh' by V. Vasudeva Rao, *et.al*.

The stretch of Eastern Ghats from Orissa to Tamil Nadu , through Andhra Pradesh has numerous aspects of ecological importance. The endeavour, while bringing out the issues of this Newsletter, is to give importance to data gaps. Fragile eco-systems and hotspots of this broken mountainous terrain are important. Hence, an issue of this Newsletter would address this topic.

We take this opportunity to draw the attention of our readers to send us articles and news clippings on 'Fragile Ecosystems of Eastern Ghats,' the theme of our forthcoming issue.

ENVIS Coordinator

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Readers are.....

WELCOME to contribute articles to our Newsletter. The theme of our next issue is on "**Fragile Eco systems of Eastern Ghats**".

Note The views expressed in the article/s are of the Authors.

ENVIRONMENT PROTECTION TRAINING & RESEARCH INSTITUTE (EPTRI), HYDERABAD

Ecology and Biodiversity of Eastern Ghats - Estuaries of India

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The Article entitled "**Ecology and Biodiversity of Eastern Ghats - Estuaries of India**"is being brought out in Two Parts. The first part has appeared in the previous issue (Vol.10, No,.3, 2004). The second and the final part of this article is given hereunder.

Benthos

Eighteen species of polychaetes were recorded from the Rushikulya estuary. Nereids, glycerids and phyllodocids were found at the mouth (Nageswara Rao, 1992).

The distribution pattern of meiofauna could be related largely to the three main types of sediment composition namely, sandy, sandy clay and clayey sand substrata in the Gosthani estuary (Rao and Sarma, 1999). Twelve groups of meiobenthic organisms are present in Godavari and Krishna estuaries. Of these, nematode (90.5%) is the most dominant group followed by harpacticoid copepods (3.7%) (Murty and Kondalarao, 1987).

One hundred and twenty three species of polychaetes coming under 94 genera and 44 families have been identified from the Vellar estuary (Srikrishnadhas *et al.*, 1987).

First record of allogromiid foraminifers from coastal Indian waters was reported from the Vellar estuary and placed in a new genus *Vellaria* by Gooday and Fernando (1992). The macrofaunal density in the Coleroon estuary is maximal at the sites of moderate salinity, high primary production and high organic content of the sediment. Low density or total depletion of macrobenthos is associated mainly with the heavy river run-off and 'shifting' of bottom sediment (Patterson Edward and Ayyakkannu, 1992).

A total of 46 foraminiferal species belonging to 3 suborders, 16 families and 25 genera have been identified from the Araniar estuary. The lower estuarine region is characterised by poor foraminiferal species diversity and abundance of specimens and the upper estuary also has low foraminiferal census both in diversity and abundance (Reddy and Reddi, 1994).

Fouling organisms

The bryozoan population in the Vellar estuary increases during the summer and premonsoon seasons but declines towards the monsoon season. The stilt roots of *Rhizophora apiculata* are usually preferred by the bryozoans for settlement (Nair, 1991). In the Edaiyur – Sadras estuarine complex the fouling organism observed were polychaetes, barnacles, green mussels, oysters, brown mussels and algae. On the long-term panels, the observed maximum biomass of settlers was 103 g/dm^2 after 328 days, whereas on the short-term panels, it was 37 g/dm^2 in 17 days (Rajagopal *et al.*, 1990).

Wood-borers

Ten species of woodborers were collected from mangroves at ten stations in the Gautami - Godavari estuary. Teredinids, the pholad *Martesia striata,* two species and a variety of *Sphaeroma* were recorded. Of these *Sphaeroma annandalei* and the teredinids *Dicyathifer manni*, *Nototeredo edax*, *Lyrodus pedicellatus*, *Bankia campanellata* and *B. carinata* account for most of the destruction (Surendra Babu and Sasira Babu, 1986). *Sphaeroma terebrans, Sphaeroma anandalei* and *Sphaeroma walkeri* are the common settling species on wood and they all intensively settled during the summer and pre-monsoon periods in the Vellar estuary.

Molluscs

Crassostrea madrasensis was dominant forming 90% of the population followed by *Saccostrea cucullata* in Kandaleru estuary. The total oyster resource of the estuary was estimated at 88.7 t in this estuary. In Swarnamukhi, the oysters were found on the rocks and pillars of the road across the Buckingham canal, which is 1.5 km away from the mouth of the estuary. There are four small oyster beds about 2 km from the Konderu estuary mouth near the western bank. *Crassostrea madrasensis* was the only species recorded (Rao *et al.*, 1996).

The total stock of oyster *Crassostrea madrasensis* and *Saccostrea cucullata* in the Ennore estuary was estimated to be 14, 379 t. The annual shell-on oyster production from the estuary varied from 1.962 to 7.115 t (Rao *et al.*, 1996). The Uppanar estuary of Thirumullaivasal, *Crassostrea madrasensis* was distributed of 2 km from the bar mouth with the density of 300 sq.m^{-1}. The oyster resources of Vellar estuary have been estimated to be 456.9 t. Size of the oysters ranged from 27 to 123 mm with a mean size of 72 mm. In Agniyar estuary there was sparse population of oysters. The size of the oysters ranged from 70 to 116 mm with an average shell-on weight of 94 g and average meat weight of 5.8 g (Rao *et al.*, 1996).

The snail *Cerithium corellium* spawns from February to September in the Vellar estuary. Maximum fecundity is about 18,400 eggs in a single egg mass (Sreenivasan, 1990). Slowing down of the growth rate of *Cerithium cingulata* is observed due to attainment of maturity and subsequent breeding activity (Sreenivasan and Natarajan, 1992. The species *Meretrix casta* shows breeding activity during March-July (Balasubrahmanyan, 1993)

Prawn / Shrimp

Penaeus monodon alone contributed around 4 - 6% to the annual total fishery in the Godavari and Krishna estuaries

(Rajyalakshmi, 1991). Around 203 crore of prawn seeds are annually harvested from this estuary. The palaemonid prawns (*Macrobrachium rosenbergii, M. malcolmsonii, Palaemon tenuipes* and *Palaemon styliferus*) are confined to the lower saline zone of the estuary.

Seventeen species of commercially important shellfish species were recorded in the Vellar estuary. Among the shell fish the shrimp *Penaeus indicus* is the dominant species (Kathiresan and Rajendran, 2002).

