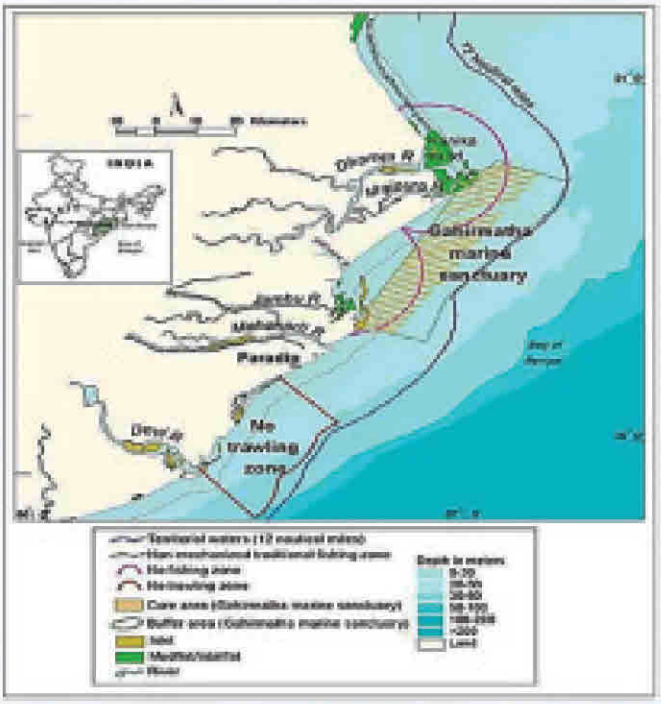
Report Card of Gahirmatha Coastal Stretch 2015

Prepared by :
Integrated Coastal Zone Management Project
State Pollution Control Board, Odisha



GAHIRMATHA COASTAL STRETCH

Gahirmatha is a marine sanctuary declared by the Government in 1997; primarily to protect the Olive Ridley Sea Turtles ***(Lepidochelys olivacea)***; who found this environment most conducive as nesting ground. This turtle species is recognized as Vulnerable by the IUCN Red list. Gahirmatha beach is the biggest nesting ground of Olive Ridley turtles in the world. They mate in the sea and arrive in droves for mass nesting, called Arribada.

GEOGRAPHICAL LOCATION OF GAHIRMATHA & CONDUSIVE HABITAT FOR OLIVE RIDLEY

Olive Ridley are occasionally found in open waters. They are found typically within 15 km of mainland shores in protected, relatively shallow marine waters (22–55 m deep). The multiple habitats and geographical localities used by this species vary throughout its life cycle.

The comprehensive ecological health assessment of Gahirmatha coastal stretch in this study is to examine the deviation of multiple ecosystem parameters including nutrient, primary productivity, biodiversity, and/or habitat. As the estuarine ecosystem is a nonlinear system, of which the structure/services are interacting in complex dynamic ways and when the components are damaged to different extents, consequent mismatching among them tends to result in dysfunction, even a sudden collapse of ecosystem observed (*Chen et. al., 2013*). In fact, understanding the complex relationship within an ecosystem especially for Gahirmatha is one of the priorities and major challenges today in the research field. Degradation of estuarine-sea ecosystem often occurs as syndromes of simultaneous declines in multiple structure and services, an appropriate evaluation in the deviation of ecosystem's health both in structure and its services from the desired status is a prerequisite to take appropriate steps to restore it (*Carpenter et. al., 2006*). In recent past it also observed that the days of Arribada has drastically reduced which in turn to the number of eggs laid.

http://www.conservationindia.org/tag/olive-ridley-turtle

Photo: Mixing zone of Estuary & Sea at Gahirmartha (ICZMP, SPCB)

A healthy sea is an ecosystem with its various components (biological, physical and chemical) operating effectively to maintain a functioning system within the limits of natural variability. It should also be resilient to some level of stress (*Rapport et al. 1998*). Assessing estuary-sea ecosystem health (or condition) requires a framework for setting the objective of the assessment and by selecting, monitoring and reporting of appropriate indicators that measure components of an estuary-sea ecosystem that contribute to its overall health/conditions. Further, an overall measure on basic characteristics and impacts on bio-system (1sttrophic level: phytoplankton)is highly required in the designated area, which in turn plays a major role on the structural and functional aspect of the ecosystem. This approach has been an effort to obtain a holistic diagnosis of ecosystem health, which would help in getting firsthand information on Gahirmatha Coastal stretch (bay-estuary-sea) and to aware different stake holders including decision-makers.

