Biodiversity of Fish Species in Aquatic Ecosystem of Rewa District

FINAL TECHNICAL REPORT
ON
BIODIVERSITY OF FISH SPECIES IN AQUATIC ECOSYSTEM OF REWA DISTRICT

Financed by

MADHYA PRADESH BIODIVERSITY BOARD

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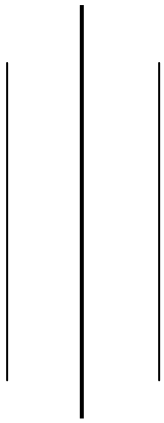

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1. INTRODUCTION

The hydrosphere is one of the major component of biosphere, which is the pioneer platform of life. The biotic community of aquatic ecosystem comprises various variety of producers, consumers and decomposers. These biological components interact with each other and establish the biological equilibrium. In other words, the biological equilibrium is the product of biological diversity of any ecosystem. When the biological diversity of the ecosystem disturbs due to any reasons the biological equilibrium must effected.

Fishes are one of the most important aquatic fauna which is directly related with human health and wealth. Hence, it is necessary to maintain their live-stock property. For that purpose the Madhya Pradesh Biodiversity Board has sanctioned the Project "Biodiversity of fish species in aquatic ecosystem of Rewa District" on 31.12.05. Keeping the aim of project rivers, lakes, reservoirs and ponds were selected for the study. During the investigation of one year 55 species of fishes belonging to 13 families were recorded. The threat assessment of some fishes is only based on the information obtained from various sources such as fisherman fish farmers, fish shape etc.

2. DESCRIPTION OF STUDY AREA

For the study of proposed research project following water bodies were selected for sample collection and regular study. The selection of study sites is based on the geographical distribution, nature of water resource, availability of facilities etc.

Tons River :

Tons river is only the major river system of Rewa District. It originates from Tamasa Kund (23º 59' N latitude and 80º 22' E longitudes) near station Jhullehi of Satna district. The main tributaries of Tons River are Belan, Behar, Mahana, Kariyari and Magardaha (Fig. ...). Tons run along the eastern margin of the Bhander group of rocks.

The drainage density of Tons River is not very high which indicates the study area receives normal rainfall with high infiltration capacity of underlying rocks. The tributaries are shorter in length but velocity of water flow is very high.

A dam is constructed near Chachai to store water for the generation of hydroelectricity. The river Beehar meets Tons near Chachai and forms Beehar Barrage.

River Beehar and Bichhia :

Rewa town is situated on the banks of river Bichhia and Beehar. River Bichhia arises near the village of Khaira and after flowing for 30 kms joins the river Beehar. The combined waters of Beehar and Bichhia under the common name of the Beehar then take a northerly course till they join the Tons (Tamus) river.

Gorama Dam :

Gorama dam is the largest dam of the area constructed at the confluence of the two median sized rivers. The dam is located on the right hand side of NH-7 in Mauganj Tahsil of Rewa district, at 24º 43-13" longitude and 82º, 2-55" latitude. The area of dam is about 2067 acres and water storing capacity is about 392.66 cubic meters.

Govindgarh lake :

Govindgarh lake is located on either side of the Govindgarh Killa. It is 20 kms away from Rewa city. It is large man made water body used for fish culture and irrigation. The catchment area of lake is hilly with stone rocks. The lake is partially divided into two parts.

Jarmohara Dam – Jarmohara Dam is situated near Semaria towns of Sirmour Tahsil, Rewa (M.P.). It is constructed for irrigation purpose. Its maximum area is about 242 ha. It is perennial water body and under the control of fisheries department for fish culture.

3. MATERIAL AND METHODS

During the investigation of fish biodiversity in this region. Beehar river, Tons river, Govindgarh lake, Gorama Dam and Jarmohara dam were selected for regular sampling. Inspite of these water resources some other water bodies were also visited randomly to collected the specimens only. For the analysis of water sample, only selected four sites were taken and water samples were collected at the time of visit. Collected samples were analysed with the help of methods given by APHA 85), Adoni (985), Trivedi *et al.* (87).

The following methods were used to analyse different physico-chemical parameters.

Air and Water Temperature :

Temperature of air and water were recorded with the help of digital temperature probe.

Transparency :

Transparency was measured with the help of secchi disc and represented in cm.

Hydrogen ion concentration (pH) :

pH of water was also measured with the help of pH meter.

Free CO_2 :

Free carbon dioxide was estimated titrimetrically as per method given by APHA (1985) and Trivedi *et al.* (1987).

Total Alkalinity :

Alkanity was determined by titrating the sample with 0.01 N sulphuric acid in the presence of phenolphthalein (for carbonale) and methyl orange (for bicarbonates) as indicators. Both types of alkalinity sum to get the total alkalinity.

Total Hardness :

Hardness was estimated by EDTA titrimetric method as given by Adoni (1985). Eriochrome Black T was used as indicator.

Chloride :

The chloride content was estimated by Argentrometric method.

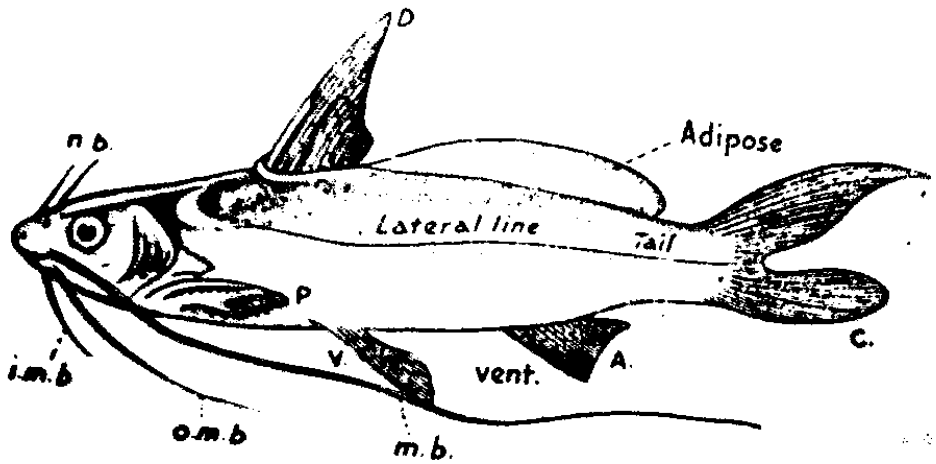
Dissolved Oxygen (DO) :

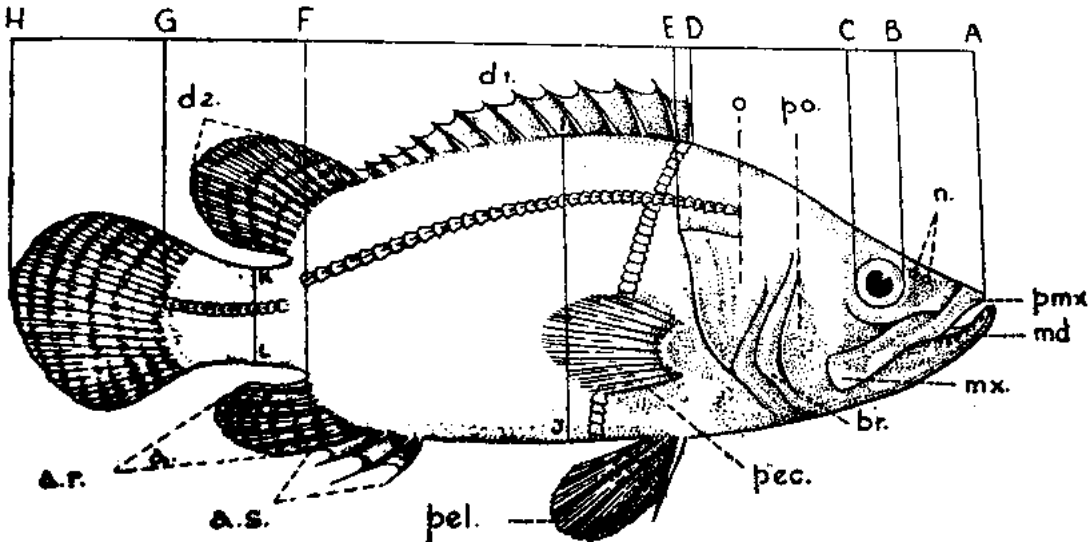
Dissolved oxygen was analysed using Winkler's Iodometric method and results were expressed in mg/L.

Study of fish diversity :

For the studying of fish biodiversity, selected water bodies was visited at a regular interval to collect the specimens. The collection work was done with the help of local persons and fishermen. The experimental fishing was also done whenever required. Inspite of collection work, several valuable informations regarding the fishery was also recorded. Collected specimens were preserved in the 8% formalien for further study.

Smaller specimens were directly put in the formalien, while medium size ones prior to the fixation, were given a longitudinal incision along the abdomen. Fixed specimens were kept in the containers with proper labelling for their identification. The identification was done with the help of 'The fisheries of India' (Day, 1958), Fishes of Eastern Utter Pradesh (Shrivastava, 1968) and The fresh water fisheries of the Indian region (K.C. Jayaram, 1999). Exploration of the terms and abbreviations used in this work are also follows :





D - Dorsal fin

P - Pectoral fin

V - Ventral fin or pelvic fin

A - Anal fin

LI - Lateral line of perforated scales

Lr - Lateral rows of unperforated scales

Ltr - Lateral transverse row of scale

O - Adipose

Bar - Barbles

Numerical Observation of Fin rays :

Fin rays are three types :

1. Soft and branched
2. Hard (Spiny) and unbranched
3. Fin without rays i.e. Adipose

After the counting of fin rays they are denoted by their number and when separated by a hyphen (-) means the range of variations. An oblique stroke (/) separates two type of rays in a fin such as spiny and unbranched rays from branched ones, vertical stroke (|) separates different fins, such as rayed dorsal fin from the adipose dorsal or second dorsal. In this way the fin rays of different fins are counted and noted down.

The Lateral line (L1) :

Lateral line is a row of perforated scales between the angle of gill opening and the base of the caudal fin. This may be complete, incomplete or interrupted.

Total length (A–H) :

It is measured from the tip of the snout to the lip of the caudalfin. Standard length (A-G) is measured from the tip of the snout to the base of caudal fin.

On the basis of above abbreviated observations, fin formulae are noted and tally with the literature available to identify the fish upto species lable.

4. PHYSICO-CHEMICAL FEATURES OF PROPOSED AREAS

The study of physico-chemical characteristics of water is an important aspects. It is difficult to understand the biological activities of water body without adequate knowledge of water chemistry.

