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Marine Biodiversity of India – Status and Challenges

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Introduction

Diversity in the species complex, typical of tropical waters and co-existence of different fish and shellfish species in the same ground are important features of Indian Marine Biodiversity. Past studies on the biological and fishery characteristics of the important groups shown that most of the species supporting the fishery are short lived with an average life span up to 3-5 years, but the fishery being mainly supported by under an year olds and one year old. They are highly fecund and spawn over longer periods mostly with fractional spawning and show wide annual variation in recruitment. Several issues in the captive fisheries sector adversely affect the marine biodiversity of the country especially in the fish as ecosystem good to human beings. The issues such as limitations of growth and production in the inshore fishing grounds, less profitability and economic returns due to increased cost of fishing operations, management problems in the context of common property multigear, multispecies nature of fisheries. The above issues brought about by the uncontrolled fishing effort put into the fishery without any regard to stock-production-recruitment relationship. Besides these the ecological problem created by increasing pollution of coastal waters by release of untreated effluents and pollutants by agro industrial complexes operating in the coastal zone. It has been observed that the sediment in certain waters contains high levels of Copper, Zinc and Lead. The mercury content in some of the marine organisms at certain places has been found to be higher than the normal which may alter the genetic makeup of species. The fly ash deposits from thermal plants at certain places are on the increase and it changes the bottom topography of the affected area and chances of species depletion and replacement. To address these issues a thorough knowledge about different marine ecosystems like mangrove ecosystems, coral reef ecosystem, estuarine ecosystem, coastal marine ecosystem, lagoon, systems, coastal ecosystems and marine protected areas of India is prerequisite.

Ecosystems

Mangrove ecosystems

A large number of Islands along the Indian coast in the Gulf of Mannar, Gulf of Kutch, Lakshadweep and Andaman group and the vast mangroves ecosystems along the coast of Goa, Karnataka, Kerala, Tamilnadu, Andhra Pradesh and West Bengal constitute rich marine biodiversity supporting variety of species of corals, sponges, ornamental fishes, crustaceans, molluscs and plants. The diversity of the species provides several ecological services like shore line protection, sea erosion, larval dispersal, breeding and larval rearing and safe habitat for migratory species for the ecosystem. Indiscriminate fishing, quarrying, dredging, deforestation, industrialization and other anthropogenic activities are the main threats causing considerable damage to these environments and consequently to the associated flora and fauna.

Regional distribution of mangroves in India

State	Locality
West Bengal	Delta system of Ganges
Orissa	Mouth of Mahanadi
Andhra Pradesh	a) Mouth of Godavari b) Mouth of Krishna
Tamil Nadu	Cauvery delta
Maharashtra	Bombay region
Gujarat	Saurashtra and Kutch
Andaman-Nicobar Islands	Bay of Bengal
	Total

Endangered species associated with Mangrove ecosystems of India			
No:	Common name	Scientific name	IUCN status
1	Dugong	<i>Dugong dugon</i>	Vulnerable
2	Bengal tiger	<i>Panthera tigris tigris</i>	Endangered
3	Smooth-coated otter	<i>Lutrogale perspicillata</i>	Vulnerable
4	Fishing cat	<i>Prionailurus viverrinus</i>	Endangered
5	Sambar deer	<i>Rusa unicolor</i>	Vulnerable
6	Hawksbill turtle	<i>Eretmochelys imbricata</i>	Critically endangered
7	King cobra	<i>Ophiophagus hannah</i>	Vulnerable
8	Sharptooth Lemon Shark	<i>Negaprion acutidens</i>	Vulnerable
9	Mangrove Whipray	<i>Himantura granulata</i>	Near threatened

Coral reef Ecosystems: India is blessed with vast stretches of coral reefs in the Gulf of Mannar and Palk Bay, Gulf of Kutch, South-west coast and along the Andaman and Lakshadweep islands. Coral reefs are the most biologically productive and diverse of all natural ecosystems. The fin fish fauna of coral reefs are extremely rich and diverse. Besides they are raw materials for industries such as cement, lime and calcium carbide. About 225 species of corals are known from the Indian seas. Indiscriminate exploitation of the corals, dredging the reef areas and the exploitation of the reef flora and fauna have resulted in the destruction of coral reefs of India. The coral reefs of India face several threats from both natural and anthropogenic origin. Indiscriminate exploitation of corals for various purposes, over exploitation of reefs associated living resource, dredging, reclamation, are important anthropogenic factors for destruction of corals in India. Pollution, sea erosion, siltation, constructive activities in lagoons also added to this man made cause for destruction of reefs. Global warming, coral bleaching, cyclones, pests like *Acanthaster planci*, white band diseases are some of the natural cause affect mortality of corals.

