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It seems that human activities are the immediate causes for the loss of biological diversity and the solutions and remedies are lying in the human behavior. The United Nations declared the International Day for Biological Diversity (IDB) to enhance the understanding and awareness of biodiversity issues. The theme selected for this year is 'Marine Biodiversity'.

Fishes and marine organisms in the ecosystem provide number of ecosystem goods and services to humans. Fish serve as food, medicine, ornaments and recreation. The fauna and flora of marine ecosystems provides services such as water and air purification, seed dispersal, flood control, shoreline protection, nutrient cycling, waste decomposition and transformation. Ecosystem services are directly related to biodiversity present in the natural system. The abundance or depletion of a species from the system increases or eliminates the ecosystem services that species provide.

#### Marine Bioresources

Kerala has a coastline of 590 Km with 44 rivers, 34 lakes and 11 backwaters making it one of the world's twenty five biodiversity hotspots. It falls in the humid equatorial climate with an average rainfall of 3000-3600 mm/year. The total area of Continental shelf of Kerala is 40,000 Km<sup>2</sup> and about 13000 Km<sup>2</sup> falls within the 50m depth zone. The coastal area is composed of several sub systems like backwaters, brackish water, lakes, estuaries, wetlands, mangroves, seagrass

beds, rocky shores, sandy shores, coral reefs, inshore area, pelagic systems and benthic systems which provides ideal conditions for the high levels biological diversity in the state. Now biological diversity has become a framework for discussing the issues raised by human relationships with other biotic components and ecosystem. Biological diversity plays a role of essential ecosystem services and goods for the human beings particularly in the form of fish and pharmaceuticals products.

The actual marine fish diversity of Kerala is unknown and under this uncertainty all the estimated numbers of species are highly variable. Various studies indicated that around 1020 species of marine finfishes occur along the Kerala coast. Fish abundance and diversity are on decline at one side and at the same time the human population and destructive activities are increasing in a higher pace on the other. The population of Kerala was 13.5 million during 1951, which rose to 33 million by 2011. The human activities are the prime sources for the decrease in the diversity of fishes as well as the marine organisms.

#### Fishery Scenario

Other than fishes like Seer, Clupeids, Mackerels, Tunas, Caranzids, Perches, Catfishes and white fish, Kerala coast have a rich array of crustaceans, corals, echinoderms, Molluscans, turtles, plants etc.

**Crustaceans:** The fishery is supported by penaeid prawns, lobsters and crabs.

Lobster fishery along the Kerala coast shows declining trend and this resource also needs conservation measures. Shrimps are the major components in the export commodity from Kerala state. A total of 57 species of shrimps belong to 22 genera and 9 families were reported. 152 species of crabs of 86 genera and 20 families and 9 species of lobsters of 3 genera and 3 orders were reported. The zooplankton component of the ecosystem was mainly contributed by the crustacean group and this forms the major food for the other groups in the food chain. High diversity of zooplankton was observed in the ecosystem and they follow a bimodal cycle of abundance annually. Several species of commercially important shrimps inhabited in the ecosystem viz., *Peneaus semisulcatus*, *P. monodon*, *Metapenaeus dobsoni* and *Parapenaeus merguensis*. An important feature of the shrimp fishery is fishing peak for single species (*P. stylifera*) in the southwest monsoon of Kerala coast.

**Corals:** About 200 species of hard corals have been reported from Kerala and Lakshadweep coast. Among these protected Corals as per the Wildlife (Protection) Act, 1972 Schedule is Reef building coral (*Scleractinians*), Black Coral (*Antipatharians*), Organ Pipe Coral (*Tubipora musica*) and Fire coral (*Millipora* species).

**Echinoderms:** A total of 275 species of echinoderms inhabit the Kerala coast of which, two are endemic to this region. They include starfish, brittlestars, sea

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urchins, and sea cucumbers which shows high species richness and diversity. All the species holothurians are put in the Schedule list of Wildlife Protection act which prevents the exploitation of resources from the ecosystem.

**Molluscans:** A total of 730 species of molluscs were enlisted from the Kerala coast. Gastropods form 515 species representing 196 genera from 75 families were recorded.