There are several abiotic factors, which directly or indirectly affect the biodiversity of aquatic environments. Some of these relatively more important factors are : temperature, light penetration, pH, alkalinity, Hardness, Dissolved oxygen, the level of nutrients etc.

During the course of present investigation following physico-chemical parameters were recorded biomonthly, throughout the year. Finally data were computed and presented seasonally (Tables 1-4).

Temperature :

The seasonal variation of air temperature was minimum 24.25ºC in winter season at Govindgarh and maximum 33.26ºC during rainy season at Tons river side.

Table–1. Seasonal variation of physico-chemical factors of Beehar river.

Factors	Season	Rainy Season	Winter Season
Air temperature ºC	32.00	32.78	28.00
Waters temperature ºC	28.00	28.05	24.00
Transparency (cm)	44	15	55
Hydrogen ion concentration (pH)	8.75	8.15	7.95
Free CO_2 (mg/L)	-	1.50	2.00
Dissolved oxygen (mg/L)	5.40	6.00	8.20
Total alkalinity (mg/L)	75.35	60.32	65.00
Total hardness (mg/L)	135.00	85.00	105.25
Chloride (mg/L)	15.25	9.00	8.50

Table–2. Seasonal variation of physico-chemical factors of Tons river.

Factors	Season	Rainy Season	Winter Season
Air temperature ºC	31.50	33.26	26.10
Waters temperature ºC	27.50	28.00	24.00
Transparency (cm)	55	10	63
Hydrogen ion concentration pH	8.88	8.22	8.50
Free CO_2 (mg/l)	-	-	1.50
Dissolved oxygen (mg/L)	6.50	7.00	8.00
Total alkalinity (mg/L)	70.23	45.00	60.00
Total hardness (mg/L)	120.00	100.00	105.20
Chloride (mg/L)	7.0	8.5	6.5

Table–3. Seasonal variation of physico-chemical factors of Govindgarh lake.

Factors	Season	Rainy Season	Winter Season
Air temperature ºC	30.15	31.32	24.25
Waters temperature ºC	27.25	26.00	23.12
Transparency (cm)	35	15	62
Hydrogen ion concentration pH	8.32	8.75	7.35
Free CO_2 (mg/l)	-	2.00	1.00
Dissolved oxygen (mg/L)	6.25	7.00	8.2
Total alkalinity (mg/L)	105.35	73	82
Total hardness (mg/L)	115.40	80.00	75.00
Chloride (mg/L)	10.00	11.00	6.75

Table–4. Seasonal variation of physico-chemical factors of Gorama Dam.

Factors	Season	Rainy Season	Winter Season
Air temperature ºC	32.25	31.00	25.25
Waters temperature ºC	27.00	28.00	23.00
Transparency (cm)	25	6	35
Hydrogen ion concentration pH	8.32	7.85	8.01
Free CO_2 (mg/l)	-	-	-
Dissolved oxygen (mg/L)	5.5	6.2	7.00
Total alkalinity (mg/L)	65.3	68.25	50.10
Total hardness (mg/L)	105.00	79.25	65.00
Chloride (mg/L)	7.25	6.00	3.5

Water temperature exhibited a linear relationship with the ambient air temperature. The lowest 23.00ºC and highest 28.05ºC water temperature were recorded in Gorama and Beehar sampling sides respectively.

Transparency :

Transparency or Secchi depth have been used as first spot checks of eutrophication. Transparency of any water body is due to presence suspended solids in the water. The penetration of light must affects the flora and fauna of water body. During the course of investigation it was recorded that maximum value 63 cm in Tons river during winter season while minimum 6 cm secchi depth was in Gorama dam during rainy season.

Hydrogen ion concentration (pH) :

pH is defined as the negative log of the hydrogen ion concentration (Goldeman and Horne, 1983). During the present investigation pH value vary 7.35 to 8.88 seasonally.

Free carbon dioxide :

Generally the presence of free carbon dioxide was recorded during rainy season and ranged from 0 to 2.00 mg/L.

Dissolved Oxygen (DO) :

Among the various chemical components in the natural water, oxygen is one of the most important constituents needed for the metabolic process of plants and animals. In the present investigation minimum 5.40 mg/L and maximum 8.2 mg/L was recorded in Beehar river and Govindgarh lake during summer and winter season respectively.

Total Alkalinity :

The alkalinity of water is its acid nutrilizing capacity and is primarily a function of carbonates, bicarbonates and hydroxide contents. The measurement of alkalinity is taken as an indication of these constituents (APHA, 1985). Generally due to wide range of fluctuation in alkalinity, it is considered as one of the important parameter indicating the trophic status and biodiversity pattern of an aquatic ecosystem.

Seasonal variation of total alkalinity was recorded 45.00 mg/L in Tons river while maximum value 105.35 mg/L was in Govindgarh lake during summer season.

Total hardness :

The hardness of water is mainly due to calcium and magnesium salts present in the water. In the present study minimum value of total hardness 79.25 mg/L was noted in Gorama dama while maximum 135.00 mg/L was in Beehar river site.

Chloride :

Chloride occurs naturally in all types of water due to its high solubility, and is one of the major inorganic anion in the water and waste water. Its concentration in freshwater is generally taken an indicator of sewage pollution. The minimum value of chloride contents 3.5 mg/L was in winter at Gorama dam while maximum 15.25 mg/L was recorded during summer season in Beehar river.

5. FISH BIODIVERSITY :

There are at least 20000 species of fishes in a variety of different aquatic ecosystems. The maximum part of total fisheries is marine. Only about 10% of the total fisheries is under fresh water. The fisheries ultimately depend on the quality and integrity of the whole ecosystem and the biodiversity within it.

Any severe loss or degradation of biodiversity in an ecosystem causes irreversible changes in that ecosystem. There are four principle which causes the loss of aquatic biodiversity.

1. Habitat destruction :

Reduces the number of species of all aquatic organisms.

2. Over fishing :

Affect whole ecosystem because of disruption to the food web caused by the loss of the targetted species that is overfished.

3. Wasting of fishes :

The loss of untargetted species caught unintentionally and simply thrown away.

4. Introduction of exotic species :

Deliberate or accidental introduction of exotic species disturbs the ecological balance.

During the course of study, five sampling sites i.e. Beehar river, Tons river, Gorama dam, Govindgarh lake and Jarmohra dam were selected. Inspite of these water bodies other water resources were also visited occasionally. The collected specimens were identified and

listed in Table No.5, according to their distribution. The maximum number of 46 species were recorded in Tons river while minimum representatives 29 were in Gorama dam and Govind garh.

The abundance and species richness were evaluated with the help of following sources :

1. Department of fishery Distt. Rewa, Govt. of M.P.
2. Local persons
3. Fishermen
4. Nearby fish market
5. Experimental and direct observations

On the basis of collected informations the distribution and abundance were represent in table-5 with the help of following abbreviations :-

(i) +R = Rarely found

(ii) + = Low abundance

(iii) ++ = Medium abundance

(iv) +++ = Rich in species

(v) - = Not found

(i) Data base register for diversity of fishes

During the investigation period, fish samples were collected from the different sites. Collected samples were identify and depicted in Table–5. The classification and nomenclature are followed given by Berg (1940), Menon (1974) and Jayaram (1999). During the study period 54 species were identified which belongs to 14 different families and 6 orders.

Classified List of Fishes identified during Investigation

Class - Teleostomi

Sub class - Actinoptengii

I Order - Osteoglossiformes

Suborder - Notopteroidei

(i) Family - Notopteridae

(i) *Notopterus notopterus*

(ii) *Notopterus chilala*

II Order - Cypriniformes

Division - Cyprini

Suborder - Cyprinodei

(ii) Family - Cyprinidae

Chela untrahi

Chela bacaila (Ham.)

C. laubuca (Ham.)

Salmostoma bacalia

Esomus danricus (Ham.)

Tor tor (Ham.)

Amblypharyngodon microlepis (Bl. Ham.)

Catla catla (Ham.)

Cirrhinus mrigala (Ham.)

C. reba (Hans)

Labeo rohita (Ham.)

L. boga (Ham.)

L. angra (Ham.)

L. calbasu (Ham.)

L. dero (Ham.)

L. gonius (Ham.)

Labeo pangusia (Ham.)

L. nukta (Ham.)

L. boggut (Ham.)

L. Potail (Ham.)

L. bata

Ctenopharyngodon idella (val.)

Cyprinus carbio (Lin.)

Hypophthal michthys molitrix (val.)

Puntius savrana (Ham.)

P. ticto (Ham.)

P. titius (Ham.)

P. chrysopterus

P. chola (Ham.)

Rasbora daniconius (Ham.)

Division Siluri

(iii) Family - Siluridae
Ompou bimaculatus (Ham.)
O. pabda (Ham.)
Wallago attu (Bl & Schn)

(iv) Family - Bagridae
Mystus bleekeri (Day)
M. cavasium (Ham.)
M. tengara (Ham.)
M. vittatus (Bloch)
M. aor (Ham.)
M. seenghala (sykes)

(v) Family - Sisoridae
Bagarius bagarius (Ham.)

(vi) Family - Schilbeidae
Silonia silondia (Ham.)
Eutrophiichthys vacha (Ham.)

(vii) Family - Saccobranchidae
Heteropneustes fossilis (Bloch)

(viii) Family - Clariidae
Clarias batrachus (Linn.)

Order - Beloniformes

(ix) Family - Belonidae
Xenentodon cancila (Ham.)
Order - Ophiocephaliformes

(x) Family - Ophiocephalidae
Channa gachua (Ham.)
C. punctatus (Bloch)
C. Striatus (Bloch)
C. marulius (Ham.)

Order - Perciformes
Sub order - Percoidei

(xi) Family - Centropomidae
Chanda nema (Ham.)
C. ranga (Ham.)