'GAHIRMATHA ECOSYSTEM' NEED TO BE PROTECTED FOR BHITARAKANIKA SANCTUARY & NATIONAL PARK, GAHIRMATHA MARINE SANCTUARY

Located in Kendrapada district, Gahirmatha is the lone mass nesting spot in Indian Ocean region and the only turtle sanctuary in Odisha. The Olive Ridley turtles travel across the South Pacific to breed on the coast of Gahirmatha. About 0.2 to 0.7 million Olive Ridley turtles visit the beach during mass nesting every year. The coast spread over 1435 sq. km, the sanctuary extends from mouth of Dhamra river in the north to the mouth of Mahanadi river in the south. The sanctuary forms part of Bhitarkanika national park. Gahirmatha was declared a turtle sanctuary in 1979 by Odisha government after considering its ecological importance and as part of efforts to save the sea turtles. Olive Ridley sea turtles migrate in huge numbers from the beginning of November, every year, for mating and nesting along the coast of Orissa. Nesting season starts from December and lasts till end of April. The middle of March witnesses a peak.

Olive Ridley turtles usually nest during night time. The 35 km Gahirmatha coast, which forms part of the Bhitarkanika National Park, is the best to witness the mass nesting. The sandy coastline free of rocks and stones, presence of wetland, backwater and brackish water and mangrove vegetation is preferred by the turtles. Barrier island (Barrier ridge) called Ekakulanasi of the Gahirmatha coast is the main turtle breeding ground. Salinity of the sea around Gahirmatha is about30.57 ppt (parts per thousand) during the breeding season. Hughes and Brent (1972) has pointed out that ridley turtles are characteristically found in waters of low salinity, high turbidity, high organic content and where prawns are commercially abundant. Bay of Bengal has a positive water balance due to the net annual addition of about 3000 km3 of fresh water from precipitation and runoff (Sengupta and Naqvi, 1984) and according to La Fond (1956), Bay of Bengal receives the largest rain fall and subsequent dilution in the world. Sahoo et al., (1996) and Das and Kar (1990) have reported high concentration of jelly fishes in the Gahirmatha area during the Olive Ridley breeding season from October to April. The peak blooms of small hydromedusae in the coastal surface waters of Bay of Bengal have been reported during February to April (Lazell, 1980) which coincides with the peak nesting season of Olive Ridleys at Gahirmatha. Jelly fish and other coelenterates are the primary food of leatherbacks (Brongersma, 1969) and olive ridleys (Dash and Kar, 1990). Concentrations of many coelenterates have primarily been reported in shallow waters (Fritts et al., 1983) where sea turtles are abundant. The sanctuary is also home to variety of flora and fauna. Wild boar, barking deer, bear, leopard, crocodile, jungle fowl, samber and wild dogs are among the other wildlife seen in the sanctuary. As this area is rich in diversity with respects to mangroves, aquatic lives; tend to face tremendous pressure from associated anthropogenic activities.

IS ESTUARINE-SEA ECOSYSTEM OF BHITARKANIKA-GAHIRMATHA IS SAFE?

As observed, documented, and recorded that sea turtle stranding dead, bloated, rotting sea turtle carcasses have been counted by Indian scientists on Odisha nesting beaches, including Gahirmatha, over the last 10 years, averaging over 10,000 turtles per year (Shanker et al.,2003). The voyage to the natal nesting beaches is the dooming factor for the sea turtles. Olive Ridley sea turtles feed on marine snails, smaller forms of fish, fish eggs, crustaceans and jellyfish. Algal material is also used as food by the Ridley. The Gahirmatha coast gets pressure constantly from discharges of Mahanadi, Gobari, Hansua, Chinchiri and Brahmani rivers and of several rivulets of Mahanadi and Brahmani. They caries the agricultural and urban runoff in to the sea, may affecting the ecosystem of the coast. Besides, Shrimp trawling and unregulated fishing by coastal gillnetters in the "protected waters" of Gahirmatha Marine Sanctuary, Bhitarkanika Sanctuary and National Park have been creating pressures over the protected ecosystem.

