



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2019; 7(6): 316-323

© 2019 JEZS

Received: 14-09-2019

Accepted: 18-10-2019

Kamal Narway

Fisheries Department, Govt. of
Madhya Pradesh, Madhya
Pradesh, India

Srijit Chakravarty

ICAR-Central Institute of
Fisheries Education, Kolkata
Centre, 32 GN Block, Salt Lake
Sector V, Kolkata, India

Abhinika Jain

ICAR-Central Institute of
Fisheries Education, Versova,
Mumbai, India

GH Pailan

ICAR-Central Institute of
Fisheries Education, Kolkata
Centre, 32 GN Block, Salt Lake
Sector V, Kolkata, India

Subrata Dasgupta

ICAR-Central Institute of
Fisheries Education, Kolkata
Centre, 32 GN Block, Salt Lake
Sector V, Kolkata, India

Corresponding Author:**Srijit Chakravarty**

ICAR-Central Institute of
Fisheries Education, Kolkata
Centre, 32 GN Block, Salt Lake
Sector V, Kolkata, India

Fish diversity and fisheries of kotwal reservoir, Morena, Madhya Pradesh

**Kamal Narway, Srijit Chakravarty, Abhinika Jain, GH Pailan and
Subrata Dasgupta**

Abstract

Sustainability of fish production as well as livelihood generation from reservoirs depends on the appropriate management measures. The present study aims to generate data on fish diversity and fisheries of the Kotwal reservoir, Morena, Madhya Pradesh, India and suggests probable remedial measures to make the production sustainable. 29 species of fishes belong to 21 genera, 11 families and 7 orders have been recorded from the Kotwal reservoir. The largest representation was recorded for Cypriniformes order with 1 family, 9 genera and 15 species. Seasonal variation in fish production was very distinct as the production was 30-35% higher in summer months compared to winter months (500-600 kg/Ha). The fish composition includes two species (*Ompok bimaculatus* and *Wallago attu*), which included as Near Threatened (NT) category in IUCN list. The study depicted various craft and gears, which were in use for catching fish in the reservoir. Besides, the study elucidated the packaging and marketing process of the fish catch. A note on various governmental programs and schemes in uplifting the fisheries and the socio-economic status of fishermen associated with this reservoir have been documented as a baseline data for the further studies.

Keywords: Kotwal, reservoir, fishing, bio diversity, Madhya Pradesh, Morena

Introduction

Reservoirs are the future untapped resources of horizontal expansion boosting the impetus of blue revolution in Indian aquaculture. They are fondly called the “sleeping giants” owing to their vast expansion (31, 53, 366 Ha) and yet untapped exploitation status (national average production being ~20 kg/Ha). Being an important feature of a river basin, they present a threat towards the native biodiversity provided some contingent measures are not adopted well in advance. The contingent plans need an inventory to start with and for the ecosystem, the first step is to acknowledge and document the ichthyofaunal biodiversity of the water body. Madhya Pradesh, with its 763 nos. 0.46 million ha of reservoirs, has the maximum waterspread under man-made lakes of all Indian States. Gandhisagar reservoir is the second largest reservoir (in area) in the country, next only to the Hirakud of Orissa (Sugunan, 1995, ENVIS, 2019) [15, 8]. Kotwal reservoir, a medium-major reservoir earthen reservoir constructed on Asan river, a tributary of Chambal river in the year 1914 is situated near Kotwal village in Morena district of Madhya Pradesh, India. Morena is one of the districts that forms a part of the Chambal riverine system. The district is bordered by Rajasthan state on its north east. The rest of the sides are bordered by the districts of Madhya Pradesh. The reservoir geographically lies between 26°29'15''N latitude and 78°7'30''E longitude and has been constructed under the Chambal Major Irrigation Project of Madhya Pradesh. The primary purpose of the reservoir is irrigation besides drinking and fisheries. The maximum water area of the reservoir is 1768 ha and the minimum water area is 809 ha. Therefore, the average water area lies between 1327-1400 ha with a catchment area of 84.289 million m³. The depth of the reservoir is 10.95 m and the length of the shoreline of dam is 294.13 m. The spillway capacity is 4918 cumec and the length of the dam is 1158 mts. This is a multipurpose reservoir used for different purposes like drinking, irrigation and fisheries etc.

Kotwal reservoir, which was constructed on Asan River in the year 1914 near Kotwal village in Morena district, Madhya Pradesh, was selected for the present study. The average water area of this reservoir fluctuates between 1327 and 1400 ha, having a maximum depth 10.95 m and a catchment area of 84.289 million m³. Geographically, the Kotwal reservoir lies between 26°29'15" N latitude and 78°7'30"E longitude. It is situated approximately 12.4 km East of Morena city at an altitude of 103 m above mean sea level (Figures 1, 2).

Mahor and Srivastava (2017) [10] after an yearly assessment of water quality parameters of the reservoir, predicted towards the productive nature of this reservoir. However, in our course of surveying the literature, there were no reports on the ichthyofaunal diversity and fisheries of this reservoir. So, the present study was carried out to evaluate the ichthyofaunal diversity, crafts, gears as well as the local cold chain management with a note on improvement of the productivity of this reservoir by species diversification, selective ranching and controlling the catch.

2. Materials and Methods

Fishes were collected from the reservoir with the help of local fishermen by using different types of nets including Drag net (*Maha Jaal*), gill net (*Fande* or *Fasla jaal*), cast net (*Ghumaua Jaal*), dip net (*Pilna*) etc. Fishes were washed in clean tap water, gutted if necessary and preserved in 5% formalin for subsequent analyses. Systematic identification of the fishes was done with the help of standard keys prepared by Day (1889) [7], Srivastava (1968) [14]. The data on conservation status for all the species collected from Kotwal reservoir was generated from “The IUCN Red List of Threatened Species” database.