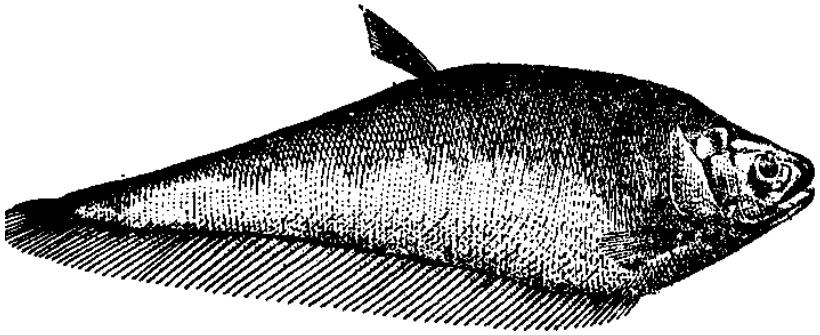
(xii) Family - Nandidae
Nandus nandus (Ham)

(xiii) Family - Cichlidae
Tilapia mossambica (Pet) OR
Oreochromis mossambica (Peters)

Order - Mastacembeleformes

(xiv) Family - Mastacembelidae
Mastacembelus armatus
M. pancalus

***Notopterus nopterus* (Ham.)**

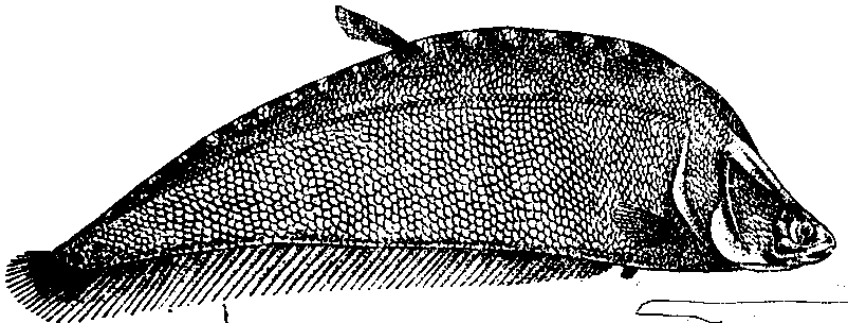


Body oblong, laterally compressed. Head compressed, mouth wide, cleft of mouth extending upto posterior border of eye. Dorsal fin small. Anal fin very low, ribbon live confluent with the caudal fin. Pelvic fins rudimentary. Caudal fin small. Scales small. Lateral line complete more or less arched.

Fin formula –

D.8(1/7); P.17; V.6; A.100; C.19; L.I.225; Vert 30/60.

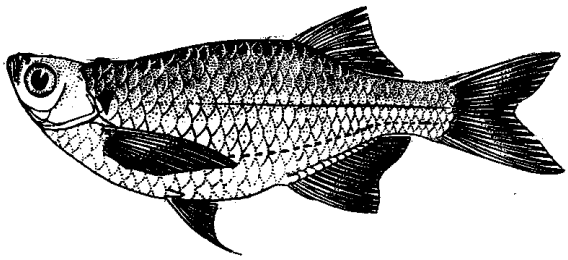
***Notopterus Chitala* (Ham.)**



Fin Formula –

D.9(1/8); P.16; V.6; A.110-118; C.12; L.1. 160-180.

***Chela bacaila* (Ham.)**



Body long compressed. Abdomen keeled from below. Head short compressed. Snout blunt, mouth oblique. Dorsal fin inserted slightly behind anal fin origin. Pelvic fine inserted nearer to pectoral fin. Pectoral fins stout and elongated. Caudal lobes equal. Lateral line curved downwards.

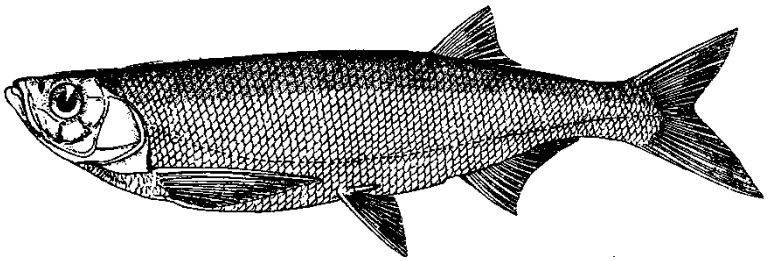
Fin Formula –

D.9-13(2/7-9); P.12-15; V.9; A.15-17(2/13-15); C.19; L.I.90-100; Ltr 17/6.

***Chela laubuca* (Ham.)**

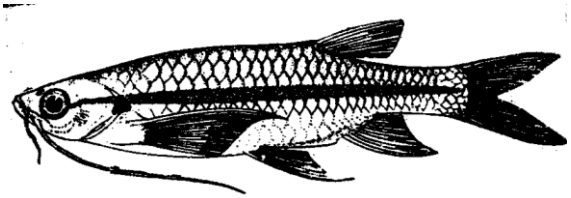
D.10; P.11; V.5; A.23; C.19; L.I.34; L.tr. 6/5.

***Salmostoma bacali* (Ham.)**



Body elongated compressed. Abdomen keeled from below pectoral fin to anus. Head moderate to long, compressed. Snout blunt, Mouth oblique to body axis. Lower jaw longer. Doral fin short. Pectoral fins long with an elongate axillary scale. Pelvic fin outer ray generally not elongated. Anal fin short caudal fin deeply formed. Scale small lateral lime complete.

***Esomus danricus* (Ham.)**

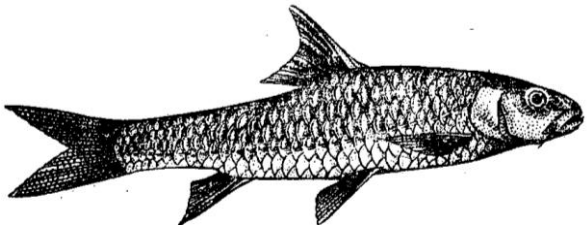


Body elongated, strongly compressed, abdomen rounded, mouth small, obliquely directed upwards. two pair of barbels, dorsal fin inserted in the interspace between anal and pelvic fins caudal fin formed. Sides with broad lateral line.

Fin formula –

D. 9(2/7); P.13; V.9; A.13–14(3/10–11); C.19; L.I.43–46; L.tr. 7/5.

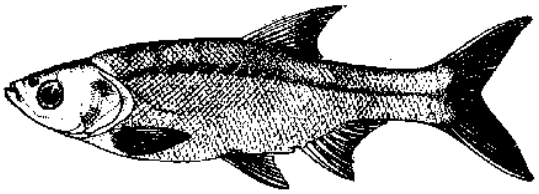
***Tor tor* (Ham.)**



Fin formula –

D. 3/9; P.17; V.9; A.7(2/5); L.1.25; L.tr. 4½/4½; Barbels 2 pairs.

***Amblypharyngodon mola* (Ham.)**

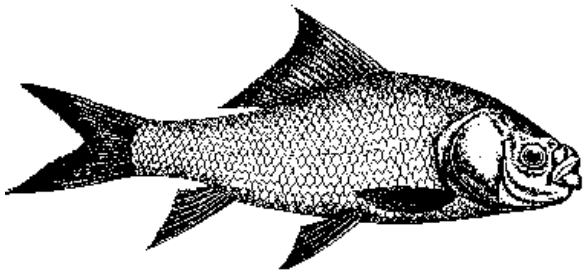


Body moderately elongate, subcylindrical head well compressed, mouth wide antero lateral. Eye large centrally placed upper lip absent. Lower jaw prominent. No barbels, dorsal fine inserted slightly behind. Anal fin short caudal fin forked. Scale very small, lateral line incomplete.

Fin formula –

D. 9(2/7); P.15; V.9; A.7(2/5); C.19; L.I.67–72; L.tr. 12/12.

***Catla catla* (Ham.)**

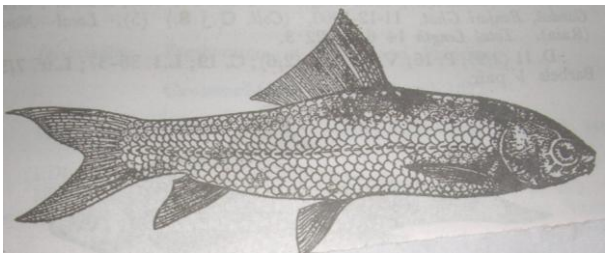


Body deep, Abdomen rounded, Head broad, very large, snout bluntly rounded. Mouth wide. Eye large Dorsal fin long. Anal fin short. Caudal fin forked. Scale moderate, Lateral line complete.

Fin formula –

D. 18–19 (3/15–16); P.19; V.9; A.8(3/5); C.19; L.I. 43; L.tr. 7½ / 6½.

***Cirrhinus mrigala* (Ham.)**



Body moderate, elongate, Head short, Mouth wide, transverse. Lower jaw sharp, dorsal fin inserted ahead of pelvic fins. Anal fin short. Caudal fin forked or lunate. Scales of varying sizes. Lateral line complete.

Fin formula –

D. 16(3/13); P.18; V.9; A.8(2/6); C.15; L.I.42–44; L.tr. 6½ / 6½; Bar. 1 Pair

***Cirrhinus reba* (Ham.)**

Fin formula –

D.11(2/9); P.16; V.9; A.8(2/6) C.19; L.1. 36-37; L.tr. 7/5; Barbels 1 pair.

***Labeo* -**

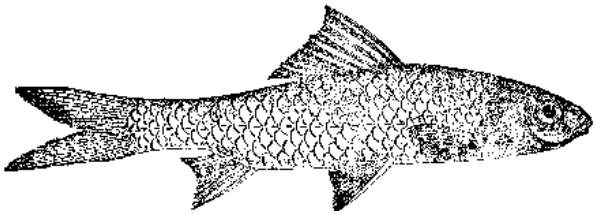
Body moderate sized deep with rounded abdomen. Head fairly large. Snout more or less swollen, rounded projecting behind mouth. Mouth moderate, inferior jaws with a sharp margin and with soft movable horny covering. Barbels always present. Dorsal fin inserted above anterior to origin of pelvic fins. Anal fin short. Caudal fin deeply forked. Scale large. Lateral line complete or little curved.