Estuarine ecosystems: A total of 14 major, 44 medium and 162 minor rivers draining fresh water into the sea through about 53 estuaries in India. Estuaries are the natural nurseries for many marine animals but their fisheries have declined due to over exploitation of juveniles and anadromous stocks. Estuaries face threats are damming of rivers, construction of barrages, fishing pressure, and pollution are the main cause for biodiversity loss and degradation of the ecosystem. Estuaries face problems of lack of effective planning and co-ordinate among the different stake holders in the implementation of management option, lack of critical knowledge on the ecological principals as well as sustainable management of resources, and low level of knowledge in the biodiversity value of goods and services provided by estuary.

Lagoon Ecosystem: A total of 17 major lagoons or lakes occur

along the coast of India. The lagoon ecosystems are the most vulnerable ecosystems due to several anthropogenic activities which threatens flora and fauna of the system. Threats include pollution from industries, dumping of city sewages, recreational boating, navigation, dredging, expansion of urban and rural settlements, reclamation, over exploitation of fish stocks, intensive aquaculture practices and pollution from different sources.

Coastal Ecosystems: Characteristic features of the Indian Ocean are the upwelling, southwest monsoon, northeast monsoon, mud-bank along the southwest coast and high coastal production. Upwelling occurs in the region between Kanyakumari and Karwar during the onset of southwest monsoon.

A total of 26 stocks are presently exploited from the inshore waters extending up to 50 meters by mechanized craft using gears like trawls, purse seines, gillnets, hooks and lines and a variety of indigenous crafts and gears. A large number of stocks of them are exploited not only by the same gear but by different gears also. Technological advances, increasing fishing effort, multigear-multiday fishing and higher investments kept the production increasing from about 0.6 million tonnes in fifteen to about 3.6 million tonnes in 2010.

Marine Protected Areas

In India, there are about 31 Marine Protected Areas (MPA) primarily in marine environments, which cover a total area of 627.2 Km² with an average size of 202.1 Km². In order to protect the ecologically important areas Government of India initiated action through the state governments to create a network of MPAs under Wildlife (Protection) Act, 1972. Recognizing ecological values and importance for biodiversity conservation, the GOI has notified three Biosphere Reserves in 1989 in marine areas viz: Great Nicobar Biosphere Reserves in Andaman and Nicobar (885 Km²), Gulf of Mannar Biosphere

Reserve (10,500 Km²) in Tamilnadu and Sundarbans Biosphere Reserve (9,630 Km²) in West Bengal (Singh, 2003).

iii. Protected Marine Organisms

Some of the marine resources like sea weeds, sponges, gorgonians, corals, pipe fishes and others are being exploited for the extraction of pharmaceuticals, active chemicals which are known to cure several diseases. While there are reports of over exploitation of certain of these resources, there are also reports of environmental degradation due to anthropogenic influences. Certain fragile and sensitive marine ecosystems will not be available to the posterity if adequate care is not taken to conserve the system. In order to achieve improved returns while protecting the environment, a suitable policy needs to be formulated to exploit the resources on sustainable levels, to extract the drugs indigenously, basically for domestic use and for limited export. It is seen that there is a tendency for intensive exploitation of exportable commodities, but country cannot lose sight of the need to protect biodiversity and meet domestic requirements in its bid to increase foreign exchange earnings. Ecosystem goods form the marine realm included the finfishes crustaceans, molluscans and seaweeds. The important flora and fauna falling to the two major kingdoms such as Animal and Plant Kingdom recorded from the Indian region and their present status are discussed below.

Whale shark – *Rhincodon typus*

Whale shark is huge, sluggish, pelagic filter-feeder, often seen swimming on the surface. Viviparous and gravid female have 300 young ones of several stages of development (Raje *et al.*, 2002).

Elasmobranchs as per the Wildlife (Protection) Act, 1972 Schedule I

Species	Common name
<i>Rhincodon typus</i>	Whale shark
<i>Anoxyprisits cuspidata</i>	Pointed sawfish
<i>Pristis microdon</i>	Largetooth sawfish
<i>Pristis zijsron</i>	Longcomb sawfish
<i>Carcharhinus hemiodon</i>	Pondicherry shark
<i>Glyphis gangeticus</i>	Ganges shark
<i>Glyphis glyphis</i>	Speartooth shark
<i>Himantura fluviatilis</i>	Gangetic stingray
<i>Rhincobatus djiddensis</i>	Giant guitarfish
<i>Urogymnus asperrimus</i>	Thorny ray

Dolphins

The species diversity of dolphins in India is one among the richest in the world. A total of five species dolphins were recorded from our seas. Important species are *Stenella longirostris* (Spinner dolphin), *Sousa chinensis* (Humpback dolphin), *Delphinus delphis* (Common dolphin), *Tursiops truncatus* (Bottlenose dolphin) and Risso's dolphin (*Grampus griseus*).