Fish and Fisheries

The catch of *Chanos* fries was higher during the high tide than the low tide in the Rushikulya estuary. The peak occurrence of the fry recorded during August, September and April. The lowest catch of the fry is observed during December (5.66%). The occurrence of the fry throughout the year indicated its protracted breeding behaviour (Patnaik and Misra, 1990). Twenty-four species of fishes belonging to 22 genera and 13 families were collected from upper reaches of Vasishta - Godavary estuary near Narsapur (Mohapatra and Venkateswarlu, 1995). The fishery of Gosthani estuary is constituted by mullets, sand whitings, silver biddies, gobies, thread fins, glass fishes, cat fishes, tiger perches, king fishes and some miscellaneous groups. Of all these groups, mullets, silver biddies, sand whiting, threadfins and catfishes form the major part of the fishery (Rao and Sivani, 1996).

As far as the fishery in the Adyar estuary is concerned, the fish *Chanos chanos*, contributed to the maximum during May to July and November to December. The size of fish fries ranges between 15 and 75 mm. Grey mullet species *Liza macrolepis,L. parsia, L. tade* and *L. cunnesius* occurred throughout the year whereas *Mugil cephalus* was found only from December to March. Fry and fingerlings of pearlspot *Etroplus suratensis* and silverwhiting *Sillago sihama* were recorded in high numbers from August - November in Adyar estuary. The fry and fingerlings of other groups like *Allanetta* spp., *Gerres* spp., *Ambassis* spp., *Lutjanus* spp., *Sphyraena* spp., *Tachysurus* spp., *Thryssa* spp., *Rhynchorhamphus* spp., occurred in meagre numbers in most part of the survey period (Nammalwar *et al*., 1991).

The Vellar estuary is used as the nursery ground for fish fry and fingerlings of the cultivable finfishes. About 86 species of finfishes were reported in this estuary. The most dominant species are mullet groups (Kathiresan and Rajendran, 2002).

Conclusions

The industrial revolution and the expanding horizon of technological capabilities increase the human activities in judicially to the environment. Anthropogenic activities in the estuarine environment change the landscape of an ecosystem. In the absence of adequate facilities for the disposal of sewage are directly discharged into the estuaries. The industries, which border the estuaries, release considerable quantity of pollutants into the estuarine ecosystem, much above the permitted levels leading to the deterioration, decay and ultimate destruction of the ecosystem. Consequently the impact to the human race through bio-magnification could be an expected trend. Pesticides and chemical fertilizers used in agriculture and aquaculture increase vulnerability to diseases and genetic changes in the ecosystem. Dams and even reservoirs minimise the freshwater flow into the estuary and dredging the canals and creating access to waterfronts for promoting real estate have already permanently changed the nature and course of flow of water in some estuaries. Also the clearance of mangrove plants in the estuarine area leading to the soil erosion. Further, construction of reservoirs in the upper reaches block the anadromous fish migration. The concentration of pollutants also increases in the estuaries due to the insufficient flushing in the lower reaches.

Human activities, viz. changing the estuarine temperature (through industrial discharge), salinity (by pumping high saline and low saline water into the estuary) and increasing the nutrient load by discharging wastewater create stress on the estuarine ecosystem. Overfishing also leads to the imbalance of the ecosystem. While, the developmental activities in the estuarine environment, show the economic growth of the country, they also greatly affect the pristine purity of the estuarine ecosystem. Following options will help conserve this ecosystem for posterity:

- Understanding of the estuarine processes and their properties.
- Evolving a plan for reclaiming land and building barrages using the expertise of the estuarine scientists.
- To monitor the pollution threats then and there and inform the users and the managers.
- Sustainable management of estuaries for improving the biodiversity.
- Dumping of waste into the estuarine areas to be stopped.
- Strict action to be taken for discharging of untreated wastewater in to the estuarine areas.
- Technology improvement for wastewater treatment and purification of estuarine wastewater.
- Maintenance of minimum freshwater flow in the river for flushing.
- Creation of awareness about the importance for estuarine environment among the users.
- Judicious management of the estuarine resources with the co-operation of local people.

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Water fowl Status at Coringa Wildlife Sanctuary, Andhra Pradesh

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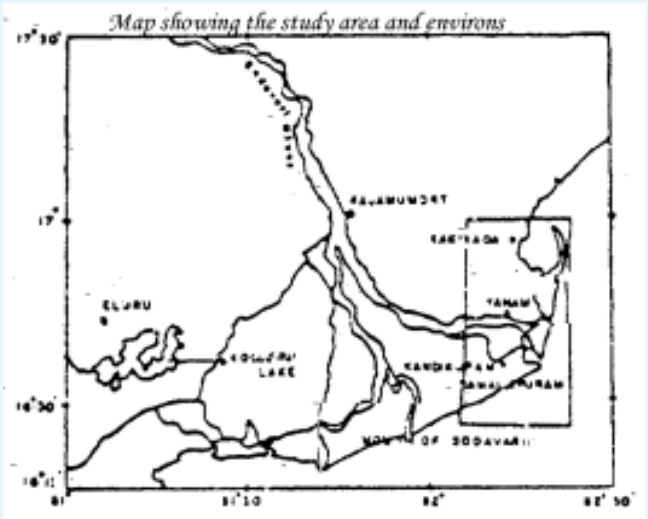
Ripley (1982) and Ali and Ripley (1983a) reported the avifauna of Indian subcontinent being represented by 2,094 forms belonging to 1200 species of which 19.9% (417 forms) belonging to 318 species (26.5%) of 146 genera are wetland birds (Vijayan, 1987). Ten Orders of 24 families represent the inland aquatic bird diversity, while in the case of estuarine habitats the numbers fluctuate with seasons and areas.

Avifauna studies in Andhra Pradesh have been widely carried out (Ali 1933a,b,c, 1934,a,b,1938; Ball, 1878, Koelz, 1947, Majumdar, 1981, Abdulali and Mathew, 1962, Abdulali, 1945, 1953, Bell, 1946, Ripley *et al.,* 1988a,b). Ecological studies of waterbirds from Andhra Pradesh are mainly restricted to Southeastern coast (Mohapatra and Rao, 1992, 1993, Rao and Mohapatra, 1993a,b, Nagulu, 1983, Joel *et al.,* 1994) and at a few scattered places (Johnson, 1992). The avifauna of Coringa Wildlife Sanctuary has not been studied in detail and the present paper deals with the status of avifauna of Coringa Wildlife Sanctuary with special emphasis on conservational aspects.