***Labeo rohita* (Ham)**

Fin formula –

D. 16(3/13); P.17; A.7(2/5); C.19; L.I.40–41; L.tr. 6½ / 9; Bar 1 pair.

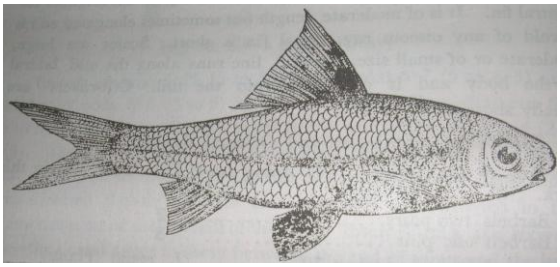
***Labeo boga* (Ham)**



Fin formula –

D. 11(2/9); P.16; V.9; A.7(2/5); C.19; L.I.37–39; L.tr. 6½ / 7.

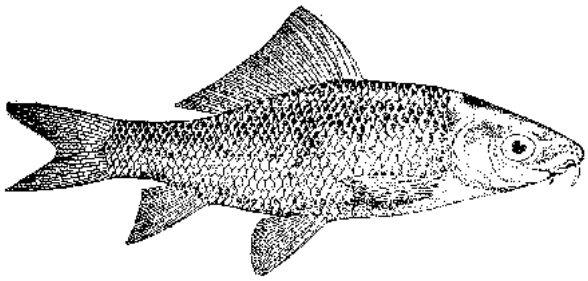
***Labeo angra* (Ham)**



Fin formula –

D. 12(3/9); P.17; V.9; A.8(3/5); C.17; L.I.42; L.tr. 8 / 8; Bar. 2 pairs.

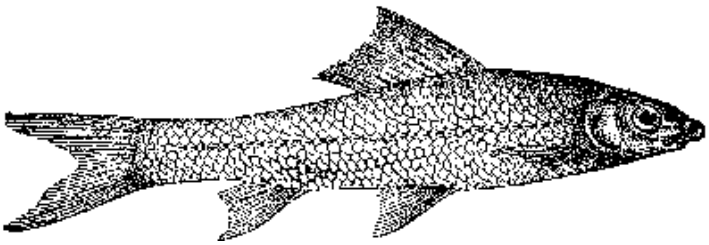
***Labeo calbasu* (Ham)**



Fin formula –

D. 17(3/14); P.19; V.9; A.7(2/5); C.19; L.I.41; L.tr. 7½ / 8; Bar. 2 pairs.

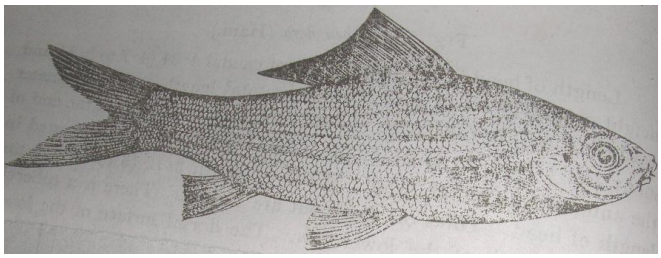
***Labeo dero* (Ham)**



Fin formula –

D.12–13(2/9–10); P.16–17; V.9; A.8(3/5); C.19; L.I.38–43; L.tr.8/6. Bar. 1 pairs.

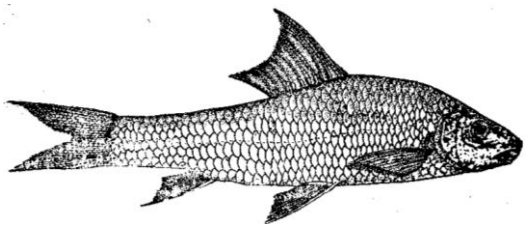
***Labeo gonius* (Ham)**



Fin formula –

D. 18(3/15); P.17; V.9; A.7(2/5); C.19; L.I.74; L.tr. 16/17; Bar 2 pairs.

***Labeo pangusia* (Ham)**



Fin formula –

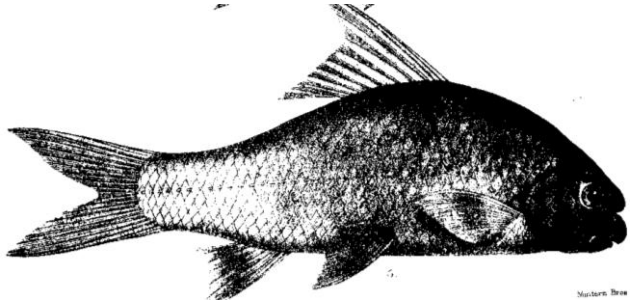
D.2(10-11; P.14-16; V.9; A.2/5; C.19; L.1.40-42; L.Tr. 15-16; Barbels 1 pair.

***Labeo bata* (Ham)**

Fin formula –

D.11-12(2-3/9-10);P.18; V.9; A.7(2/5);C.19;L.1.37-40; L.tr. 7/6-7; Barbels 1 pairs

***Labeo boggut* (Ham)**



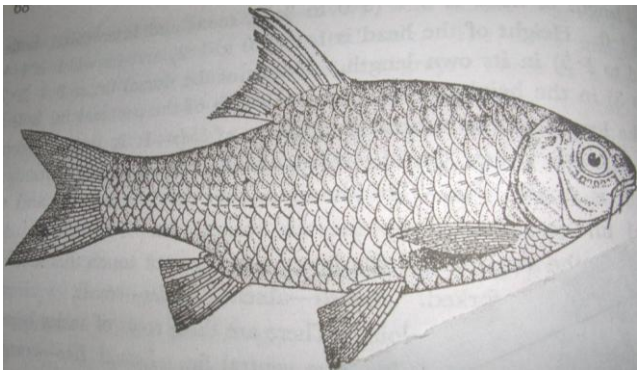
Fin formula –

D.12; P.17; V.9; A.7 (2/5); C.19; Li. 62; L.tr. 12/14.

***Puntius* (Ham.)**

Body short to moderately elongate. Head short, mouth arched, anterior or inferior. Barbels present. Dorsal fin short inserted nearly opposite present. Dorsal fin short inserted nearly opposite pelvic fins. Anal fin short. Caudal fin forked. Scale moderate or large, with few and strongly divergent striae. Lateral line complete or incomplete.

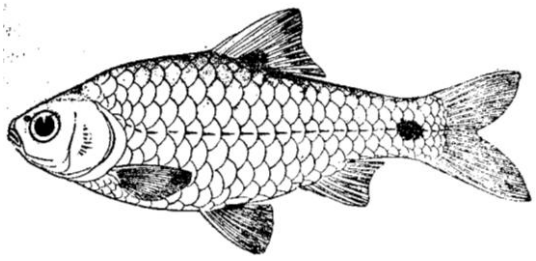
***Puntius sarana* (Ham)**



Fin formula –

D. 11–12(3/8–9); P.15–16; V.8–9; A.8(3/5); C.19; L.I.33–34; Ltr 6½ / 6; Bar. 2 pairs.

***P. sophore* (Ham)**

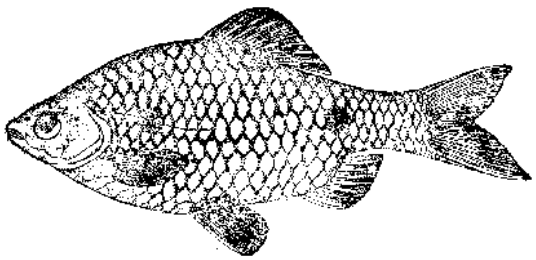


There are two black blotches one at base of the dorsal fin and other at caudal pendencle.

Fin formula –

D. 11(3/8); P.15–16; V.9; A.8(3/5); C.19; L.I.25–26; Ltr 5½ / 5½.

***P. ticto* (Ham)**

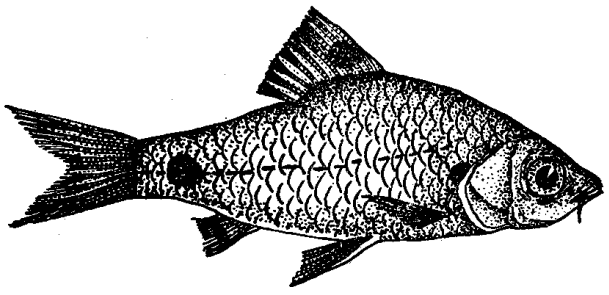


Anterior colour spot always present.

Fin formula –

D. 11(3/8); P.13; V.9; A.8(3/5); C.19; L.I.25–25; Ltr 5½ / 6½.

***P. titus* (Ham)**



Fin formula –

D.2/8; O,15-17; V.9; A.2/5; C.19; L.1. 24-26; L.tr. 5-50/5; Barbels 1 pair.

***P. chrysopterus* (Ham)**

Fin formula –

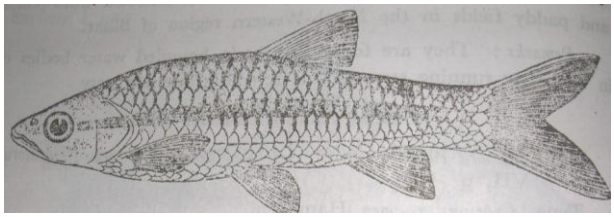
D.2/9; P.17; V.9; A.2/5; C.19; L.1. 23-25; L.tr. 4-5/4-5;

***P. chola* (Ham)**

Fin formula –

D.11 (3/8); P.14-15; V.9; A.8 (3/5); C.19; L.1. 27-28; L.tr. 6½/5½; Barbels 1 pair.

***Rasbora daniconius* (Ham.)**



Body elongate, compressed, Head larged pointed, lower jaw prominent, no barbels, dorsal fin inserted behind origin of pelvic fins. Caudal fin emarginate or froked. Scale large or moderate. Lateral line concave.

Fin formula –

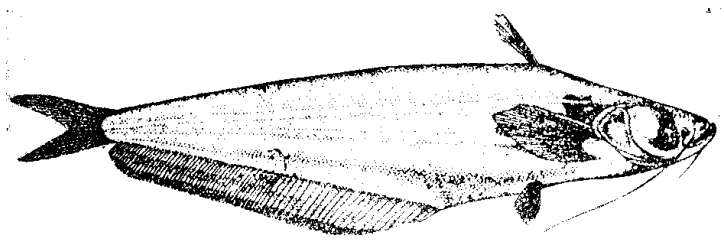
D. 9(2/7); P.15; V.9; A.7(2/5); C.19; L.I.31; L.tr. 5½ / 4½.

***Ompok* -**

Body elongate, compressed, Head small broad. Snout bluntly rounded. Mouth superior. Lips thin. Jaws sub equal, lower jaw prominent. Barbels present. Dorsal fin inserted above last half of pectoral fin. Pelvic fins short. Anal fin very long, close to caudal fin. Caudal fin is forked. Lateral line complete.

***Ompok bimaculatus* (Ham.)**

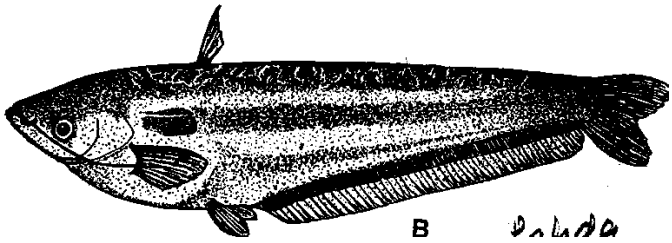
Pelvic fin not reaching anal fin origin.