Whales

Whales constitute the most dominant groups of marine mammals. They usually occupy in the temperate and polar oceanic waters, they migrate to tropical waters for breeding and avoid extreme climatic conditions during certain seasons. Whales are classified into Odontoceti (toothed whales) and mysticeti (baleen whales). All the Cetaceans are included in the list of protected animals. A total of about 10 species have been reported from Indian seas. They are *Indopacetus pacificus* (Longman's Beaked whale), *Balaenoptera borealis*, *Balaenoptera musculus*, *Balaenoptera acutorostrata*, *Pseudorca crassidens*, *Physeter macrocephalus*, *Ziphius cavirostris* and *Balaenoptera sp.*

Sea Cow

The sea cow, Dugong dugon inhabits in the Gulf of Mannar and Palk bay area and is included in the List of protected animals as per the Wildlife (Protection) Act, 1972 Schedule I.

Turtles

Five species of sea turtles were reported In India which include Olive Ridley (*Lepidochelys olivacea*) Green Turtle (*Chelonia mydas*), Leatherback (*Dermocheylus coriacea*), Hawksbill (*Eretmochelys imbricata*) and Loggerhead (*Caretta caretta*). All the five species were included in the list of protected animals as per the Wildlife (Protection) Act, 1972 Schedule I.

Crocodiles and Gharial

The Crocodile species like *Crocodylus porosus*, *Crocodylus palustris* and Gharial (*Gravialis gangeticus*) are protected under the Wildlife (Protection) Act, 1972 Schedule I.

Marine Molluscs

A total of 3271 species of molluscs distributed among 220 families and 591 genera, of which 1900 are gastropods, 1100 bivalves, 210 cephalopods, 41 polyplacophora and 20 scaphopods. Among these 8 species of oysters, 2 species of mussels, 17 species of clams, 3 species of pearl oysters, 3 species of giant clams, 1 species of windowpane oyster and gastropods such as Sacred Chank, Trochus, Turbo and 15 species of Cephalopods are exploited from the Marine sector

of India. The species like *Cassis cornuta*, *Charonia tritonis*, *Conus milneedwardsi*, *Cypraecassis rufa*, *Nautilus pompilius*, *Hippopus hippopus*, *Tridacna maxima*, *Tridacna squamosa* etc are the some of the molluscs protected under the Wildlife (Protection) Act, 1972 Schedule I.

Corals and Gorgonians

The Reef building coral (All Scleractinians), Black Coral (All Antipatharias), Organ Pipe Coral (*Tubipora musica*), Fire coral (All Millipora Species) and Sea Fan (All Gorgonians) are protected under Wildlife (Protection) Act, 1972 Schedule I.

Other Marine Organisms

The Sea horses, Pipe fishes (Syngnathidae) and Sea Cucumber (Holothurians) are included in the list of protected animals as per the Wildlife (Protection) Act, 1972 Schedule I.

CITES in India

International trade in all wild fauna and flora in general, and the species covered under CITES is controlled jointly through the Wild life (Protection) Act 1972, Amendment Act, 2002, the Foreign Trade (Development regulation) Act 1992, the Foreign Trade Policy of Government of India and Customs Act, 1962. The Director of Wildlife Preservation, Government of India is the Management Authority for CITES in India. Import of animals and their parts and products for zoological parks and circuses or for research may be permitted subject to the provisions CITES and on the recommendations of the Chief Wildlife Warden of the States and Union Territories under license from Director General of Foreign Trade (DGFT). Import of wild

animals as pests in the personal baggage of a passenger is also subject to the provisions of CITES in accordance with the Ministry of Commerce's rules. All imports and exports of wild animals including marine species and plants are permitted only through the Customs points at Mumbai, Kolkata, New Delhi, Chennai, Cochin, Amritsar and Tuticorin according to the rule. Two essential conditions governing the import and export of Wildlife and the derivatives are (i) compliance with the provisions of CITES (ii) inspection of the consignments by the Regional Deputy Directors of Wildlife Preservation at the Customs points. In case of items covered under CITES, an endorsement is made on the relevant CITES export permit. All marine species that have been included in the Schedules of the Wild Life (Protection) Act, 1972 are not permitted for export.

Conclusion

The exploited marine fisheries resources from the coastal area have been reached maximum from the present fishing grounds up to 200 m depth. The coastal fisheries faces several threats such as indiscriminate fishing, habitat degradation, pollution, social conflicts, introduction of highly sophisticated fishing gadgets, need management measures and conservation of marine biodiversity to maintain sustainable use of marine biodiversity. Some of the measures such as control of excess fleet size, control of some of the gears like purse seines, ring seines, disco-nets, regulation of mesh size, avoid habitat degradation of nursery areas of the some of the species, reduces the discards of the low value fish, protection of spawners, implementation of reference points and notification of marine reserves for protection and conservation.