STUDY AREA

Coringa Wildlife Sanctuary is located 20 km (circa 15° 17' N & 76° 26' E) south of the port city, Kakinada; on the Kakinada-Yanam State Highway, nestled on the deltaic branches of Gouthami and Godavari rivers at Kakinada bay (Fig. 1). At its widest portion, the area is in east-west direction with a length of 30 km in the north-south direction. Approximately 50% of the area is backwaters in the northern half which includes a stretch of sand bar of 20 km in length, running in the north-south direction. Two rivers namely Coringa and Gaderu and their deltaic branches criss cross the entire region, which along with other water channels draining in them or directly into the sea, form an area of about 332.7 sq.km of marsh with vegetation. Of this, 235.70 sq. km of marsh primarily being wetland forest and mangrove scrub accounts the sanctuary. In addition to these major channels, a lot of creeks emanate to cris cross the entire marsh, thus ensuring water supply to the interior areas during high tides, which recede by draining at ebb tide. The mudflats in this region get submerged under 5 m of water during monsoon.



Map showing the study area and environs

Vegetation is basically of mangrove type. Venkatanna (1991), reported 12 mangrove species. 15 mangrove associated species and 9 halophytic species from the Godavari Estuary. Exclusive flora of the Sanctuary are *Aegiceras corniculatum, Avecennnia alba, Avicennia marina, Avecennia officinalis, Bruguiera gymnorrhiza, Ceriops decardra. Lumnitzera racimosa, Rhizophora apiculata, Scyphiphora hydrophyllacea, Sonneratia apetala, Sonneratia caseolaris, Xylocarpus granatum, Acanthus ilicifolius, Barringtonia acutangula, Caesalpinia nuba, Clerodendrum inerme, Dalbergia horrida, Derris trifoliata, Hibiscus tiliaceus, Ipomoea violacea, Salvadora persica, Cressa cretica, Sesuvium portulaca strum* and *Suaeda maritima.* Interestingly, *Hibiscus tiliaceus,* a malvaceous shrub is found nowhere except in this locality as an element of mangroves (Venkanna, 1991). Along the creeks *Avicennia* spp. and *Barringtonia acutangula* are found densely growing. Over exploitation of mangroves since last five decades (Raju, 1968) has. resulted in extensive damage to the overall habitat of this area, thus providing a large extent of mudflats.

The dominant fauna of Coringa Wildlife Sanctuary are common Otter *(Lutra perscipicillata)* and Estuarine Crocodile *(Crocodilus porosus).* Besides these, Fishing Cat *(Felis viverrina)* , Jackal *(Canis aureus)* and Sea Turtles are also commonly seen.

METHODOLOGY

Routine surveys were conducted over a period of five years *(1990-1995)* throughout the sanctuary. All observation were made walking along the mudflats, mangrove swamp, creeks and village vicinities using 7 X 50 and 8 X 40 binoculars. Advantage of high tides and low tides were taken regularly to monitor differential occurrence of waders and piscivorous birds. Identification was aided by standard guides such as, Ali (1981), Ali and Ripley (1983b), Sonobe and Usui (1993). Nomenclature of birds recorded is as given by Ali and Ripley (1983b).

RESULTS AND DISCUSSION

Avifaunal composition of Coringa Wildlife Sanctuary is represented by 236 species belonging to 16 Orders and 47 families (Table 1), Of the total, 19 species (8.05%) are abundant, 178 species (75.42%) are common, 26 species (11.01%) are occasional and 13 species (5.50%) are rare in occurrence. Status wise, 104 species (44.49%) are residents, 82 species (34.74%) are breeders, 43 species (18.22 species) are migrants and 80 species (37.28%) are winter migrants.

The largest Order present is Passeriformes with 17 families and 73 species, followed by Order Charadriiformes with 7 families and 59 species. All other Orders are represented by significant number of families and species (Table 2). Except Passeriformes and

Charadriiformes, Other Orders with high number of species representation are Ciconiiformes (21 species), Falconiformes (19 species), Anseriformes (17 species) and Coraciformes (9 species). Most abundant species recorded belonged to Order Ciconiiformes, while the most common species belonged to Orders Passeriformes, Charadriiformes, Anseriformes, Falconiformes, Ciconiformes and Galliiformes. Occasional sightings of 6 species belonging to Order Falconiformes and 5 species belonging to Ciconiiformes, Charadriiformes and Passeriformes each and rare sightings of 11 species belonging to Order Charadriiformes are notable.