Fin formula –

D. 4; P.1/13; V.8; A.65–69(2/63–67); C.18; Bar. 2 pairs

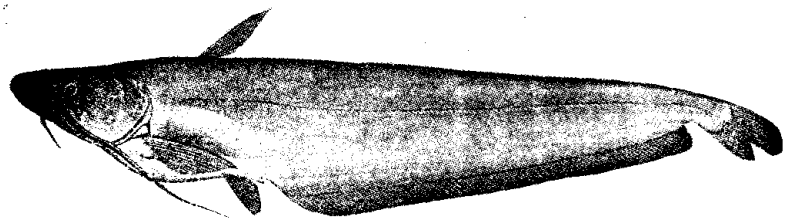
***O. pabda* (Ham.)**



Fin formula –

D.5; P.15 (1/14); V.8; A.67(2/65); C.20; Bar. 2 pairs.

***Wallago attu* (Bloch)**



Body elongate, compressed. Head large depressed. Snout spatulate. Mouth subterminal, gape of mouth very wide. Dorsal fin inserted above half of pectoral fin. Pectoral fin short, Anal fin long, reading upto caudal fin caudal fin deeply forked with rounded lobes.

Fin formula –

D. 5; P.15(1/14); V.10; A.86(4/82); C.17; Barbels 2 pairs.

***Mystus* -**

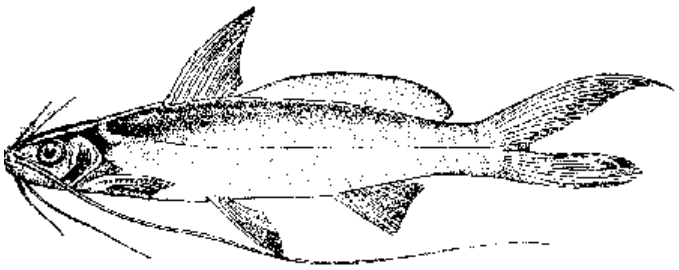
Body short or moderately elongated. Head moderate size. Snout rounded. Mouth sub-terminal, wide. Dorsal fin inserted above last quarter of pectoral fins. Adipose dorsal varying in length. Pectoral fins serrated. Pelvic fin short. Barbels present caudal fin forked. Unequal bilobed.

***Mystus bleekeri* (Ham.)**

Fin formula –

D.1/7/0; P.1/9-10; V.6; A.9-10(3/6-7); C.17; Barbels 4 pairs.

***Mystus cavasius* (Ham.)**



Maxillary barbels reach caudal fin base or beyond. A dark spot at base of dorsal fin. No band on body.

Fin formula –

D. 1/7/0; P.1/9; V.6; A.11(3/8); C.16; Barbels 4 pairs.

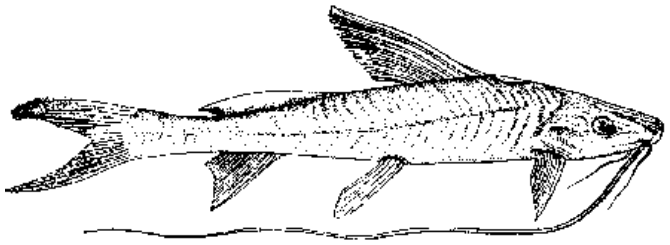
***M. vittatus* (Bloch)**

Body with 3 or 4 longitudinal colour bands above and below lateral line. A dark shoulder spot. No spot at base of caudal fin.

Fin formula –

D. 1/7/0; P. 1/8; V.6; A.11(2/9); C.17; Barbels 4 pairs.

***M. aor* (Ham.)**

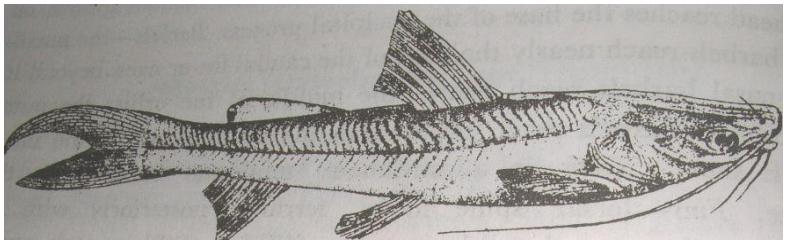


Snout rounded.

Fin formula –

D. 1/7/0; P.1/10; V.6; A.13(3/10); C.17; Barbels 4 pairs.

***M. Seenghala* (Ham.)**



Snouth spatulate wide gape of mouth.

Fin formula –

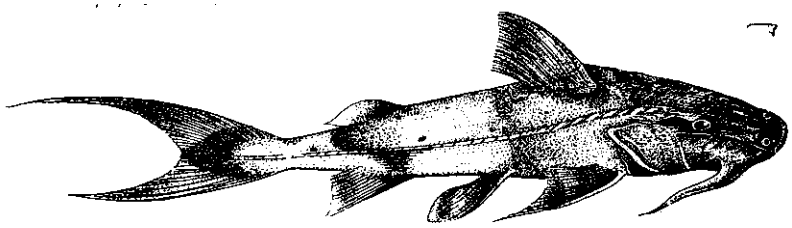
D. 1/7/0; P. 1/9; V.11–12 (3/8–9); C.19–21; Barbels 4 pairs.

***M. tengra* (Ham.)**

Fin formula –

D.1/7/0; P.1/8; V.6; A.12-13 (2-3/9-10); C.19; Barbels 4 pairs.

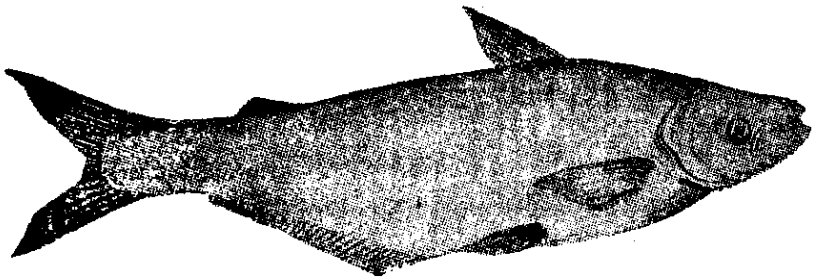
***Bagarius bagarius* (Ham.)**



Fin formula –

D.1/6/0; P.1/12; V.6; A.13 (3/10); C.17; Barbels 4 pairs.

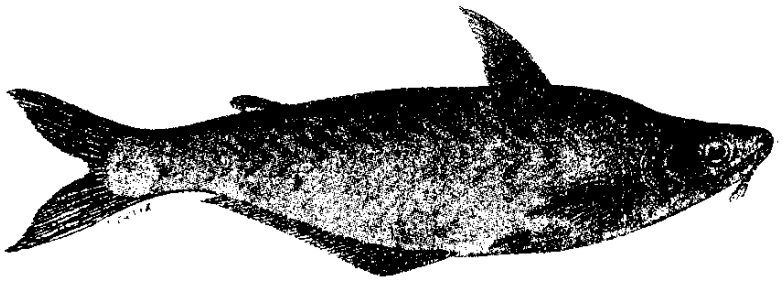
***Silonia silondia* (Ham.)**



Fin formula –

D.1/7/0; P.1/2; V.6; A.40-43 (4/36-39); C.17; Barbels 1 pair.

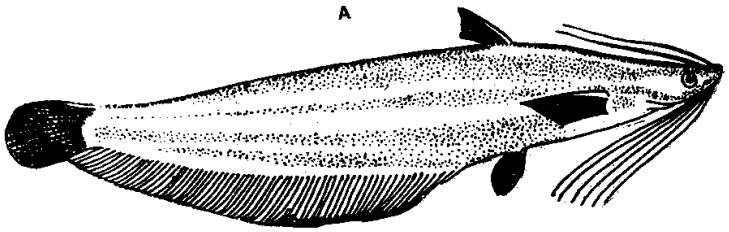
***Eutropiichthys vacha* (Ham.)**



Fin formula –

D.1/7/0; P.1/15-17; V.6; A.48 (3/45); C.17; Barbels 4 pairs.

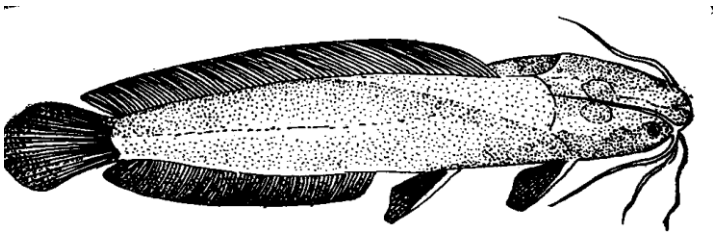
***Heteropneustes fossilis* (Ham.)**



Fin formula –

D.6; P.1/7; V.6; A.62-66; C.19; Barbels 4 pairs.

***Clarius batrachus* (Lin.)**



Body elongate compressed. Head moderate size. Snouth broadly rounded. Mouth terminal, wide, Dorsal fin long without any spine. Commencing from near occupier and extending to but not continuous with caudal. Adipose absent. Pectoral fins with a strongly terrated spine. Pelvic fins short. Anal fin long. Caudal fin almost rounded.

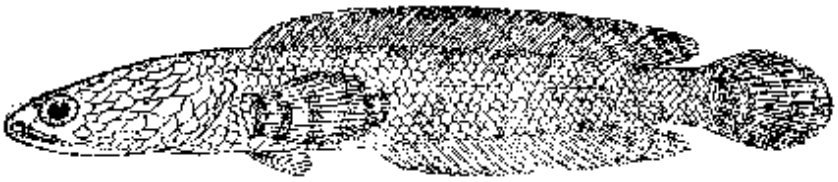
Fin formula –

D. 65–70; P.1/18; V.6; A.47; C.17; Barbels 4 pairs.

***Channa* -**

Body elongated, subcylindrical anteriorly. Head large, depressed with plate like scales. Snouth somewhat obtuse. Mouth fairly large. Dorsal fin long, inserted almost above pectoral fins. Anal fin long. Dorsal and anal fins free from caudal fin. Caudal fin rounded. Scale small. Lateral line abruptly curved.

***C. gachua* (Ham.)**



Scale on head are broad and irregular lateral line curve. Pectoral fin with deep blue base, transfersalty barred with orange and blue stripes, caudal fin some times barred.

