

# MANGROVE ECOSYSTEMS

**A MANUAL FOR THE ASSESSMENT  
OF BIODIVERSITY**

**A follow up of the  
National Agricultural Technology Project  
(NATP.), ICAR.**

*Mangrove Ecosystem Biodiversity :  
Its Influence on the Natural Recruitment of  
Selected Commercially Important Finfish and Shellfish  
Species in Fisheries*

*Edited by :*  
**Dr. George J. Parayannilam**



**Central Marine Fisheries Research Institute**  
(Indian Council of Agricultural Research)

P.B. No. 1603, Ernakulam North P.O; Cochin – 682 018, Kerala, India













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## **A Manual for the Assessment of Biodiversity**

*Published by :*

**Prof. Dr. Mohan Joseph Modayil**

Director

Central Marine Fisheries Research Institute, Cochin - 18, Kerala, India

Telephone : + 91-484-2394798

Fax : + 91-484-2394909

E-mail : [mdcmfri@md2.vsnl.net.in](mailto:mdcmfri@md2.vsnl.net.in)

Website : <http://www.cmfri.com>

**ISSN : 0972-2351**

**CMFRI Special Publication No. 83**

*Edited by :*

**Dr. George J. Parayannilam**

*Editorial assistance :*

**Mr. P. K. Jayasurya**

**Dr. Ansy Mathew**

*Cover design :*

**Sreejith K. L.**

© 2005, Central Marine Fisheries Research Institute, Cochin - 18.

Price :

Indian Rs. 600/-

Foreign \$ 60/-

*Printed at :*

**Niseema Printers & Publishers, Cochin - 18, Kerala, India. Ph : 0484-2403760**



# Methodology for Assessing Status of Fish Stock in Mangroves

M. K. Patra, S.K. Acharjee and S.K.Chakraborty

In the world more than 28,500 finfishes have been recorded so far and among these 2200 species have been reported from India (Anon, 1998). Fish constitute chief source of protein and people living in the catchment areas of different aquatic systems depends on fishes for their livelihoods. There the indigenous traditional knowledge (ITK) brought down has turned them into a repository of self experts in fishery sectors in due course of time. Nevertheless, new methodology has been devised utilising the perception of the fisher flocks in order to determine the conservation status of fish stocks of a particular area.

## Methods :

The earlier method of grouping of fishes into different categories viz. Threatened, Extinct , Endangered, Vulnerable and Rare have been lead to different criticisms and thrown into a stressed situation for their subjective nature and abstractive dimension. The IUCN Council adopted the latest version (IUCN, 2001). (Red List Categories and Criteria. Version 3.1) As a result of recommendations of IUCN (1994) and Species Survival Commission (SSC) (IUCN, 1998) followed by a final meeting of the Criteria Review Working Group in 2000, nine categories of species have been identified. They are Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD) and Not Evaluated (NE). Among these Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species belong to 'threatened' category and all the nine categories as per IUCN Version 3.1 have been defined as follows :-

**EXTINCT (EX):** A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and or expected habitats, at appropriate

times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be completed to within a time appropriate to the taxon's life form.

**EXTINCT IN THE WILD (EW):** A taxon is Extinct in the Wild when it is known only to survive in cultivation/culture in captivity or as a naturalized population (or populations) well outside the past range.

**CRITICALLY ENDANGERED (CR):** A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria (IUCN, 2001) for Critically Endangered category and it is therefore considered to be facing an extremely high risk of extinction in the wild.

**ENDANGERED (EN):** A taxon is endangered when the best available evidence indicates that it meets any one of the criteria for Endangered category (IUCN, 2001) and it is therefore considered to be facing a very high risk of extinction in the wild.

**VULNERABLE (VU):** A taxon is Vulnerable when the best available evidence indicates that it meets any one of the criteria for Vulnerable category (IUCN, 2001) and it is therefore considered to be facing a high risk of extinction in the wild.