WATER FOWL STATUS AT CORINGA WILDLIFE SANCTUARY

Table 1. Checklist of birds of Coringa Sanctuary

Order Podicipitiformes		
Family podicepididae		
1. Little Grebe *Podiceps ruficollis*	A	Res/B
Order Pelecaniformes		
Family Phalacocoracidae		
2. Indian Shag *Phalacocorax fuscicolfis*	C	LM
3. Little Cormorant *Phalacocorax niger*	A	LM
Order Ciconiiformes		
Family Ardeidae		
4. Grey Heron *Ardea cinerea*	A	
5. Purple Heron *Ardea purpurea*	C	Res/B
6. Little Green Heron *Ardeola striatus*	C	LM
7. Pond Heron *Ardeola grayii*	A	Res/B
8. Cattle Egret *Bubulcus ibis*	A	Res/B
9. Large Egret *Ardeola alba*	A	LM
10. Smaller Egret *Egretta intermedia*	A	LM
11. Little Egret *Egretta garzetta*	A	Res/B
12. Indian Reef Heron *Egretta gularis*	C	Res/B
13.Night Heron *Nycticorax nycticorax*	C	Res/B
14.Little Bittern *Ixobrychus minutus*	C	Res
15.Chestnut Bittern *Ixobrychus cinnamomeus*	C	Res/B
16. Yellow Bittern *Ixobrychus sinensis*	C	LM
17.Black Bittern *Ixobrychus flavicollis*	O	LM
Family Ciconiidae		
18.Painted Stork *Mycteria leucocephala*	C	LM
19.Openbill Stork *Anastomus oscitans*	A	LM
20.White necked Stork *Ciconia episcopus*	O	WM
Family Threskiornithidae		
21.White Ibis *Threskiornis aethiopica*	C	WM
22. Black Ibis *Pseudibis papillosa*	O	LM
23. Glossy ibis *Plegadis falcinellus*	O	WM
24. Spoonbill *Platalea leucorodia*	O	WM
Order Anseriformes		
Family Anatidae		
25. Barheaded Goose *Anser indicus*	O	WM
26. Lesser Whistifing Teal *Dendrocygna javanica*	A	LM
27. Large Whistling Teal *Dendrocygna bicolor*	C	WM
28. Ruddy She/duck *Tardorna ferruginea*	C	WM
29. Pintail *Anas acuta*		WM
30. Common Teal *Anas crecca*	C	WM
31. Spotbill Duck *Anas poecilorhyncha*		WM
32. Gadwall *Anas strepera*	C	WM
22. Wigeon *Anas Penelope*	C	WM
34. Garganey *Anas querquedula*	C	WM
35. Shoveller *Anas clypeata*	C	WM
36. Redcrested Pochard *Netta rufina*	C	WM
37. Common Pochard *Aythya ferina*	C	WM
38. White-eyed Pochard *Aythya nyroca*	C	WM
39. Tufted Duck *Aythya fuligula*	C	WM
40. Cotton Teal *Nettapus coromandelianus*	C	WM
41. Nakta *Sarkidiornis melanotos*	A	WM
Order Falconiformes		
Family Accipitridae		
42. Blackwinged Kite *Elanus caeruleus*	C	Res/B
43. Blackcrested Baza *Aviceda leuphotes*	O	LM
44. Crested Honey Buzzard *Pernis ptilorhynchus*	O	LM
45. Pariah Kite *Milvus migrans govinda*	C	Res/B
46. Brahminy Kite *Haliastur indus*	C	Res/B
47. Shikra *Accipiter badius*	C	Res
48. Sparrow Hawk *Accipiter nisus melaschitos*	C	Res
49. Tawny Eagle Aquila rapax vindhiana	C	Res
50. Black Eagle Ictinaetus malayensis	O	LM
51. Whitebellied Sea Eagle *Heliaeetus leucogaster*		LM
52. Indian longbilled *Vulture Gyps indicus*	C	Res
53. Indian White backed *Vulture Gyps bengalensis*	C	Res
54. Egyptian Vulture *Neophron percnopterus*	C	Res
55. Pale Harrier *Circus macrourus*	C	Res
56. Pied Harrier *Circus mlanoleucos*	O	LM
57. Marsh Harrier *Circus aeruginosus*	C	LM
58. Osprey *Pandion haliaetus*	O	LM
Family Falcanidae		
59. Peregrine Falcon *Falco peregrinus japonensis*	O	LM
60. European Kestrel *Falco tinnunculus*	C	WM
Order Galliformes		
Family Phasianidae		
61. Grey Patridge *Francolinus pondicerianus*	C	Res/B
62. Grey Quail *Cotrunix cotrunix*	C	Res/B
63. Rain Quail *Cotrunix coromandelica*	C	Res
64. Jungle Bush *Quali Perdicula asiatica*	C	Res
65. Red Spurfowl *Galloperdix spadicea*	C	Res
66. Painted Spurfowl *Galloperdix lunulata*	C	Res
67. Indian Peafowl *Pavo cristatus*	C	Res/B
Family Turnicidae		
68 Indian Bustard-Quail *Turnix suscitator*	C	Res
Order Gruiformes		
Family Rallidae		
69. Water Rail *Rallus aquaticus*	R	LM
70. Little Crake *Porzana parva*	O	LM
71. Ruddy Crake *Porzana Fusca*	C	LM

72. Brown Crake *Amaurornis akool*	O	LM
73. Indian White breasted Waterhen *Amaurornis phoenicurus*	C	Res/B
74. Watercock *Gallicrex cinerea*	C	Res
75. Indian Moorhen *Gallinula Chloropus*	C	Res/B
76. Purple Moorhen *Porphyria porphyria*	C	Res/B
77. Coot *Fulica atra*	C	Res/B
Order Charadriiformes		
Family Jacanildae		
78. Pheasant-tailed Jacana *Hydrophasianus chirurgus*	C	Res/B
79. Bronzewinged Jacana *Mettopidius indicus*	C	Res/B
Family Charadridae		
80. Sociable Lapwing *vanellus gregarius*	C	WM
81. Redwattled Lapwing *vanenus indicus*	C	Res/B
82. Yellow-wattled Lapwing *Vanellus malabaricus*	C	Res/B
83. Golden Plover *Pluvialis apricaria*	R	WM
84. Eastern Golden Plover *Pluvialis dominica fulva*	C	WM
85. Large Sand Plover *Charadrius leschenaultii*		WM
86. Ringed Plover *Charadrius hiaticula*	C	WM
87. Uttle Ringed Plover *Charadrius dubius*	C	WM
88. Longbilled Ringed Plover *Charadrius placidus*	R	WM
89. Lesser Sand Plover *Charadrius mongolus*		WM
90. Whimbrel *Numenius phaeopus*	C	WM
91. Curlew *Numenius arquata*	C	WM
92. Blacktailed Godwit *Umosa limosa*	C	WM
93. Bar1ailed Godwit *Umosa lapponica* .	O	WM
94. Spotted Redshank *Tringa erythrops*	R	WM
95. Common Redshank *Tringa totanus*	C	WM
96. Marsh Sandpiper *Tringa stangnatilis*	C	WM
97. Green Shank *Tringa nebularia*	C	WM
98. Green Sandpiper *Tringa ochropus*	C	WM
99. Wood Sandpiper *Tringa glareola*	C	WM
100. Spotted Green Shank *Tringa gutfifer*	C	WM
101. Terek Sandpiper *Tringa terek*	R	WM
102. Common Sandpiper *Tringa hypoleucos*	C	WM
103. Solitary Snipe *Gallinago solitaria*	R	WM
104. Wood Snipe *Gallinago nemoricola*	C	WM
105. Pintail Snipe *Gallinago stenura*	C	WM
106. Great Snipe *Gallinago media*	R	WM
107. Common Snipe *Gallinago gallinago*	R	WM
108. Woodcock *Scolopax rusticola*	R	WM
109. Knot *Calidris canula*	C	WM
110. Eastern Knot *Calidris tenuirostris*	C	WM
111. Sanderling *Calidris alba*	C	WM
112. Little Stint *Calidris minuta*	A	WM
113. Temminck's Stint *Calidris temminckii*	C	WM
114. Dunlin *Calidris alpina*	C	WM
115. Curlew-Sandpiper *Calidris testacea*	O	WM
116. Ruff and Reeve *Philomachus pugnax*	R	WM
Family Rostratulidae		
117. Painted Snipe *Rostratula bengalensis*	C	WM
Family Recurvirostridae		
118. Blackwinged Stilt *Himantopus himantopus*	C	WM
119. Avocet *Recurvirostra avoselta*	R	WM
Family Dromadidae		
120. Crab Plover *Dromas ardeola*	R	WM
Family Glareolidae		
121. Indian Courser *Cursorius coromandelicus*	C	Res
122. Collared Pratincole *Glareola pratincola*	C	WM
123. Large Indian Pratincole *Glareola maldivarum*	C	WM
124. Small Indian Pratincole *Glareola lactea*	C	WM
Family Laridae		
125. Herring Gull *Larus argentalus*	A	WM
126. Lesser Balckbacked Gull *Larus fuscus*	C	WM
127. Great Blackheaded Gull *Larus ichthyeatus*	C	WM
128. Brownheaded Gull *Larus brunnicephalus*	A	WM
129. Whiskered Tern *Childonias hybrida*	C	
130. Gullbilled Tern *Geleochelidon nilotica*	R	WM
131. Caspian Tern *Hydroprogne caspia*	O	WM
132. Indian River tern *Sterna aurantia*	C	LM
133. Common Tern *Sterna hirundo*	C	LM
134. Balckbellied Tern Tern *Sterna acuticauda*	C	LM
135. Little Tern *Sterna albifrons*	C	LM
Order Columbiformes		
Family Columbidae		
136. Blue Rock Pigeon *Columba livia*	C	Res/B
137. Spotted Dove *Streptopelia chinensis*	C	Res/B
138. Little Brown Dove *Streptopelia senegalensis*	C	Res/B
Order Psittaciformes		
Family Psittacidae		
139. Roseringed Parakeet *Psittacula krameri*	C	Res/B
Order Cuculiformes		
Family Cuculidae		
140. Pied Crested Cuckoo *Cocomantis jacobinus*	C	WM
141. Indian Plaintive Cuckoo *Cocomantis passerinus*	C	Res
142. Koel *Eudynamis scolopacea*	C	Res/B
143. Small Greenbilled Malkoha *Rhopodytes viridirostris*	C	Res/B
144. Crow-Pheasant *Centropus sinensis*	C	Res/B
Order Stringiformes		
Family Strigidae		
145. Indian Great Horned Owl *Bubo bubo*	O	LM
146. Brown Fish Owl *Bubo zeylonensis*	O	LM
147. Spotted Owlet *Athene brama*	C	Res/B
Order Caprimulgiformes		
Family Caprimulgidae		
148. Indian Jungle Night jar *Caprimugulus indicus*	C	LM
Order Apodiformes		
Family Apodidae		
149. House Swift *Apus affinis*	C	Res/B
150. Palm Swift *Cypsiurus parvus*	C	Res/B
Order Coraciformes		
Family Alcedinidae		
151. Lesser Pied Kingfisher *GerrIe rudis*	C	Res/B