Fin formula –

D. 35–37; P.15–16; A.21–23; C.12; L.I. 41–45; Ltr. 4/7.

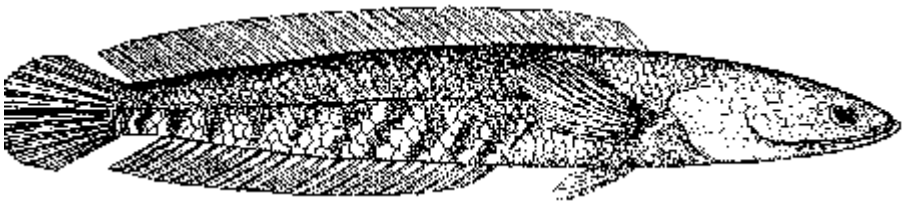
***C. punctatus* (Bloch)**

Pectoral fin may be overreaching the origin of anal fin. Lateral line straight with slight curve. Body mostly black or dark grey. Several bands pass from the downwards to the middle of body. Fine are spotted.

Fin formula –

D. 29–30; P.16–17; V.6; A.20–22; C.12; L.I. 35–37; Ltr. 4/7.

***C. striatus* (Bloch)**

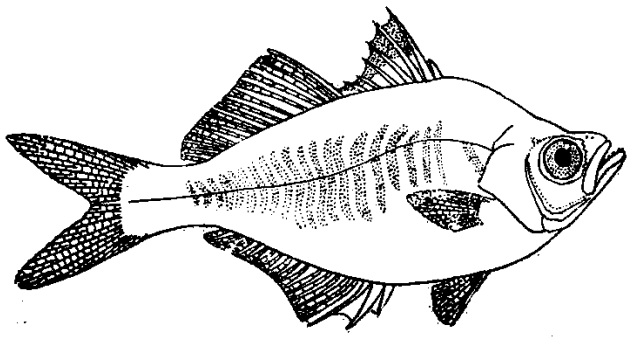


Scale large, irregularly shaped, lateral line curved down wards, colour dark greyish depending upon the locality. Transverse bands of gray or back descend from the sides to the abdomen.

Fin formula –

D. 41–43; P.16–18; V.6; A.24–25, C.12; L.I. 58–60; Ltr. 7/10.

***Chanda nema* (Ham.)**

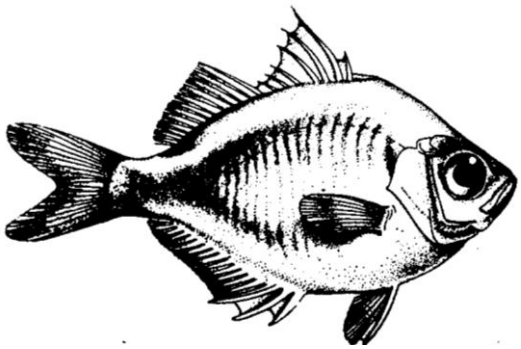


Body more or less elevated and strongly compressed Dorsal fins with spine. The ray gradually decrease in length. Caudal fin is deeply frocked. Scale minute. Lateral line broken. Anal fin has spots at the base of the spine.

Fin formula –

D. 1+7/1/16; P.12–13; V.1/5; A.3/16–18; C.17; L.I. scales deciduous.

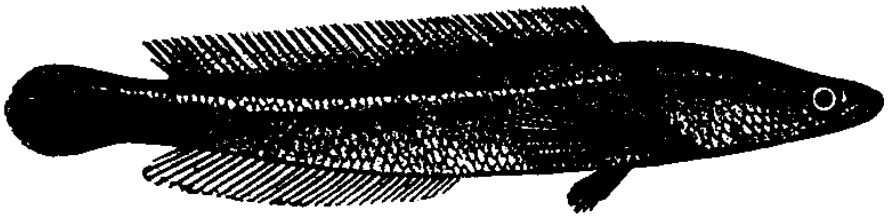
***C. ranga* (Ham.)**



Fin formula –

D. 1/7/1/13; P.11-13; V.15; A 3/14-16; C.17; L.I. scales deciduous

***C. marulius* (Ham.)**

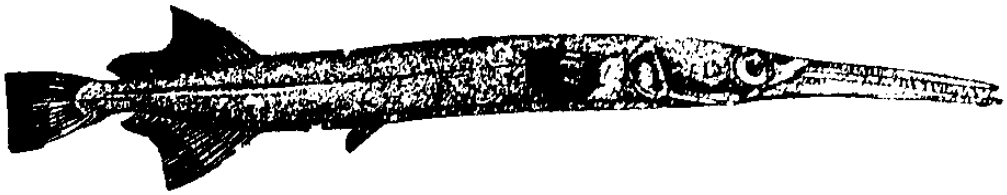


Body more or less elevated and strongly compressed Dorsal fins with spine. The ray gradually decrease in length. Caudal fin is deeply frocked. Scale minute. Lateral line broken. Anal fin has spots at the base of the spine.

Fin formula –

D. 1+7/1/16; P.12–13; V.1/5; A.3/16–18; C.17; L.I. scales deciduous.

***Xencntodon cancila* (Ham.)**



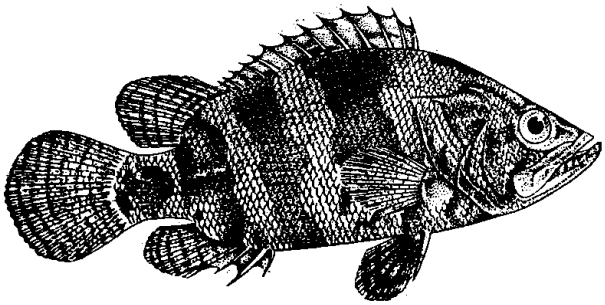
A deep longitudinal groove runs along the upper surface of the head. Lower jaw is slightly longer. Supraorbital margin in sooth.

Both the jaws are provided with a row of large sharp widely separated teeth and an eternal row of numerous fine ones which are more on the lower jaw. Dorsal fin commences opposite the anal. Caudal find slightly emarginate. The last few anal and dorsal rays are not elongated.

Fin formula –

D. 17; P.11; V.6; A.17; C.15.

***Nandus nandus* (Ham.)**



Fin formula –

D. 13/12-13; P. 15-17; V. 1/5; A.3/8; C.15; L.I. 46-48; L.tr. 6/17.

***Mastacembelus armatus* (Lacepede)**

Body eel like, elongate, compressed, long, pointed, snout long, mouth inferior. Eye small, Dorsal fin inserted above middle of the pectoral fins with spines. Anal fin with three spines. Caudal fin rounded. Dorsal and anal fins may confluent with caudal.

Fin formula –

D. 37–39/78–82; P.23–25; A.3/75–78.

***M. puncalus* (Ham.)**

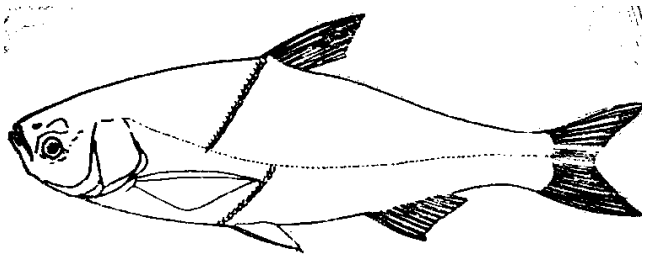
Body eel like. Dorsal spines short gradually increasing in length posteriorly. Its last spine is short. Dorsal fin spines commence over the pectoral. Soft dorsal and anal are separated by a notch from the caudal. Caudal fin is short and rounded. In some specimens yellowish white spots over. The side of the body.

Fin formula –

D. 24–26 / 30–37; P.19; A.3/31–40; C.12.

List of Exotic Fishes

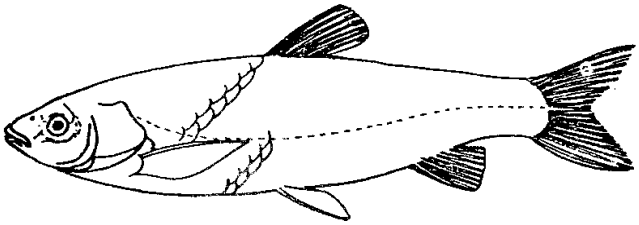
***Hypothalmichthys molitrix* (Val.)**



Small scales on the body. Lower jaw upward. Eye small. Body oblong, slightly compressed. Abdomen has shark edge. Snout bluntly rounded.

***H. nobilis* (Val.)**

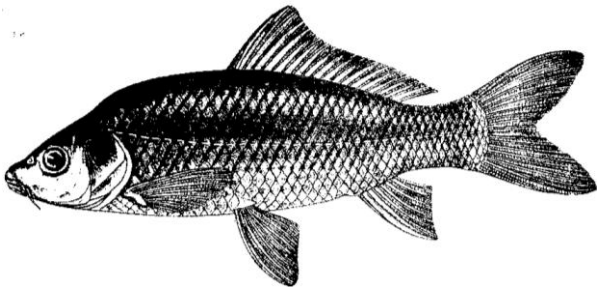
***Ctenopharyngodon idellus* (Val.)**



Body elongated and moderately compressed. Head broad with short rounded snout. Upper jaw slightly longer. Barbels absent.

Mouth subterminal. Colour of body dark grey above and silveryon belly. Base of scale dark brown.

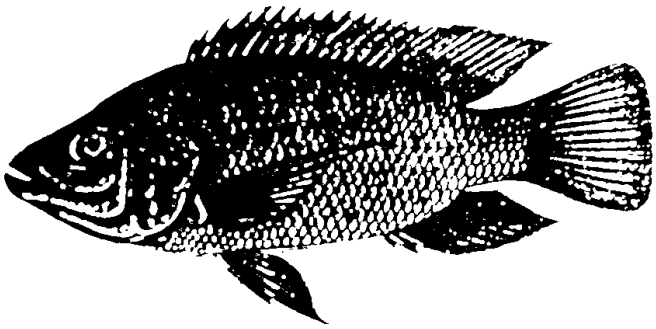
***Cyprinus carpio* (Com.)**



***C. carpio specularis* (Ham.)**

Body covered merely with a few large and bright scales. A large area of body is however naked. Barbels present. Candle fin forked.

***Tilapia mossambica* (Ham.)**



Body compressed and snout is compressed. Ventral fin reacting the origin of small fin. Lateral line interrupted. Two dorsel fin, 1st is with skin and blackish colour. Coudel fin with lined rays.