THE HEALTH REPORT CARD:

Environmental samples were collected, analyzed and subjected for interpretation for health status. Water Quality Standards were selected to evaluate the Water Quality Index (WQI) for each zone as distributed. The estuarine-sea ecosystem of Gahirmatha has been considered into four (04) zones viz., (1) Bay water (Maipura creek and Gobari river impact) (2) Mixing zone 1 (confluence of River Hansua and sea) (3) Mixing zone 2 (River Hansua and Chinchiri) and (4) Sea up stream towards Dhamra.

WHY MONITORED?

The report card was developed as an integral part of the mandate of the World Bank funded ICZM Project, adopted by Odisha State Pollution Control Board, in order to enhance the understanding and management of the activities in the coastal stretch of 80 KM from Paradeep to Dhamra in Bay of Bengal. As the Gahirmatha-sea ecosystem having marine sanctuary, which is a part of the designated study area, is quite vulnerable due to various activities; it is

important to determine the quality of water in terms of health, so that natural-resource-managers may oversee the condition of this ecosystem and to target investment to improve ecosystem health. This reporting would also provide prominence to determine appropriate management actions, monitoring the effectiveness of management and contributing to the ongoing management of sea, estuaries and their catchments. The report card of estuarine-sea ecosystem of Gahirmatha for the year 2015 is prepared to understand the quality of health/conditions by addressing different issues arising out of this assessment.

WHAT IS ECOSYSTEM REPORT CARD?

Ecosystem health is determined by the response of the environment to natural and human inputs; may be defined as the degree to which the actual state of an ecosystem diverges from an ideal state. A healthy estuarine and marine ecosystem is said to have the desired characteristics: to operate key processes maintaining stable and sustainable ecosystems, associated human impacts that do not expand or deteriorate and aquatic ecosystems (critical habitats) to remain intact. These characteristics are complex and are really difficult to measure the attributes comprehensibly. While compiling this report card, few key water quality as well as biological indicators, have been determined and considered during the periodical monitoring and analysis. These results are compared to acceptable levels of national and international reference conditions.

MEASURES OF REPORT CARD

pH, Temperature, TSS & Turbidity:	Indicate water column characteristics and put both direct & indirect impact on nutrient cycle and indirect impact on primary productivity & influence in controlling the food chain and food web.
Disolved Oxygen & BOD:	Indicate the impact on biological status or health of aquatic environment (Hypoxia/anoxia)
Nutrients (NO_2, NO_3, PO_4, Silicate):	Signify the status of presence of nutrient and its enrichment in the ecosystem& suggest the extent of control on biological growth and health of the marine eco system.
Pollutants (TOC, Fe, Mn, Cd, Pb, Hg):	Indicate potential biological response to marine matrix contamination (Toxicity)
Chlorophyll, TC/FC:	Indicate the health status of the marine ecosystem for primary production and carbon cycle of the ecosystem

DESIRED CONDITIONS & THRESHOLDS FOR THE REPORT CARD

Desired conditions (Threshold) are based on available guidelines, current scientific knowledge, and/or data and trends; and by taking into account the influence of a variable climate from year to year. The table below outlines the desired conditions developed or identified for each indicator and the source of this information.

Category	Indicator	Desire Condition	Source of Data
Water Quality	Temperature	20°C-30°C	SPCB, ICZMP
	pH	6.5-8.5	CPCB
	Dissolved Oxygen	≥3 mg/l	CPCB
	BOD	≤ 3 mg/l	CPCB
	TSS	≤ 20 mg/l	ANZECC(2000)
	Turbidity	8 NTU	ANZECC(2000)
	TOC	≥ 0.3 mg/l	ANZECC(1992)
	Nitrate	≤ 1 mg/l	ANZECC(2000)
	Phosphate	≤ 0.1 mg/l	ANZECC(2000)
	Silicate	0.3-1.0 mg/l	ANZECC(2000)
	Fecal Coliform	≤ 100 nos./100 ml	CPCB
	Chlorophyll-a	≤ 3.4 µg/l	ANZECC(2000)
	Mercury	≤ 1 µg/l	CPCB
	Manganese	≤ 500 µg/l	CPCB
	Iron	≤ 500 µg/l	CPCB
	Lead	≤ 1 µg/l	CPCB
	Cadmium	≤ 10 µg/l	CPCB

EVALUATION OF REPORT CARD GRADE FOR ESTUARINE-SEA CONDITIONS AT GAHIRMATHA

The report card for estuarine-sea ecosystem of Gahirmatha coastal stretch is developed by comparing the standards for different indicators (Temperature, pH, dissolved oxygen, BOD, TSS, Turbidity, TOC, Nitrate, Phosphate, Silica, Chlorophyll-a, Fecal coliform, Fe, Mn, Hg, Pb and Cd) and evaluated these thresholds scientifically. These indicators are combined into an Overall Health Index, which is presented as percent score.