Bivalves form 16 orders and 35 families were constituted by 171 species from 91 genera.

Cephalopods form 12 genera and 28 species was enlisted under 4 orders. Class Scaphopoda was characterized by 2 orders forming 5 different genera comprising of 14 species. The Polyplacophora was solely constituted by single order constituting 2 genera. The protected marine molluscs as per the Wildlife (Protection) Act, 1972 Schedule I are *Cassis comuta*, *Charonia tritonis*, *Conus malneedwardsi*, *Cypracasis rufa*, *Nautilus pompilius*, *Hippopus hippopus*, *Tridacna maxima*, *Tridacna squamosa* and *Tudicla spiralis*.

**Turtles:** Five species of sea turtles were reported which include, *Lepidochelys olivacea* (Olive Ridley), *Chelonia mydas* (Green Turtle), *Dermochelys olivacea* (Leather back), *Eretmochelys imbricate* (Hawksbill) and *Caretta caretta* (Logger

# Marine Biodiversity of Kerala



head). All the five species were included in the list of protected animals as per the Wildlife (Protection) Act, 1972 Schedule.

**Plantae:** Marine phytoplankton is the major components in the ecosystem which is responsible for the production of oxygen, carbohydrate and many other process and services. About 480 species belonging to 154 genera, 89 families, 55 orders are occurring along the Kerala coast. About 120 species of seaweeds were reported from our coast. The sea grass was the one of the important biotic component of the sea grass ecosystem which serves as supply of oxygen, regulation of the water quality and important nursery grounds for marine organisms. There are about 12 species of sea grasses have been found in the Kerala and Lakshadweep coast and important species are *Thalassia hemprichii*, *Halphila ovalis*, *H. decipiens*, *Cymodocea serrulata*. The most abundant species found in the sea grass bed were *Hemirhamphus far*, *Lutjanus lutjanus*, *L. malabariucus*, *Sardinella gibbosa*, *Parupeneus indicus* and *Siganus canaliculatus*.

### **Biodiversity indicators**

**Mudbanks:** The mudbanks (Chakara) are 1 to 3 m thick in calm, turbid near



Although the total catch of marine fishes of Kerala is showing increasing trends the catch per unit effort and fish abundance in the ecosystem shows a declining trend. The increased catch was mainly due to the intensive exploitation and expansion of fishing area and multiday-mutligear operations of the vessels. The present level of exploitation may ultimately lead to serious overfishing and depletion of some of the resources.

shore waters of 2-5 Km along the coast with a width of 1.5 to 4 Km appear along with southwest monsoon. Mudbanks are known to exist from time immemorial to present and always been matter of curiosity and mystery for the public as well as Scientists. Mudbanks can be divided in to four depending on the source of the mud supplied to the mudbank. According to that mud can be formed by subterranean mud, by the aggregation of coastal mud, by the sediments discharged from rivers and estuaries and by the accumulation of mud resulting from dredging operations. The results obtained so far are not final and further refinement of the hypothesis and concepts are necessary to reveal the mystery surrounding the phenomenon of mudbanks. There are several anthropogenic activities which are negatively affecting the mudbank formation along the Kerala coast.

**Pokkali fields and prawn farming:** In Kerala, the total brackish water resources including the lower reaches of rivers, the brackish water lakes, the backwaters and the adjacent low-lying fields and mangrove swamps are estimated at about 2, 43,000 hectares. A traditional system of more than 3000 year old prawn

farming in paddy fields using highly salt resistant 'Pokkali rice' is another important uniqueness of Kerala coast. The microheterotrophs in the pokkali fields are represented by protozoans, metazoans and Bacteria. The interaction between phytoplankton and protozoan are the major pathways in the cycling of the nutrients in the system. Recently the Pokkali rice got GI (Geographical Indication) status which will enhance higher marketing and returns. But at the same the loss of habitat, degradation of habitat, loss of associated species in the pokkali fields and other socioeconomic issues have to be addressed immediately to conserve this important traditional farming system.