Table-5. Distribution and abundance of Fishes in different water resources

S. No.	Name of fishes	Local Name	Beehar Bichia	Tons	Govind garh	Gorama Dam	Jarmohra
01.	*Notopterus notopterus*	irksyk	++	+++	+	-	++
02.	*N. chitala*	eksi	+	+	++	-	-
03.	*Chela untrahi*	psyok	+	-	+	-	+
04.	*C. bacaila*	psyok	-	+	-	+	-
05.	*C. laubuca*	psyok	+	+	-	-	+
06.	*Salmostoma bacalia*	cdsyk	-	+	-	+	-
07.	*Esomus danricus*	MsMqvk	++	-	+	-	-
08.	*Tor tor*	egk'ksj ;k egk'khj	+	+	+R	-	+
09.	*Amblypharyngodon microllepsi*	eksjok	-	++	-	+	++
10.	*Catla catla*	dryk	+	++	+++	+++	+++
11.	*Cirrhinus mrigala*	fexy	+	+	+++	+++	++
12.	*C. reba*	xksVfj;k	+++	++	-	+	+
13.	*Labeo rohita*	jksgw	++	+++	+++	+++	+++
14.	*L. boga*	Hkxu	++	+	-	+	-
15.	*L. angra*	jb;k	+	--	-	+	+
16.	*L. calbasu*	djkSNj	-	++	++	+++	++
17.	*L. dero*	vjaxh] jb;k-	-	+	+	-	+
18.	*L. gonius*	dqlhZ	+	++	+	++	++
19.	*L. pongusia*	dkjh	++	+++	-	++	-
20.	*L. nukta*	dkjh	+	+	-	-	+
21.	*L. boggat*	iFkjpVh	++	+++	-	+	+++
22.	*L. potail*	dkjh	-	+	+	++	-
23.	*L. bata*	iFkjpVh] ckVk	+	++	++	+	++

24.	*Puntius sarana*	ijnh	+	-	+	-	+
25.	*P. sophore*	fl?knh	-	++	-	++	++

S. No.	Name of fishes	Local Name	Beehar Bichia	Tons	Govind garh	Gorama Dam	Jarmohra
26.	*P. ticto*	ckjcj	-	+	-	+	-
27.	*P. titus*	fl/kjh	-	+	-	+	-
28.	*P. chrysopterus*	fl/kjh	-	+	-	+	-
29.	*P. chola*	iksVh	++	++	-	-	++
30.	*Rasbora daniconius*	MsMqvk] Mjbyh	++	+	+	-	-
31.	*Ompok bimaculatus*	ty diwj	+	++	-	-	++
32.	*O. pabda*	ikonk	+	+++	++	++	+++
33.	*Wallago attu*	ikfM+u	++	+	+	-	+
34.	*Mystus bleekeri*	Vsxjk	+	++	-	-	-
35.	*M. cavasius*	Vsxjk	+	++	-	-	-
36.	*M. tengra*	Vsxjk	++	+++	-	-	++
37.	*M. vittatus*	Vsxjk	+	-	+	-	-
38.	*M. aor*	Vsxjk	-	+	-	-	-
39.	*M. seenghala*	Vsxjk	-	++	-	+	+
40.	*Bagarius bagarius*	ykaHkj] xksp	+R	+	-	-	-
41.	*Silonia silondia*	flyan	+R	++	-	-	-
42.	*Eutropiichthys vacha*	pj[kh	-	++	-	-	-
43.	*Heteropneustes fossilis*	fla?kh	++	++	++	++	++
44.	*Clarias batrachus*	ekxqj	++	+++	++	+	+++
45.	*Xenentodon cancila*	lqtuk	+	+++	+	+	+++
46.	*Channa gachua*	lkSj	+	++	+++	++	++
47.	*C. punctatus*	lkSj	++	+	+	+	-
48.	*Channa striatus*	lkSj	-	-	-	+	-
49.	*C. marulius*	lkSj	-	+	+	+	-

50.	*Chanda nema*	ek;k	-	-	+	-	-
51.	*C. ranga*	[kM~Mh	-	-	+	-	-

S. No.	Name of fishes	Local Name	Beehar Bichia	Tons	Govind garh	Gorama Dam	Jarmohra
52.	*Nandus nandus*	pdM+h	+	+	+	-	+
53.	*Mastacembelus armatus*	cke	++	++	+	-	+
54.	*M. pancalus*	cke] funksg	++	+++	++	+	++
			37	**46**	**29**	**29**	**31**

Note :

+	=	Low Abundance	++	=	Medium Abundance
+++	=	Rich in Species	R	=	Rarely
–	=	Not found			

The maximum 46 species were recorded from Tons river while minimum 29 species were from Govindgarh and Gorama dam. The fish fauna of Tons river was dominated by nine species i.e. *Notopterus notopterus, Labeo rohita, L. pungusia, L. boggat, Ompak pabda, Mystus tegra, Clarius batraculus, Xenantodon cancila* and *Mastacembelus armatus*.

The fish fauna of Beehar river consists of 37 species. Though the Beehar river is connected with newly constructed Bansagar Dam, but its fish fauna was moderate. The reason for its moderate fish fauna may be due to maximum human interference and uncontrolled fishing. During the investigation it was also found that the people of adjacent area uses unconventional methods of fishing like poisoning and electric current. Five migratory fishes like *Mystus tegra, M. Seenghala, Tilapia, Silonia silondia* and *Eutrophichthys vacha* were also recorded. It is believed that these fishes are actually belongs to Sone river system. But, due interconnectings connecting system of Son

river with Tons and Beehar, these fishes were found in long stretch. The fishermen of nearby area of Beehar river reported that the occurrence of *Bagarius bagarius* (Labhar) is decreasing with the comparison of past days.

Govindgarh lake is fully under the control of fisheries department. Fish seeds of major carps i.e. Catla, Rohu and Mrigal were introduced every year, which was reflected by its fauna. Inspite of major carps some exotic fishes were also introduced in this lake. The Govindgarh lake is suffering from uncontrolled weeds problems which also affected the fish fauna. *Tor tor* was abundant in Govindgarh lake previously but now a days it is rarely occurred. It may be due to uncontrolled weed and some exotic fishes which competitive with *Tor tor*.

Gorama dam was constructed by impounding the Gorama river near Hanumana Tahsil. Its catchment area is rocky with Dumat soil. In the Gorama dam, lotic and lentic eco-system exists together. Its fish was reflected by 29 species. This dam is also under the control of fisheries department. During the study period 11 species Labeo was record. In which maximum 8 species of Labeo were found in Gorama dam.

The fish fauna of Jarmohra was dominated by six species i.e. *Catla, Labeo, Ompok pabda, Clarias batrachus, Xenantodon cancila* and *Labeo boggat*. It was found that the minor carps contribute a major part of fish production in Jarmohra water body.

Exotic Fishes :

During the investigation 6 species of exotic fishes were also found in different water bodies of Rewa district, which are given below:

List of Exotic Fishes

S. No.	Name of Fishes	Local Name	Beehar	Tons	Govind garh	Gorama	Rani Talab	Bansagar querry
01.	*Hypothalmichthys molitrix* (Val.)	flYoj dkiZ	-	-	++	-	-	+++
02.	*H. nobilis*	flYoj dkiZ	-	-	-	-	-	++
03.	*Ctenopharyngodon idellus* (Val.)	xzkl dkiZ	-	-	++	R	-	++
04.	*Cyprinus carpio* communis	Ldsy dkiZ ;k dkeu dkiZ						
05.	*C. carpio specularis*	Ldsy dkiZ ;k dkeu dkiZ			++			
06.	*Tilapia mossambica*	frykfi;k	+	+	++	+	+++	+++

Note :

+	=	Low Abundance	++	=	Medium Abundance
+++	=	Rich in Species	R	=	Rarely
–	=	Not found			

1. ***Hypophthalmichthys*** **–** It is commonly known as silver fish due to its silvery sinning. Their two species i.e. *H. molitrix* and *H. mobilis* were recorded in Govindgarh lake and Bansagar querry. In India, the first ever consignment of 360 fingerlings of silver carp was brought from Japan in 1959, to the pond culture

divisions of CIFRI Cuttack, Orissa. It is planktophagous species, when it is kept in pond, it thrives well on artificial feeds, such as bone meal, rice bran and flour (Hora and Pillay, 1962). When it reaches 1.5 cm in the length, it begin to feed on phytoplankton. It is surface feeder.

2. ***Ctenopharyngodon idellus*** **(Grass Carp) –** The first consignment of grass carp was brought in the year 1959 from Hong-Kong to Cuttack. It is fresh water fish but also able to tolerate slightly brakish water. The fish from more than size 30mm, start to feed on vegetation. It is found quite effective in controlling certain aquatic weed. It feed all aquatic weed except Echhornia and Pistia. Hence, grass carp used for biological control of weeds.

3. ***Cyprinus carpio*** **(Common carp) –** During the investigation two species of cyprinus carpio i.e. C. Carpio communis and C. carpio specularis were found in Govindgarh and some other tanks. It was first introduced in the Ootacamund lake in the year 1939 from Ceylon. From Himanchal Pradesh it has been transported in Madhya Pradesh. It is an ideal fish for introduction in hilly region where it thrives very well and breeds. The fish has also been reported to breed in plains. The catchment area of Govindgarh is hilly. The run off water during rainy season create a water current which favour the breeding of common carp. The fish is voraciously omnivorous and grows very fast. It is non predetory and competes for food mostly with mrigal and calbasu.

4. ***Tilapia mossambica (Oreochromis mossambicus)*** **–** In India the first consignment of tilapia was brought by CMFRI, Mandapam

on August 7, 1952 from Bangkot. According to Hora and Pillay (1962) the fry of tilapia feed exclusively on diatoms and other unicellular planktonic and epiphytic algal. The adult tilapia subsist mainly on vegetable food. Where vegetable food are scare, worms, insects, crustaceans, fish larvae and detritus are eaten. Tilapia when cultured with major carp in ponds, was observed to feed on carp spawn even in the presence of its natural food items. The medium sized specimens of tilapia (about 25 cm long) being more destructive than larger ones.

Tilapia reaches its maturity when about 2 months old and 9-10 cm long. it breeds throughout the year except during cold season. Due to its feeding and breeding habits, it dominate in the water body very soon. So it is necessary to maintain the natural stock of native fishes, tilapia must be cultured in controlled manner.

(ii) THREAT ASSESSMENT FOR MAINTENANCE OF GENE POOL :

All human activities is underpinned by biological resources. We exploit plants and animals for food and raw materials at different levels of sophistication in different societies. Fishes are directly related with human and used as food. Various types of fishing gears and other methods are used for fish hunting. During the fishing, only those fishes are collected which are beneficial. Rest of fishes are thrown away without knowing their ecological and genetic importance. During the investigation an attempt was made to assess the name of fishes which are decreasing. This type of threat assessment is totality based on the informations gathered from the local persons, fishermen

and adjacent sources. On the basis of collected informations following fishes are listed under the threatened specieses.