**NEAR THREATENED (NT):** A taxon is 'Near Threatened' when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable categories now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

**LEAST CONCERN (LC):** A taxon is 'Least Concern' when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered or Vulnerable or Near Threatened. Widespread and Abundant taxa are included in this category.



**DATA DEFICIENT (DD):** A taxon is 'Data Deficient' when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied and its biology is well known but appropriate data on abundance and / or distribution are lacking. Data Deficient is therefore not a category of threat. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

**NOT EVALUATED (NE):** A taxon is 'Not Evaluated' when it has not yet been evaluated against the criteria.

#### **PARTICIPATORY RURAL APPRAISAL (PRA) METHOD (a case study)**

It is a participatory and objective methodology of assigning threatened categories and deriving recommendations for conservation through interactive group dynamics from a number of stakeholders. Selected PRA methods were carefully designed and applied to extract quality primary information relating to the conservation of fishes. The techniques like-Trend Analysis and Matrix and Rank Based Quotient (RBQ) were used. Trend Analysis was carried out to analyse the nature of declining pattern of the target fish population over decades considering the experience profile above 40 years of 50 stakeholders. Fish Magnitude Value (FMV) was calculated through the participatory approach where the decadal availability of a fish species in quantity on exploitation vis-à-vis biomass (Kg) was assessed and that was multiplied by the area of occupancy (Km) [IUCN, 2001]. To avoid the biases in the perceptual assessment, the total score value of the group was divided by the number of stakeholders to have an interpolated mean value. The formula followed was:

$$\text{Mean Fish Magnitude Value (FMV)} = \frac{\text{Biomass} \times \text{Area of occupancy}}{\text{Number of responding stakeholders.}}$$

The entire process of coining FMV and monthly market landing of the fishes were carried out through the techniques of Participatory Group Dynamics (Mukherjee, 1995) and in conforming with the IUCN guidelines. In the present context the categorisation

of fishes has been done considering the decline on FMV and mean decline on market landing of fishes as follows: Critically Endangered (CR) decline on FMV > 80 and mean decline on market landing >60; for Endangered (EN) decline on FMV > 75-80 and mean decline on market landing > 40-60; for Vulnerable (VU) decline on FMV >50-75 and mean decline on market landing > 30-40; for Near Threatened (NT) category, decline on FMV 40-50 and mean decline on market landing 15-30 and for Least Concern (LC) category, decline on FMV and the mean decline on market landing had been < 40 and < 15 respectively. Matrix Ranking was used to isolate and rerank the perceived causes and their relative values in relation to the depletion of target fish population. 20 stakeholders, having experience profile above 40 years, were considered. Rank Based Quotient (RBQ) was calculated to rerank the identified causes in relation to dwindling of fish population (Patra *et al.*, 2003). The formula followed was :

$$\text{RBQ} = \frac{\sum^n f_i (n+1 - i) \times 100}{Nn}$$

where N = total No. of stakeholders  
n = Number of ranks  
i = Rank position  
and f<sub>i</sub> = frequency of 'i'.