152. Small Blue Kingfisher *Alcedo atthis*	C	Res/B
153. Whitebreasted Kingfisher *Halcyon smyrnonsis*	A	Res/B
154. Blackcapped Kingfisher *Halcvon pileata*	A	Res/B
Family Meropidae		
155. Bluetailed Bee-eater *Merops philippinus*	C	WM
156. Small Green Bee-eater *Merops orientalis*	C	Res/B
Family Coraclldae		
157. Indian Roller *Coracias benghalensis*	C	Res/B
Family Upupidae		
158. Indian Hoopoe *Upupa epops*	C	Res
Family Bucerotidae		
159. Grey Hornbill Tockus birostris	C	LM
Order Piciformes		
Family Capitonidae		
160. Large Green Barbet *Magalaima zeylanica*	C	Res
161. Small Green Barbet *Megalaima viridis*	C	Res
162. Crimsonbreated Barbet *Megalaima hemacepahala*	C	Res/B
Family Picidae		
163. Lesser Goldenbacked Woodpecker *Dinopium bengalensis*	C	Res
Order Passeriformes		
Family Pittidae		
164. Indian Pitta *Pitta brachyura*	C	Res
Family Alaudidae		
165. Madras Bush -Lark *Mirafra assamica affinis*	C	
166. Redwinged Bush-Lark *Mirafra erythroptera*	C	Res/B
167. Ashycrowned Rnch-Lark *Ermeopterix grisea*	C	Res/B
168. Short-toed Lark *Calandrella cinerea*	O	Res
169. Indian Small Skylark *Alauda gulgula*	C	Res/B
Family Hirundinidae		
170. Dusky Crag Martin *Hirundo concolor*	C	WM
171. Swallow *Hirundo rustica*	C	WM
172. Wiretailed Swallow *Hirundo smithii*	C	WM
173. Indian Striated Swallow *Hirundo daurica*	C	Res
Family Laniidae		
174. Indian Grey Shrike *Lanius excubitor*	C	Res/B
175. Indian Bayabcked Shrike *Lanius vittatus*	C	Res/B
176. Rufousbacked Shrike *Lanius schach*	C	Res/B
Family Oriolidae		
177. Golden Oriole *Griolus oriolus*	C	Res/B
Family Dicruridae		
178. Black Drongo *Dicrurus adsimilis*	C	Res/B
179. Whitebellied Drongo *Dicrurus caerulescens*	C	WM
Family Artamidae		
180. Ashy Swallow-Shrike *Artamus fuscus*	C	LM
Family Sturnidae		
181. Brahminy Myna *Sturnus pagadorum*	C	LM
182. Pied Myna *Sturnus contra*	C	Res/B
183. Common Myna *Acridotheres tristis*	C	Res/B
184. Bank Myna *Acridotheres ginginianus*	C	Res
Family Corvidae		
185. Southeastern *Treepie Dendrocitta vagabunda*	C	Res/B
186. House Crow *Corvus splendens*	C	Res/B
187. Jungle Crow *Corvus macrorhynchos*	C	Res/B
Family Campephagidae		
188. Wood Shrike *Tephrodornis pondicerianus*	C	Res/B
189. Large Cuckoo-Shrike *Coracina novaehollandiae*	C	LM
190. Small minivet *Pericrocotus cinnamomeus*		Res/B
Family Irinidae		
191. Central Indian lora *Aegithinia tiphia*		Res/B
Family Pycnonotidae		
192. Redwhiskered Bulbul *Pycnonotus jacosus*	C	LM
193. Redvented Bulbul Pycnonotus cafer	O	Res/B
194. Yellowthroated Bulbul *Pycnonotus xantholaemus*	O	LM
Family Muscicapidae		
195. Common Babbler *Turdoides caudatus*	C	Res/B
196. Large Grey Babbler *Turdoides malcomi*	C	Res/B
197. Whiteheaded Babbler *Turdoides affinis*	C	Res/B
198. Redbreasted Flycatcher *Muscicapa parva*	C	WM
199. Tickell's Blue Flycatcher *Muscicapa tickelliae*	C	WM
200. Verditer Flycatcher *Muscicapa thalassina*	O	WM
201. Whitebrowed Fantail Flycatcher *Rhipidura auereoia*	O	WM
202. Paradise Flycatcher *Terpsiphone paradisi*	C	Res
203. Streaked Fantail Warbler *Cisticola juncidis*	C	Res/B
204. Rufousfronted Wren-Warbler *Prinia buchanani*	C	Res
205. Plain Wren-Warbler *Prinia subflava*	C	Res
206. Ashy Wren-Warbler *Prinia socialis*	C	Res/B
207. Jungle Wren-Warbler *Prinia sylvatica*	C	Res/B
208. Tailorbird *Orthotomus sutorius*	C	Res/B
209. Indian Great Reed Warbler *AcrocephaJus stentorel*	C	Res
210. Blyth's Reed Warbler *Acrocephalus dumetorum*	C	WM
211. Booted Warbler *Hippolais caligata*	C	WM
212. Chiffchaff *Phylloscopus collybita*	C	WM
213. Olivaceous Leaf Warbler *Phylloscopus griseolus*	C	WM
214. Green Leaf Warbler *Phylloscopus trochiloides*	C	WM
215. Magpie-Robin *Copsychus saularis*	C	LM
216. Redstart *Phoenicurus phoenicurus*	C	LM
217. Pied Bush Chat *Saxicola caprata*	C	LM
218. Rock Thrush *Motacilla saxatilis*	C	Res
Family Motacillidae		
219. Tree Pipit *Anthus trivialis*	C	LM
220. Paddyfield Pipit *Anthus novaeseelandiae*	C	LM
221. Yellow Wagtail *Motacilla flava*	C	WM
222. Yellowheaded Wagtail *Motacilla citreola*	C	WM
223. Grey wagtail *Motacilla caspica*	C	WM
224. Indian White Wagtail *Motacilla alba*	C	WM
225. Large Pied Wagtail *Motacilla maderaspatensis*	A	Res/B