List of threatened fisher in Tons river

Name of fishes	Local Name
Bagarius bagarius	ykHkj
Wallaga attu	ikfM+u
Catla catla	dryk
Tor tor	egk'ksj
Nandus nandus	piM+h

List of threatened fisher in Govindgarh

Name of fishes	Local Name
Labeo calbasu	dkjh
Wallago attu	ikfM+u
Tor tor	egk'ksj
Nandus nandus	piM+h
Chanda ranga	ekik

List of threatened species of this region

Name of fishes	Local Name
Bagarius bagarius	ykHkj
Wallaga attu	ikfM+u
Tor tor	egk'ksj
Nandus nandus	piM+h
Chanda ranga	ek;k
Specimen not found	dqjlk

Migratory fishes in Tons & Beehar

Name of fishes	Local Name
Mystus tegra	Vsxjk
Mystus seenghala	Vsxjk
Tilapia	frykfi;k
Silonia silondia	flyUn
Eutrophiichthys vacha	pj[kh

Finally six species of fishes were found to be decreasing with the time. It is necessary to take appropriate step for their conservation for future generation.

Shelton (1986) mentions about integration of different techniques as a potential tool for meaningful genetic research in cyprinids. Gynogenesis among cyprinids can provide on all female progeny which can be androgen treated to produce male brood stock. Sex inverted males when bred with normal females should produce only females. By this method reproductivity limited population can be produced on a practical scale with the help of induced gynogenesis, sex inversion and polyploidisation.

The Chinese grass carp silver carp, Tilapia are fish introduced in India and there is great fear that these species, if they get into the country's rivers instead of remaining isolated in fish farms or land-locked drainage system, will cause damage to indigenous ichthyo fauna with attached sentimentality among people. Through induced triploidy it is possible for hatcheries in India to continuously produced sterile species which while subserving purpose of enhanced production would avoid the risk of gene contamination with exotic species.

In future genetical research among fish, morphological markers, particularly colour markers, electrophoretically distingwishable proteins and blood group antigens would probably play significant roles. Morphological markers such as genes for colour and scale pattern are perhaps the easiest to identify among carps. Soviet scientists have made great use of scale pattern in their genetical work and Japanese with their ornamental carp. Serological reactions indicate occurrence of distinct blood groups among fish similar to those of man. These can be used as genetic markers. Electrophoretic markers are perhaps of greatest utility to fish breeders and population biologists. Electrophoretic proteins appear to be controlled by different allels at a single locus.

Mutagenesis, implying induction of mutations by irradiation of chemical mutagens and mutatic breeding appear to be potential tools in future genetical work in fish.

(iii) HIGH YIELDING VARIETIES AND POSSIBILITIES OF HYBRID :

The Indian major carps i.e. *Catla catla*, *Cirrhinus mrigala* and *Labeo rohita* are the well known species of high yielding variety of fishes. The department of fisheries also introduce some exotic varieties of fishes to get more production in limited water bodies. Inspite of above Indian major carps, several minor carp are also contribute a major role in the fish production.

To improve the quality and quantity in the field of fish production new techniques like biotechnology and hybridization has been used in the recent years. Carps, catfishes, sunfishes and cichlids provided the basic material for the above experimentation. Jhingran

(1969) work in hybridization of fishes and indicated the potentialities of hybrids in fish culture. Chaudhuri (1959, 1971, 1973) did pioneering work in India in evolving a number of hybrids using Indian economic carps. Natarajan *et al.* (1976) had reported natural occurrence of the catla-rohu hybrid in Rihand reservoir in Uttar Pradesh. He stated that the inter-generic catla-rohu hybrid had better productive values.

The Indian cultivated fish are by and large what nature has made them, wild different river systems perhaps holding stocks of the same species. Little is known of the heritability of desirable characters of any of India's cultivated fish. Controlled breeding by hypophysation has however provided a valuable tool to begin section work. Techniques which are likely to prove useful in developing strains with stable desirable characters are :

(i) Selective breeding

(ii) Hybridisation

(iii) Gynogenesis

(iv) Polypoloidy

(v) Sex inversions

(vi) Irradiations

(vii) Genetic Engineering

For genetic improvement of India's cultivated fish the first step might comprise segregation and isolation of stocks of different rivers, their characterisation. The initial breeding to develop more desirable traits must be selective. A choice of characters to develop may be made. Growth rate, body shape and colour, fecundity,

resistance to disease, fat content etc. may be the parameters to start with.

Selective breedings :

Generally selected fishes like major carps are used for hypophysation. Repeated phenomenon of breeding for long time may reduced their genetic potentiality. Captive populations are highly prone to interbreeding leading to reduced growth rate and disease tolerance.

Hybridisation :

A single generation of sib-mating (sister-brother mating) is known to reduce growth rate 10-20%. Hybridisation between different genetic groups is well known to lead to hybrid vigour known as heterosis. Bhowmick *et al.* (1987) have reported that Catla–Calbasu hybrid grows faster than calbasu, has a smaller head than that of Catla, greater girth than that of Calbasu. Kowtal and Gupta (1985) have described the mrigal-common carp hybrid.

Gynogenesis :

Gynogenesis is the development of an individual with exclusively maternal inheritance frequently involving retention of second polar body as a means of restoring diploid state. The various application of gynogenesis are : Chromosomal mapping, interbreeding with homozygosity and generation of monosex populations.

Polyploidy :

It is found that triploids are sterile, tetrapoloids can be used to breed for triploids. In polyploidy the male genome is included which

is excluded in gynogenesis. Triploid is induced by polar body retention and tetraploidy from first mitotic interference. Among better know fish, direct induction of triploidy has been induced in common carp and grass carp. Triploid grass carp are now being marketed in USA.

Sex inversion and irradiation are also used as tool for genetic research. Vardaraj and Pandian have developed a method of sex reversal of *Oreochromis mossambicus* for producing genetically and functionally all male tilapia through super males. For sustained production of male only stocus, a batch of sex reserved males have to produced each year. This is dose by feeding of selected batch of 'yy' fry on estrogen.

During the present study interesting naturally intergeneric hybrid was found in the Govindgarh lake. By observing the hybrid it was seems like Catla-Rohu hybrid. According to fishermen catla-rohu hybrids are found rarely.

In many respect the hybrid is superior to its parent species. In terms of body flesh to the total weight of hybrid is superior to its

parent species. Its growth rate is also faster. The present observation may be a step in the field of hybrid study.

(iv) ROLE OF SCIENTIFIC COMMUNITY AND COMMON MAN TO PROTECT THE BIODIVERSITY :

It is difficult to estimate the vulnerability of fishes from a particular aquatic ecosystem without knowing all the relevant factors. Department of fisheries and fish farmers are only centralised to culture those fishes which have market value and more production. For that purpose the Indian major carps are stimulated for breeding by hypophysation.

Unfortunately they were not aware that monoculture or culture of certain species only is ecologically unstable. Being genetically uniform, they invite diseases and pests, also vulnerable to environmental stress and pollutants. The technology for breeding high yielding varieties indeed, a technology which breeds uniformity and at the same time threatens the biodiversity conservation and sustainability. If production continues to be based on the logic of uniformity and homogenisation, it will continue to displace diversity, leading eventually to biodiversity erosion.

During the investigation it was found that maximum species of fishes were inhabitat in rivers. But the rivers are neither control of fisheries department nor fishing is banned. Due to unemployment, several families are engaged in fishing work. Some of them uses untraditional methods like poisoning and electric shock to get more fish in minimum time. In this situation, the role of scientific community, researchers, social workers and common man are more

pronounced in the field of conservation of biodiversity. For the conservational view, it is necessary to mind following points :-

1. Ecological monitoring of aquatic ecosystems of this region.
2. Minimise the habitat destruction.
3. Most of the old perennial rivers of this region are dry now-a-days due to low rainfall, decreasing catchment area and unjudicious uses of water for irrigation. This causes destruction or loss of natural habitat of fishes. Hence, it is necessary to impound the rivers at regular distance by stop dams.
4. Do not ignore the rights and privileges of local communities of fishes.
5. The importance of local fishes in fish production and ecological balance should popularise to common man.
6. Uncontrolled fishing should be checked by fisheries department.
7. Fishermen societies should be form and trend for fishing.
8. Unconventional methods of fishing like poisoning, and electric shock must be strictly prohibited and included under criminal offence.
9. Threatened specieses should be banned for fishing and try to conserve in their natural habitat.
10. .The construction of dame, reservoir ponds etc. are mainly for irrigation and also use for fish culture. But no particular water resources has been developed till today where the fishes lived freely without fear of fishing.
11. The possibilities of hybrids should be studied in this region.

During the investigation several meeting and public awareness programmes were organised. Most of the poor families are engaged in fishing work and called it 'ROJI ROTEE'. After the long conversation, these peoples were realised that only judicious exploitation of fishes should be done. They also took the oath to never use the untraditional fishing methods.

SUGGESTIONS AND RECOMMENDATIONS :

On the basis of study on Biodiversity of fish species of Rewa district, which was carried out one year following suggestion are recommended to conserve the biodiversity of fish species :

1. Most of the fish species are found in rivers. But unfortunately maximum stretch of rivers dry from March upto June, July. Hence, it is necessary to makes stop dam at certain interval to conserve the water.
2. It is found that rivers are free for fishing to every one. It should be stop by making the effective rules.
3. Untraditional fishing methods like poisoning and electric shock must be checked by regular monitoring and convicted persons must be punished.
4. To control of untrationl fishing, some powers should be given to Panchayat level and ultimate responsibility should be fixed.
5. Regular Public Awareness programmes must be arranged at Panchayat level to explain the importance of biodiversity.
6. Trend fishermen societies should be form for fishing at different places.

7. Ponds and lakes of this region should be scientifically studied, which will help to check the causes of eutrophications.
8. The exotic fishes like grass carp, silver carp and Tilapia must be cultivated in control manner.
9. Grass carp should be introduced where aquatic weeds are more.
10. Due to high fertility and reproductive power Tilapia may dominate the fish fauna of any water body.
11. Tilapia prefer the carps fry as food, hence it must affect the production of fisheries.
12. Do not introduce exotic fishes in rivers, otherwise indigenous ichthyo fauna of this region may disturbs.
13. Exotic fishes should be cultivated in fish farms or land-lock drainage system.
14. Monospecific culture of fishes could not be promoted.
15. Avoid sib-mating during hypophysation of carps.
16. Possibilities and hybrids should be studied.
17. The construction of small dams and ponds will be promoted.
18. Preservation and processing centre must be establish in this region which will help to keep fish for long tiny and better marketing opportunities to those persons engaged with fish farming.
19. The study of biodiversity programmes must be continue in future which will help to assess the loss of biodiversity with respect of time.

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