The overall water quality index is calculated by comparing the threshold of water quality standards to the average of the water quality indicators (Temperature, pH, dissolved oxygen, BOD, TSS, Turbidity, TOC, Nitrate, Phosphate, Silica, Chlorophyll-a, Fecal coliform, Fe, Mn, Hg, Pb and Cd).. Alternately the index is the computed average of the water quality indicators.

GRADING AS CONSIDERED

A 80-100% All water quality indicators meet the desired levels of Standard. The water quality in those locations tends to be very good, most often leading to very good habitat condition for Marine lives

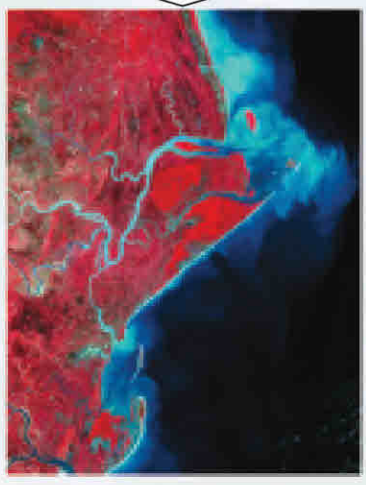
B 60-80% Most water quality indicators meet the desired levels of Standard. The water quality in those locations tends to be good, most often leading to good habitat condition for Marine lives

C 40-60% Blend of good and poor levels of water quality indicators. Quality of water in these locations tends to be fair, leading to fair habitat conditions for Marine lives

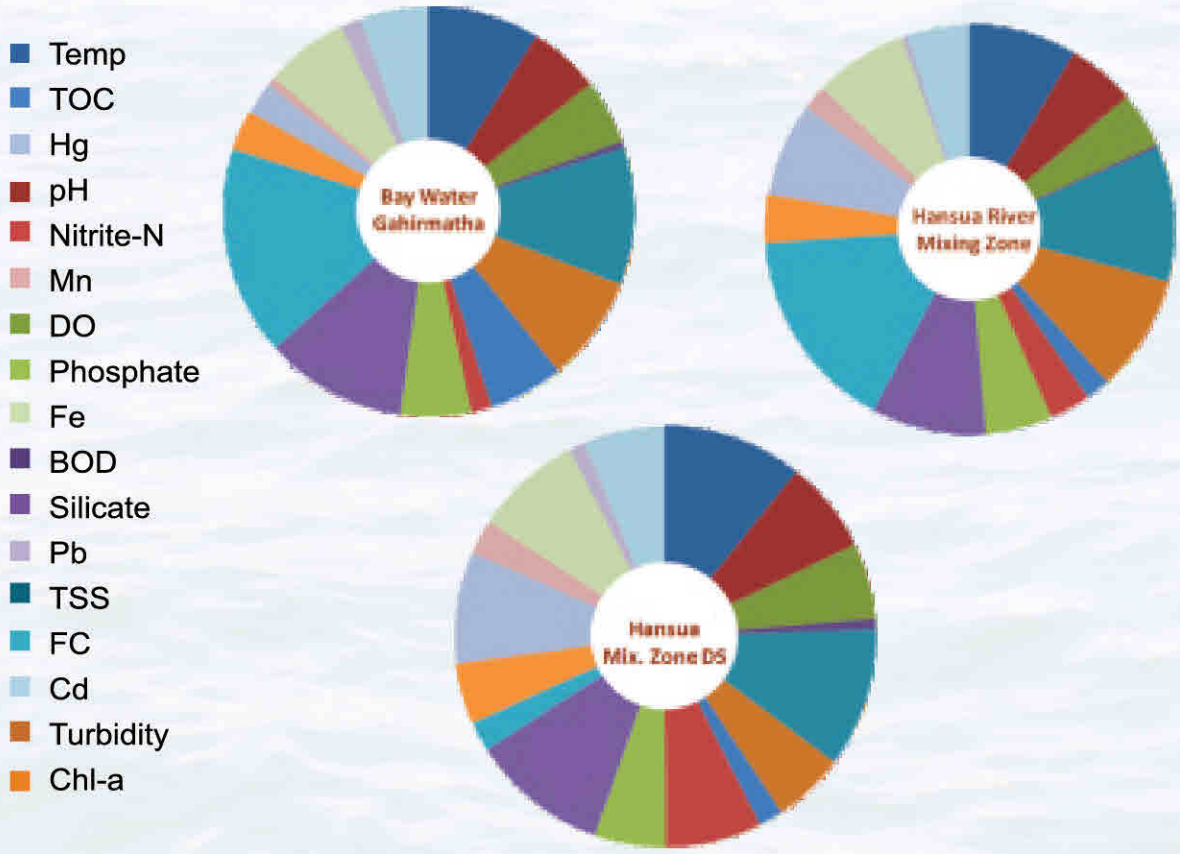
D 20-40% Few water quality indicators meet desired levels. Quality of water in these locations tends to be poor often leading to poor habitat conditions for Marine lives