Family Dicaeidae		
226. Thick billed Flowerpecker *Dicaeum agile*	C	Res/B
227. Tickells Flowerpecker *Dicaeum erythrorhynchos*	C	Res
Family Nectariniidae		
228. Purplerumped Sunbird *Nectarinia zeylonica*	C	Res/B
229. Purple Sunbird *Nectarinia asiatica*	C	Res/B
Family Zosteropidae		
230. White-eye *Zosterops palpebrosa*	C	Res/B
Family Ploceidae		
231. House Sparrow *Passer domesticus*	C	Res/B
232. Baya *Ploceus philippinus*	C	Res
233. Whitethroated Munia *Lonchura malabarica*	C	Res/B
234. Whitebacked Munia *Lonchura striata*	C	Res
235. Spotted Munia *Lonchura punctulata*	C	Res/B
236. Blackwinged Munia *Lonchura malacca*	C	LM

Key: A – Abundant ; C - Common; O - Ocassional; R - Rare; Res – Resident; B - Breeder; LM – Local Migrant; WM – Winter Migrant

Galliiformes: Occasional sightings of 6 species belonging to Order Falconiformes and 5 species belonging to Ciconiiformes, Charadriiformes and Passeriformes each and rare sightings of 11 species belonging to Order Charadriiformes are notable.

Important Orders with more than 5 species recorded from this area are as follows:

Passeriformes: This Order is represented by 73 species belonging to 17 families, important among them are Alaludidae (5 species), Hirudinidae (4 species), Laniidae (3 species), Sturnidae (4 species), Corvidae (3 species), Campephagidae (4 species), Pycnonotidae (4 species), Muscicapidae (24 species), Motacillidae (7 species) and Ploceidae (6 species). About 63.01% species are residents, while 15.06% are local migrants and 21.91% are winter migrants. 32 species (32.02%) of the total breeding bird records belong to this Order. Occasionally sighted species are Short-toed Lark, Redwhiskered Bulbul, Yellowthroated Bulbul, Verditer Flycatcher and Whitebrowed Fantail Flycatcher.

Charadriiformes: This Order is represented by 7 families and 59 species, of which 48 (81.35%) are winter migrants, which account for about 54.54% of the total winter migrants recorded during the study period. Golden Plover, Longbilled ringed Plover, Terek Sandpiper, Solitary Snipe. Great Snipe, Woodcock, Ruff, Avocet. Crab Plover and Gullbilled Tern were: of rare occurrence in this region. Most of them being the first sight record from the Godavari Estuary.

Ciconiiformes: This Order is represented by 3 families and 21 species of which 7 species (33.33%) were abundant, 9 species (42.82%) were common and 5 species (23.80%) were of occasional occurrence. 8 species (38.09%) were residents, 9 species (42.8%) were local migrants while 4 species (19.04%) were winter migrants. A total of 8 species (9.75%) of all the breeding bird records belonged to this Order. Occasionally sighted representatives belonging to this Order are Black Bittern, White necked Stork, Black Ibis, Glossy Ibis and Spoonbill.

Falconiformes: This Order is represented by 2 families and 19 species, of which 12 species (63.15%) were common, 6 species (31.57%) were occasional while 1 species (5.26%) was rare in occurrence. Of the total species recorded, 10 species (52.63%) were residents, 8 species (42.10%) were local migrants, while 1 species (5.26%) was winter migrant to this region. Three species (3.65%) of the total breeding birds recorded from the area belonged to this Order. Occasional sightings were that of Blackcrested Baza, Crested Honey Buzzard, Black Eagle, Pied Harrier, Osprey and Peregrine Falcon. Whitebellied Sea Eagle was seen only once during the study period.

Anseriformes: This Order is represented by a single family and 17 species of which 16 (94.11 %) were winter migrants, while 1 species was local migrant to this area. 4 species (23. 52%) namely the lesser Whistiling Teal, Pintail, Spotbill Duck and Nakta were abundant; 12 species (70.58%) were common, while one species (5.88%) was occasional in occurrence. Barheaded goose record is probably the first reported from this area.

Coraciiformes: Nine species belonging to five families represent this Order, of which seven species (77.7%) were common while two species (22.2%) were abundant in occurrence and seven species (77.7%) were residents, while one species (11.1%) . each were winter migrants and local migrants. About six species (7.31%) of the total breeders belonged to this Order.