#### **Suggested References**

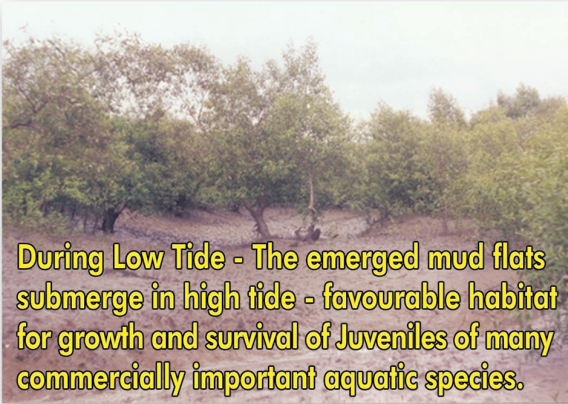
- Anon (1998). Executive Summary Report of Biodiversity Conservation Prioritization Project (BCPP) Conservation Assessment Management Plan (CAMP) on freshwater fishes of India, NBFGR, Lucknow, Zoo Outreach Organisation/CBSG, India. pp - 1-7.
- Crawford, S.S. and Morito, B. (1997). Comment: towards a definition of conservation principles for fisheries management. *Canadian Journal of Fisheries and Aquatic Sciences*. **54** (11): 2720-2723.
- IUCN, (1994). *IUCN Red List Categories*. Prepared by the IUCN Species Survival Com., IUCN, Gland, Switzerland.
- IUCN, (2001). *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, U.K., 1-30.
- Jhingran, A.G. (1988). Aquatic pollution with special reference to the Ganga River System. *National Symposium on Environmental impacts on Animals and Aquaculture*. May, 14-16, 1988. Dept of Zoology, University of Kalyani, Kalyani, India. pp. 6-19.



- Mukherjee, N. (1995). *Participatory Rural Appraisal and Questionnaire Survey*. Concept Publishing Co. Delhi.
- Pandit, P.K., Bhaumik, U and Chatterjee, J.K. (1994). Threatened fishes of Sundarbans, West Bengal. *Threatened fishes of India*. Natcon Pub. **4**: 253-359.
- Patra, M.K and Chakraborty, S.K. (2003). Ichthyofaunal resources of North-East Sundarbans, W.B., India. *J. Inland. Fish. Soc. India*
- Patra, M.K., Acharjee, S.K. and Chakraborty, S.K. (2003). Conservation Categories of Siluroid fishes in North-East Sundarbans, India. *Biodiversity and Conservation*.



## MANGROVES NATURAL

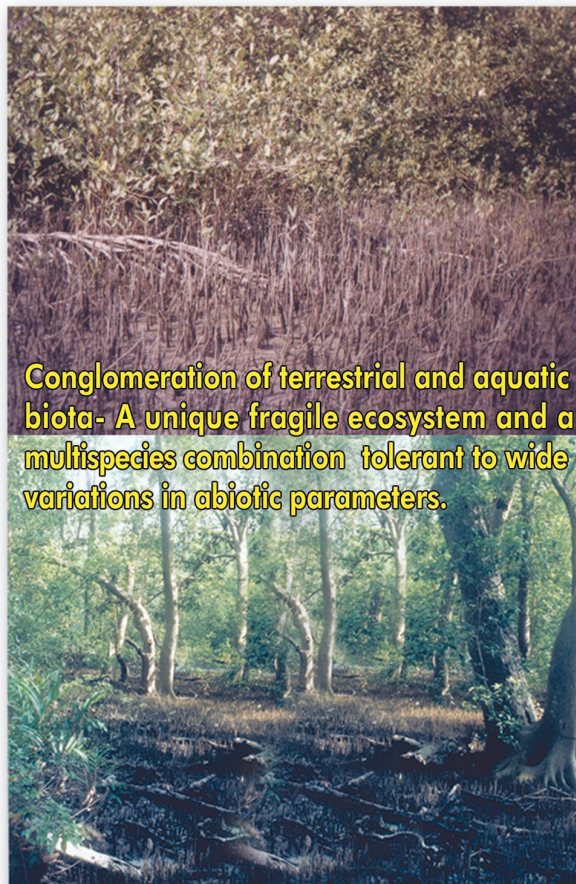


During Low Tide - The emerged mud flats submerge in high tide - favourable habitat for growth and survival of Juveniles of many commercially important aquatic species.

## MANGROVES RESTORATION & CONSERVATION



Participatory Afforestation for reclamation of Mangroves.



Conglomeration of terrestrial and aquatic biota- A unique fragile ecosystem and a multispecies combination tolerant to wide variations in abiotic parameters.



Natural Propagation of Mangrove Plants- less human intervention.



*Rhizophora mucronata* - Planted for Restoration of destructed mangroves.