### **Biodiversity loss**

Although the total catch of marine fishes of Kerala is showing increasing trends the catch per unit effort and fish abundance in the ecosystem shows a declining trend. The increased catch was mainly due to the intensive exploitation and expansion of fishing area and multiday-mutligear operations of the vessels. The present level of exploitation may ultimately lead to serious overfishing and depletion of some of the



resources. Biodiversity losses occur as a result of reduction, depletion, addition and substitutions of species from the ecosystem. Reduction and depletion occur because of overfishing, pollution, habitat loss and climate change. As a consequence of overexploitation of the fishes, the top predators in marine and fresh water ecosystems shows decline which results in fishing down the food web.

The ecosystem services provided by fishes have direct and indirect impacts on the human welfare. Healthy ecosystems have the natural components of biotic, abiotic and habitat interactions will be in an equilibrium state. If the system is disrupted it will end up in the collapse of the ecosystem and ultimate loss of biodiversity. In Kerala there are several examples for the partial or complete biodiversity loss in the coastal and adjacent areas. The lakes like Vembanad and Ashtamudi Kayal are under the threat of biodiversity loss due to several factors. The largest backwater the Vembanad Lake which stretches out into the Arabian Sea at Cochin Port is under constant threat from anthropogenic origin. The other important backwaters such as Veli, Edava,

Kadinakulam, Madayara, Kayamkulam, Paravoor, Kodungallur, Ashtamudi and Chetuwa also face several threats due to urbanisation and expansion of human activities. The Industrial areas adjacent to coasts like Chavara, Cochin Barmouth and Kadalundy areas are also facing the problem of biodiversity loss.

Past studies indicate that marine species which have peculiar characters such as long life span, slow growth, low production, low reproductive effect, large size at sexual maturity, poor regeneration, short dispersal, near shore occurrence, narrow depth range, small geographic range, high vulnerability to anthropogenic action and small population size faced the threat of extinction.

### **Biodiversity conservation**

Our basic knowledge of marine fish diversity and conservation is meagre as compared to other developed countries to put forward a specific sustainable conservation measures. Taxonomy is directly related to diversity and conservation aspects of organisms and hence understanding specific diversity, subspecies, stock, evolution etc., assumes importance. Biodiversity of a particular taxon in a defined area in its simple form is the total number of species. As such, the first step towards documenting the diversity of a particular ecosystem to know the exact identity of the species from that area. IUCN Red lists of threatened species are available for Indian Ocean. But the actual picture of threatened fishes could be elucidated only from the real time local assessment using IUCN criteria. The present lists are the result of Global assessments only which may not be fully applicable case to case and area to area.

The Central Marine Fisheries Research Institute (CMFRI), Cochin was recognized as a 'Designated National Repository' by the Government of India, in December 2007 in consultation with the National Biodiversity Authority under the Biological Diversity Act, 2002. A Designated National Repository (DNR) is an Institution authorised to keep in safe custody of specimens of different categories of biological material. Researchers in the field of Marine Sciences can now deposit their valuable holotype specimens (species new to science) in the Marine Biodiversity Museum of CMFRI. The Museum offers a glimpse of the bioresources of the Indian seas. Currently the museum houses six

holotype specimens, 878 finfish species, 136 crustaceans, 217 molluscs, 44 echinoderms, 162 corals, 12 sponges, 20 ascidians, 82 seaweeds and 9 sea grasses besides a dolphin and three Antarctic birds. The Museum is open to scientists, teachers, students and the general public. The fact that students form more than 85% of the visitors highlights the role played by the Museum in education. The specimens are of fundamental importance to taxonomic, systematic and biodiversity studies.

Although we had a very good knowledge on the distribution, biology and commercial importance of the marine resources of Kerala we don't have much information on the species diversity, richness and biodiversity value of most of the resources in relation to their ecosystem. Another important lacuna in our knowledge about biodiversity is the lack of information on the various services provided by the system and benefits offered for the human beings in the vast area of Kerala coast on a locality basis. Considering the above gaps in the information and importance of biodiversity valuing of marine ecosystems, CMFRI has taken up study of the total economic value of biodiversity of the selected groups of important resources in the ecosystem so that necessary policy interventions are evolved for long term and sustainable management of the bio-resources of the marine sector. ■

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