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Status of Birds recorded in Coringa Wildlife Sanctuary

S.No.	Order	No of Families	No. of species	Abundance				Status			
				A	C	O	R	Res	B	LM	WM
1	Podicipitiformes	1	1	1				1	1		
2	Pelicaniformes	1	2	1	1					2	
3	Ciconiiformes	3	21	7	9	5		8	8	9	4
4	Anseriformes	1	17	4	12	1				1	16
5	Falconiformes	2	19		12	6	1	10	3	8	1
6	Galliformes	2	8		8			8	3		
7	Gruiformes	1	9		6	2	1	5	4	4	
8	Charadriiformes	7	59	3	40	5	11	5	4	5	48
9	Columbiformes	1	3		3			3	3		
10	Psittaciformes	1	1		1			1	1		
11	Cuculiformes	1	5		5			4	3		1
12	Strigiformes	1	3		1	2		1	1	2	1
13	Apodiformes	1	2		2			2	2	.	
14	Coraciiformes	5	9	2	7			7	6	1	1
15	Piciformes	2	4		4			4	1		
16	Passeriformes	17	73	1	67	5		46	32	11	16
		47	**236**	**19**	**178**	**26**	**13**	**105**	**72**	**43**	**88**

Coastal Follies and the Tsunami

Ashish Kothari and Manju Menon[1]

[**This article first appeared in *InfoChange News & Features*, January 2005**]

In the wake of the colossal, post-tsunami human tragedy unfolding in South and South-east Asia, the immediate needs of relief and rehabilitation are paramount. Such events however also require us to start working towards more long-term responses. The recurring question is: are there ways to minimise human casualties in the face of such disasters? Indeed, by intelligently using nature's own defences, can we buffer ourselves against the powerful forces generated by nature?

Most so-called 'natural' disasters today have a major element of human folly. Floods annually cause havoc, not because nature itself is cruel, but because we have encroached on floodplains, destroyed forests that act as sponges, and interfered with natural watercourses. Droughts become killer famines because people no longer have access to emergency foods from forests and wetlands, or to traditional crops that could grow even in conditions of rainfall failure. Earthquakes kill many people quite unnecessarily because of inappropriately built homes that come down like a pack of cards.

Nothing could have completely prevented the damage the tsunami caused. However, if India's natural coastal and marine defences had been intact, the destruction is likely to have been far less. Tropical coastlines are characterised by several natural buffers. Coral reefs grow like underwater rainforests, forming a protective shield around the shore, and mangrove forests a sturdy barrier between the sea and the land. Sand dunes, cliffs, and littoral forests form further buffers. In many areas, lagoons and estuaries also act as shock-absorbers. With all these intact, the force of the sea is significantly reduced. When a super cyclone hit the Orissa coast some years back, observers reported that areas with intact mangroves suffered significantly less than those where such vegetation had been destroyed. Some reports point to the same conclusion from the tsunami affected areas. Reportedly, communities living along the Pichavaram and Muthupet region in Tamil Nadu were protected against the tsunami's impact by intact mangroves. In Alappuzha and Kollam in Kerala, where the impact should have been less due to distance, it was actually greater due to illegal sand mining. On Sri Lanka's eastern coast, much less damage was seen in Yala National Park's intact ecosystems, than in the human-altered coastal stretches and tourist resorts.

Human folly along the coast

Unfortunately, far from protecting the natural ecosystems that protect us, we have dealt recklessly with our coasts and seas. The Government of India estimates that over 40% of India's mangroves have already been destroyed. Extensive coral reef damage has taken place in the Gulfs of Kachchh and Mannar, and parts of Andaman and Nicobar Islands. Till recently corals were actually mined for industrial use and road-building! Beaches across India have been mined for sand, leaving the coast vulnerable to even normal wave action. In Great Nicobar, 21 beaches have been lost to sand mining between 1981 and 2000. Sensitive coastal stretches have been used for tourist resorts, urban growth and mushrooming settlements. Reclamation of the sea by ports, harbours, roads, and industries, has greatly increased the coast's vulnerability. Communities too have been pushed into more vulnerable positions; scientists like John Kurien note that in many cases landward areas are occupied by private individuals and governments, and not made available for fishing settlements, forcing them to occupy more seaward lands.

And then there is pollution: in 1998, scientists R. Sengupta and S.Z. Qasim estimated that every year we threw into the sea 1.3 billion tonnes of domestic sewage, 1000 million tonnes of industrial effluents, 105 million tonnes of solid wastes and garbage, 2.6 million tonnes of chemical fertilizers, and 20,600 tonnes of pesticides! Is it any wonder that our seas are dying, and with them, the natural defences that India once abounded in?

Protection of the coast's protectors?

In 1991, the Government of India notified the Coastal Regulation Zone (CRZ) notification. This revolutionary legislation attempted to regulate development along the coasts, and was applauded by environmentalists, wildlife activists, and traditional fisherfolk. Unfortunately, the CRZ notification has been undermined by the government itself, by turning a blind eye to violations, or giving permission for destructive activities. Worse, the central government has repeatedly diluted the provisions of the CRZ notification... as many as a dozen times (see box)! States have been tardy in finalising Coastal Zone Management Plans and setting up Coastal Zone Management Authorities. Only one state (Goa) committee has a NGO member. It is not a major surprise that CRZ norms are observed more in the breach.

Weakening coastal regulations

Over the last decade, the central government has repeatedly amended the CRZ notification, each time diluting the original intent of the notification. These include:

- allowing sand and rare earth mining, and atomic en ergy projects along the coast (Kalpakkam, which has had to be shut down due to the tsunami, came up as a result);
- reducing the no-development zone to a mere 50 mts, and relaxing norms for tourism projects, in the A&N and Lakshadweep Islands;
- allowing ports and resorts along the coast, with mini mal environment impact assessment;
- allowing several kinds of units without any environ mental assessment, in Special Economic Zones.

In July 2004, the MoEF set up a high powered committee, to review the CRZ notification. Environmentalists worry whether, given MoEF's past record, such a review would lead to further dilution. Post the tsunami, however, we hope that the committee will recommend a roll-back of all the past dilutions, strengthen the norms for the protection of coastal ecosystems, set up stringent standards for coastal use, and recommend transparent and participatory ways to implement the notification.

What lies ahead?

We are now faced with the task of rebuilding our ravaged coastline and the lives and livelihoods of the affected families. A well-thought out reconstruction plan is vital, with a key focus on rebuilding natural coastal defences, and ecologically friendly settlements. Here are the elements. Revive coral reefs, regenerate mangroves, restore beaches and sand dunes, and prevent pollution. Through this, generate considerable livelihoods for coastal communities. Bring all remaining natural ecosystems under conservation laws, without alienating the communities that have traditionally lived there. Strengthen the CRZ, allow only environmentally sensitive development in fragile areas. Listen to traditional fisherfolk's demands to prohibit industrial trawling and commercial shrimp-farming. Prepare a comprehensive disaster management plan for each area, with community participation.

