

70% of the land area of this state. The altitude of this state varies from 780 m in the North-Eastern part to 15 m or even less in the Western part above the mean sea level. The state with 31,91,186 population (according to the census of 2001) is facing an unprecedented increase in human population since the independence of our country for various reasons. This has resulted a great pressure on the economy of this state. The increase in human population is causing extensive habitat alteration due to vast tracts of forests are cleared for agricultural, industrial and urbanization purposes consequently affecting the aquatic bodies which in turn affecting the fish population in particular. Deforestation, urbanization, water diversion, overexploitation and introduction of the exotic fishes are some of the problems threatening the fish population particularly their endangered, vulnerable and rare species of Tripura. Considering these factors some suggestions for protection and conservation of these fishes of Tripura are furnished in this paper.

Following measures can be adopted to protect and conserve the threatened fishes of Tripura :

- (i) Deforestation is one of the important problems affecting the fish population. Deforestation along the course of the river should be avoided because it causes soil instability that increases the turbidity of the water bodies. It also increases the temperature of the breeding ground of the fishes. Where the vegetation has been destroyed, replantation is desirable to stabilize the soil erosion, to maintain the clear water and to maintain the required temperature of the spawning grounds of the fishes.
- (ii) Pesticides and agricultural fertilizers along the watercourses should be used very carefully. The fishermen or the local people employed in fishing should be told to use only rapidly degradable types of pesticides.
- (iii) Increasing urbanization has led to pollution both by human activities and industrial discharges. Effluents from industrial areas should be released into the river systems after proper treatment to remove toxic materials. If this is not done it will reduce the growth of plankton and will decrease oxygen content of the water body, ultimately affect it will the aquatic animals especially the fish population as a whole.
- (iv) The threatened fish species of the degraded habitats if possible should be transferred to appropriate water bodies keeping in mind that the resident fish of those water bodies would not be adversely affected.
- (v) Water diversion is another factor affecting the fish population adversely. It is well known that if the course of a river system is diverted due to obstruction by damming, the resident fishes will be definitely affected. The Gumti Hydel Project across the river Gumti, therefore is sure to affect the fish population of that locality. Where dams are to be constructed for immediate benefits, the long-term effects have to be kept in consideration. The dams totally change the river ecosystems and causes irreversible damage to the aquatic organisms, primarily due to siltation and aquatic weed growth. It obstructs the migration of the fishes

consequently affecting their growth and reproduction. Since several fish species migrate or move upstream to spawn during the breeding period (early monsoon flood) their reproductive cycle is affected due to the construction of dams resulting the depletion of their multiplication.

- (vi) Overexploitation or indiscriminate harvesting of fishes is another menace to the whole fish population irrespective of the matured or the juvenile fishes. This should be controlled or monitored by imposing closed seasons especially during the spawning period. At the same time the immature specimens should be protected by banning the use of very small mesh sized nets so that juveniles are escaped. The fish resources also to be sustainably utilized otherwise commonly found fishes will also soon disappear from our fish menu meal.
- (vii) Introduction of the exotic fishes has been found in some cases adversely affecting the native fishes due to competition for food, breeding grounds and predation. In view of these types of potential hazards, introduction of exotic fishes should not be done without careful consideration of the ecological and biological impact over the resident fishes.
- (viii) Lastly it may be mentioned since out of the 4 endemic fish species 2 species are already threatened species in Tripura, therefore, all the endemic species should be considered at par the threatened species. Proper care should be taken for their sustainable utilization otherwise in course of time the remaining 2 species will sure to face the problem of their existence like those of the threatened fish species of Tripura.

### SUMMARY

Tripura, one of the states of the North-East India contains several species, which are common to both the Indo-Gangetic and South-East Asian river systems. The presence of these fishes in the sub-Himalayan region of Tripura is of special importance in the Fish Geography of the North Eastern region and that of the Indo-Malayan Archipelago. Generally the North Eastern Region of India is considered as of the Hot Spots of Biodiversity including that of the freshwater fishes of India. Therefore, an attempt was undertaken to estimate Fish Fauna of Tripura. The present author has identified the Fish fauna of this state. It shows that the fish fauna of Tripura contains 129 species belonging to 78 genera, 33 families and 11 orders. Out of these 129 species, 28 species are Vulnerable, 10 species are Endangered and 4 species are Rare species. This state also contains 4 endemic species. As the population in Tripura has been increasing, vast tracts of forests are cleared for agricultural, industrial and urbanization purposes. Several freshwater fish species of India have been described as the threatened species. To conserve and sustainably exploit the fish fauna particularly its threatened species of Tripura, measures should be adopted to protect and conserve this natural resources. Suggestions for conservation of these fishes are discussed in this paper.