F 0-20% Very few or no water quality indicators meet desired levels. Quality of water in these locations tends to be very poor, most often leading to very poor habitat conditions for Marine lives

Overview of Gahirmatha Coastal Stretch with Estuaries

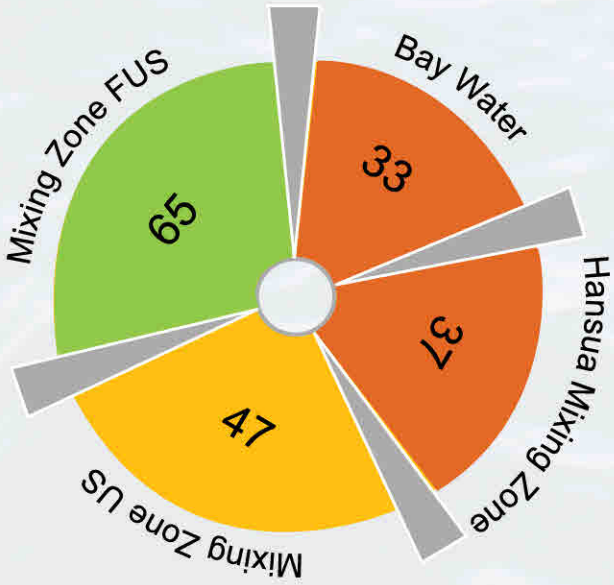


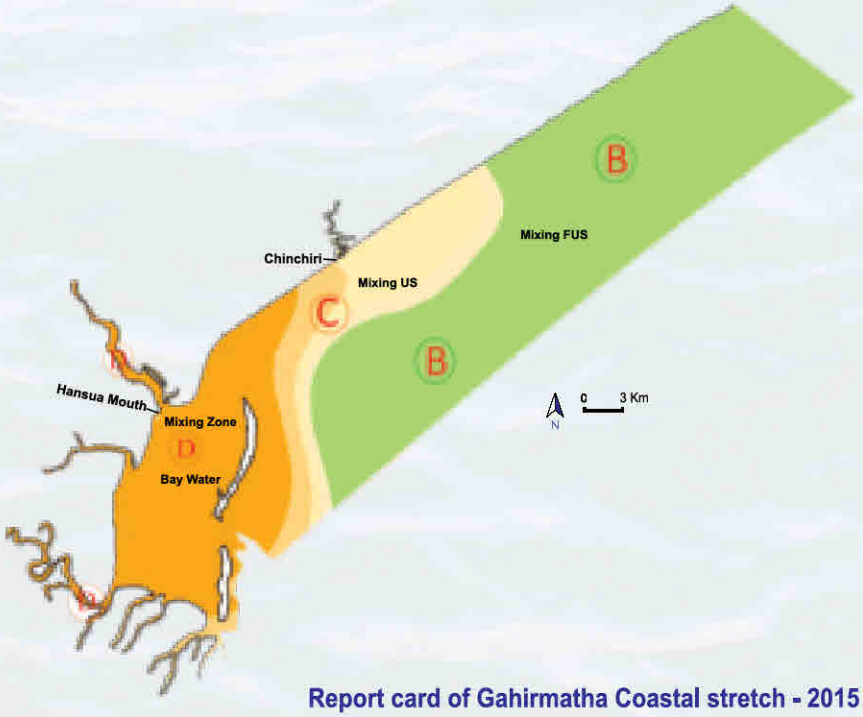
CONTRIBUTION OF INDICATORS IN THE ESTUARINE-SEA CONDITIONS AT GAHIRMATHA COASTAL STRETCH