Listen also to the animals. Systematic observations of aquatic and land animals could provide as good a warning as sophisticated sensors sunk into the sea. Scientists have repeatedly recorded pre-earthquake patterns of abnormal behaviour in wildlife. On December 4th 2004, scientist Arunachalam Kumar sent out an email about the mass beaching and death of whales in Australia, and predicted that a major quake was likely to hit someplace on earth soon. Three weeks later, it did. Strange behaviour in fish and dolphins was reported in Indonesia just before the quake. Again, can we learn from nature?

If we don't take such long-term measures now, we will simply be doing what we are so good at: not learning from our mistakes, and regretting this the next time a tragedy comes our way.

News Items on POST TSUNAMIC CHANGES –ESTUARIES

Mangroves can act as shield against Tsunami'
Correspondent: G. Venkataramani (Tuesday, December 28, 2004)

CHENNAI, DEC. 27. "Tsunami is a rare phenomenon. Though we cannot prevent the occurrence of such natural calamities, we should certainly prepare ourselves to mitigate the impact of the natural fury on the population inhabiting the coastal ecosystems. Our anticipatory research work to preserve mangrove ecosystems as the first line of defence against devastating tidal waves on the eastern coastline has proved very relevant today.

The dense mangrove forests stood like a wall to save coastal communities living behind them," said M.S. Swaminathan, Chairman, M.S. Swaminathan Research Foundation (MSSRF), Chennai.

The mangroves in Pitchavaram and Muthupet region acted like a shield and bore the brunt of the tsunami.

The impact was mitigated and lives and property of the communities inhabiting the region were saved.

"When we started the foundation 14 years ago, we initiated the anticipatory research programme — a two-pronged strategy — to meet the eventualities of sea level rise due to global warming. One is to conserve and regenerate coastal mangroves along the eastern coast of the country, and the second is transfer of salt-tolerant genes from the mangroves to selected crops grown in the coastal regions.

It is now found that wherever the mangroves have been regenerated, especially in the Orissa coast, the damage due to tsunami is minimal," he said.

Livelihood options

The MSSRF will soon be publishing a scientific document 'Tsunami and mangroves' highlighting the need to conserve and rehabilitate mangroves as the frontline defence against tidal forces.

The foundation will also prescribe multiple and multi-level livelihood options for the communities inhabiting the mangrove ecosystem.

Alternative cropping patterns to provide household economic and nutrition security for the rural poor will also be developed, according to Prof. Swaminathan.

The foundation will also press into service public address systems and communication network with village knowledge centres to forewarn the coastal population.

All efforts will be made to further strengthen the knowledge centres and information dissemination strategies.

A core group of experts has been set up to prepare concrete action plans and coordinate the short-term and long-term relief measures for the affected communities in the coastal belts.

A voluntary relief fund is created, and it will be used to meet the immediate needs of the affected communities, according to Prof. Swaminathan.

The foundation held a condolence meeting for those who lost their lives due to the tsunami and resolved to help mitigate the sufferings.

(SOURCE: The Hindu, Tuesday, December 28, 2004)

'Water table along East Coast may be hit'
Correspondent: Staff Reporter (Visakhapatnam)

The devastating earthquake that struck off Sumatra coast and caused damages along India's Eastern Coast, may seriously affect the ground water table and equilibrium between fresh and saline water saturation points.

Because of rise in water in the Bay of Bengal there is a possibility for thrust of saline water reducing the available fresh water near the coast up to three to four km, according to Prof Bhanu Kumar, Head of the Department of Meteorology and Oceanography, Andhra University.

He said the east coast was a rift margin containing transform faults and the adjustment might give rise to earthquakes. During any such vertical displacement there was a possibility that the seawater might encroach upon the land.

(SOURCE: The Tribune, Tuesday, December 28, 2004)

Restore Mangroves to fight disaster: Experts
(*By **Jatindra Dash,** Indo-Asian News Service,* January 3, 2005)

Bhubaneswar, Jan 3 (IANS) Mangrove forests could go a long way in reducing the devastation caused by disasters like tsunamis but in Orissa, which has been repeatedly ravaged by cyclones, these natural barriers have been fast disappearing.

"If a killer tsunami wave hits Orissa's coast, we estimate that at least 100,000 people would die since the damage will be more extensive than what happened in Andhra Pradesh and Tamil Nadu," said Biswajit Mohanty, secretary of the Wildlife Society of Orissa.

The state's coastline was once covered by luxuriant mangrove forests, which flourished due to the large quantities of silt washed down by various rivers like the Rushikulya, Devi and Mahanadi.

"It is estimated that at least 1,000 sq km of mangroves existed in the pre-independence period, the Bhittarkanika and Mahanadi delta being the most rich," Mohanty told IANS.

"However, due to rampant proliferation of prawn farms along the coast and estuarine areas, these forests are now down to as little as 215 sq km," he said citing the last Forest Survey of India report.

Mangrove is an efficient soil binder and has a dense root and branch structure, which can combat the most violent of cyclones and tidal waves. Tidal surges thrown up by tsunamis can easily be arrested and slowed down by thick mangrove vegetation.

Added S. Afsar Abbas, a scientist at the Institute of Physics here: "Massive and continuing loss of greenery has contributed significantly to the frequent disasters. It is a great shame that we have not done enough to restore this."

Environmentalists estimate that 10,000 acres of mangrove forests have been taken over by prawn farms in the Mahanadi delta and Bhittarkanika areas alone.

"Apart from this, 50,000 acres of prawn farms exist illegally on the Orissa coast in Jagatsinghpur, Ganjam, Bhadrak and Balasore districts," Mohanty told IANS.

Just like mangrove forests have fast disappeared, high sand dunes along the state's coast, which acted as the first line of defence on the coastal beaches, have gone too thanks to the ill-advised Casuarinas plantations taken up by the forest department.

"Sand dunes are dynamic natural structures, which build up on beaches depending upon sea winds. Artificial beach plantations destroy sand dunes and lead to flat beaches, which cannot stop tidal surges," Mohanty said.

Such plantations had been done in the early 1980s after Swedish forestry consultants advised the government to plant a coastal shelterbelt for cyclone protection.

"These trees are useless since they broke like matchsticks during the last super cyclone in 1999," he said.

After the super cyclone of 1999, which killed more than 10,000 people, the Wildlife Society of Orissa had demanded that the state government should not plant trees on beaches. However, the government continued to cover sandy beaches with Casuarinas.

"Now there is an urgent need to cover the estuarine and river mouth areas with mangrove plantations and also free the beaches from Casuarinas trees so that natural sand dunes can be rebuilt," Mohanty said.

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