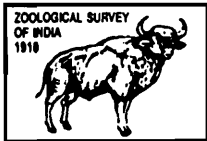
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## **THE FISHES OF THE KOLLERU LAKE, ANDHRA PRADESH, INDIA WITH COMMENTS ON THEIR CONSERVATION**

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### **INTRODUCTION**

Kolleru Lake is one of the National wetlands and the largest freshwater lakes of our country. Wetlands are very important productive ecosystems and their socioeconomic values are well established. Moreover, the riverine fishes use wetlands as their breeding grounds. In addition to these, this lake has been found to contain some threatened species of fishes, which needs to be conserved to protect them from extinct in near future. Considering these facts an attempt has been made to estimate the Fish resources of this lake. This work is based primarily on the fish collections from this lake by the author (Barman, 1993) in addition to the fishes recorded from this lake following the works of Chacko *et al.* (1952) and Dutt & Murthy (1971 & 1976). This Lake has been found to contain 51 freshwater fish species belonging to 35 genera, 21 families and 9 orders. A review on the fishes of this lake shows that it contains 4 endangered, 11 vulnerable and 1 rare species following the works of Molur and Walker (1998) and Menon (1999) as per the guidelines and criteria provided by the IUCN for determining the threatened species. Almost all the fishes of this lake are commercially important. Since this lake contains some important commercial fishes and 16 threatened species, it has been suggested for conservation specially to protect the threatened species and to maintain its biodiversity of the fishes as a whole.

### **TOPOGRAPHY**

The Lake Kolleru is a natural depression with an average depth of 1 metre and a maximum depth of 3 metres during the southwest monsoon, in the coastal belt between the deltas of the river Godavari to the east and Krishna to the west. It is located partly in Krishna and West Godavari districts of Andhra Pradesh. The Eluru canal (irrigation canal) connects these two rivers

to the north of this lake and the Bay of Bengal passes to its southwest side. This lake has an area of almost 250 sq. km. Four major streams, viz., Budameru, Thammileru, Ramileni and Gunderu and several irrigation channels open into this lake, carrying a considerable amount of silt in this lake. The Bay of Bengal is 32 km. away and is connected to this lake by one outlet, named Upputeru. This lake is a low-lying swamp type with almost 85% freshwater dominance. Although the lake is connected with the Bay of Bengal through Upputeru, the tidal waters do not enter into the lake proper, so the freshwater fishes can thrive there well.

### SYSTEMATIC ACCOUNT OF THE FISHES OF THE KOLLERU LAKE

The classification of Greenwood *et al.*, (1966) and Menon (1999) is followed here in listing the fishes of this lake as follows :

#### Order I ANGUILLIFORMES

##### Family 1 ANGUILLIDAE

1. *Anguilla bengalensis* (Gray and Hardwicke) (**Endangered species**)

#### Order II CLUPEIFORMES

##### Family 2 CLUPEIDAE

2. *Gudusia chapra* (Hamilton)

#### Order III OSTEOGLOSSIFORMES

##### Family 3 NOTOPTERIDAE

3. *Notopterus notopterus* (Pallas)

#### Order IV CYPRINIFORMES

##### Family 4 CYPRINIDAE

4. *Salmostoma clupeioides* (Bloch)
5. *Amblypharyngodon mola* (Hamilton)
6. *Chela laubuca* (Hamilton)
7. *Danio devario* (Hamilton)
8. *Esomus danricus* (Hamilton)
9. *E. thermoicos* (Valenciennes)
10. *Parluciosoma daniconius* (Hamilton) (= *Rasbora daniconius*)

11. *Thynnichthys sandkhol* (Sykes) (**Rare & Endemic species**)
12. *Osteobrama cotio cotio* (Hamilton)
13. *Rohtee ogilbii* Sykes (**Vulnerable & Endemic species**)
14. *Barbodes sarana sarana* (Hamilton) (= *Puntius sarana sarana*) (**Vulnerable species**)
15. *Hypselobarbus dobsoni* (Day) (= *Puntius dobsoni*) (**Endangered & Endemic species**)
16. *Puntius chola* (Hamilton) (**Vulnerable species**)
17. *P. sophore* (Hamilton)
18. *P. ticto* (Hamilton)
19. *Catla catla* (Hamilton)
20. *Cirrhinus mrigala* (Hamilton)
21. *C. reba* (Hamilton) (**Vulnerable species**)
22. *Labeo bata* (Hamilton)
23. *L. calbasu* (Hamilton)
24. *L. fimbriatus* (Bloch)
25. *L. rohita* (Hamilton)

#### Family 5 COBITIDAE

26. *Lepidocephalus guntea* (Hamilton)

#### Order V SILURIFORMES

#### Family 6 BAGRIDAE

27. *Mystus bleekeri* (Day) (**Vulnerable species**)
28. *M. cavasius* (Hamilton)
29. *M. gulio* (Hamilton)
30. *M. vittatus* (Bloch) (**Vulnerable species**)

#### Family 7 SILURIDAE

31. *Ompok bimaculatus* (Bloch) (**Endangered species**)

#### Family 8 SCHILBEIDAE

32. *Pseudeutropius atherinoides* (Bloch) (**Endangered species**)

#### Family 9 CLARIIDAE

33. *Clarias batrachus* (Linnaeus) (**Vulnerable species**)

#### Family 10 HETEROPNEUSTIDAE

34. *Heteropneustes fossilis* (Bloch) (**Vulnerable species**)