OVERALL WATER QUALITY REPORT CARD OF ESTUARINE-SEA CONDITIONS AT GAHIRMATHA COASTAL STRETCH

A	B	C	D	F
100-80%	80-60%	60-40%	40-20%	20-0%





ESTUARINE-SEA ECOSYSTEM CONDITIONS OF GAHIRMATHA :

The additional pressure mainly from riverine influx impacted on the overall score card of Gahirmatha coastal stretch which is seen as distinct visible groups. The score of 33 % for Bay water, 37% for Hansua river estuarine zone and 47% in the in mixing zone in the grading scale indicated the impacts of load in the estuary, which in turn might have been diluted at confluence. The impact of load in downstream of mixing zone further reduced due to the influence of Chinchiri. This also falls in grade-C quality. However, upstream towards Dhamra beyond the mixing zone observed having better water quality with score of 65%, which falls under grade-B. Storm water contributes a high load of sediment, nutrients and heavy metals to the assessed coastal stretch. Discharges from boats in fishing jetty, agricultural runoff & other industrial discharges from catchment area which is flowing with riverine systems deteriorated the quality in the estuary and also in the mixing zone (Grade-C). The inflow of pressures has to be restricted, so that the quality by implementing mitigation plan in timely to save the ecosystem.

CURRENT AND EMERGING RISKS TO THE GAHIRMATHA-MARINE ENVIRONMENT

REASONS ALMOST CERTAIN FOR RISKS

Catastrophic	Major	Moderate	Minor	Insignificant
increases, with impacts on fish and plankton Acidification, with impacts on plankton and primary production	Port developmentleading to destruction or disturbance of the environment Marine debris, which may poison species Sea level rise and impacts of coastal erosion and inundation. Extreme or severe event (storm, tidal, rainfall, flooding), which may increase run-off and sediment/nutrient levels Increase in catchment-sourced nutrients, sediments and toxins Algal blooms in estuaries, which can be toxic or may result in hypoxic water Ocean current changes, leading to shifts in production	Fishing (commercial), leading to change or loss of species or impacts on ecosystems Shipping, leading to the wider introduction of pests Beach or shoreline modifications, leading to change or loss of habitat Oil and gas extraction, Refinery activities leading to increased shipping and onshore development, and consequent impacts on ecosystems	Fishing (traditional), leading to change or loss of species Vessel strikes & accidents Ghost fishing-lost nets that may entangle species	Fishing by local fisherman for lively hood by non-mechanized boat

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Few Photographs of Fauna & Flora of Bhitarakanika Sanctuary:

Photographs of Sampling & Fixing of Samples

STATE POLLUTION CONTROL BOARD, ODISHA
(Department of Forest & Environment, Govt. of Odisha)
A-118, Nilakantha Nagar
Unit-VIII, Bhubaneswar
Odisha, India - 751012

ICZMP, BHUBANESWAR:
Coastal Laboratory, ICZMP
State Pollution Control Board
4th Floor, Central Laboratory
Plot No: 59-B/2&3, Chandaka Industrial Estate
Po: KIIT, Bhubaneswar, Odisha, India-751024

ICZMP, PARADEEP :
Centre for Management of
Coastal Ecosystem (CMCE), ICZMP
State Pollution Control Board
Nua Sandhakuda, Near Panthanivas, Paradeep
Dist: Jagatsinghpur, Odisha, India-754142

CONTACTS FOR MORE INFORMATION:

Member Secretary, State Pollution Control Board, Bhubaneswar,
E-mail: membersecretary@ospcboard.org
Nodal Officer cum Project Coordinator, ICZMP, State Pollution Control Board, Bhubaneswar,
E-mail: opcbiczm@gmail.com

An electronic copy of this report can be found in www.ospcboard.org

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Cover Photo Source: http://www.odisharajya.com/tourism/gahirmatha_marine_sanctuary.html#prettyPhoto