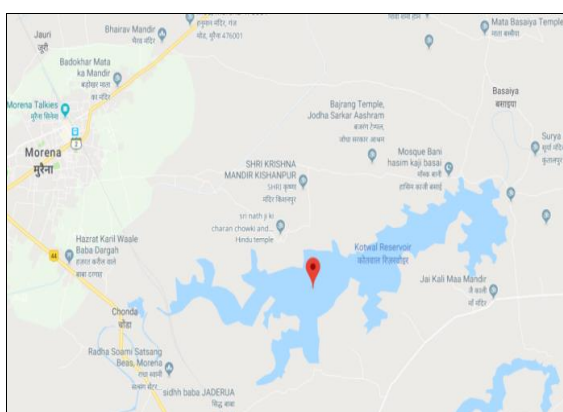


Fig 1: Map view of Kotwal Reservoir

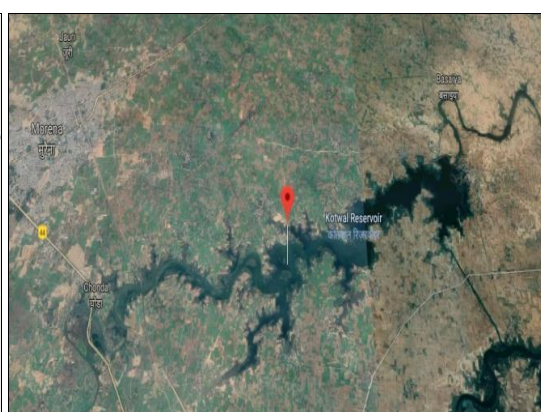


Fig 2: Satellite View of Kotwal Reservoir

3. Result

3.1 Fish Diversity: In this study, a total of 29 species were identified from the Kotwal reservoir. Those species belonged to 21 genera, 11 families and 7 orders. Cypriniformes

represented as largest order comprising of 1 family, 9 genera and 15 species. Rest six orders are depicted in Table 1. The IUCN status of individual species is presented in Table 1.

Table 1: Fishes found in Kotwal reservoir and their conservation status

| S. No | Order | Family | Scientific name | Vernacular name | IUCN status # |
|-------|-------------------|------------------|------------------------------------|-----------------|---------------|
| 1) | Cypriniformes | Cyprinidae | <i>Labeo rohita</i> | Rohu | LC |
| | | | <i>Labeo calbasu</i> | Kirawat | LC |
| | | | <i>Labeo gonius</i> | Kursa | LC |
| | | | <i>Labeo bata</i> | Bata | LC |
| | | | <i>Catla catla</i> | Catla | LC |
| | | | <i>Cirrhinus mrigala</i> | Naren | LC |
| | | | <i>Cirrhinus reba</i> | Temri | LC |
| | | | <i>Cyprinus carpio</i> | Common carp | LC |
| | | | <i>Ctenopharyngodon idella</i> | Grass carp | LC |
| | | | <i>Hypophthalmichthys molitrix</i> | Silver carp | LC |
| | | | <i>Salmostoma bacaila</i> | BarotiChal | LC |
| | | | <i>Salmostoma clupeioides</i> | Chal | LC |
| | | | <i>Puntius sophore</i> | Putiya | LC |
| | | | <i>Puntius sarana</i> | Putiya | LC |
| | | | <i>Amblypharyngodon mola</i> | Mola | LC |
| 2) | Siluriformes | Siluridae | <i>Wallag oattu</i> | Lonch | NT |
| | | | <i>Ompok bimaculatus</i> | Pabda | NT |
| | | Heteropneustidae | <i>Heteropneustes fossilis</i> | Singhi | LC |
| | | Clariidae | <i>Claria smagur</i> | Magur | LC |
| | | Bagridae | <i>Sperata seenghala</i> | Singhara | LC |
| | | | <i>Mystus cavasius</i> | Kituwa | LC |
| 3) | Channiformes | Channidae | <i>Channa marulius</i> | Sol | LC |
| | | | <i>Channa striata</i> | Darkasol | LC |
| | | | <i>Channa punctatus</i> | Cut soura | LC |
| 4) | Osteoglossiformes | Notopteridae | <i>Notopterus notopterus</i> | Patola | LC |
| 5) | Synbranchiformes | Mastacembalidae | <i>Mastacembelus armatus</i> | Bam | LC |
| 6) | Beloniformes | Belonidae | <i>Xenentodon cancila</i> | Suja | LC |
| 7) | Perciformes | Nandidae | <i>Nandus nandus</i> | Dhebari | LC |
| | | Ambassidae | <i>Parambassis ranga</i> | Chanda | LC |

(LC= Least Concern)

The IUCN status revealed that two species (*Ompok bimaculatus* and *Wallago attu*) were under Near Threatened (NT) category and remaining twenty seven belonged to Least Concern (LC) category (Table 1, Fig 3). The least concern status of 27 species indicated a better environment and less exploitation of these species (Vie *et al.* 2008) [16]. Alike endangered species, management may view habitat condition as a necessary component for the continued persistence of populations or individuals of near threatened species (Casazza *et al.* 2016) [5]. The percentage share of different families showed the decreasing order as Cyprinidae>Channidae >Siluridae>Bagaridae>Heteropneustidae>Clariidae>Notopteri dae>Mastacembalidae>Belonidae>Nandidae>Ambassidae (Fig. 3).

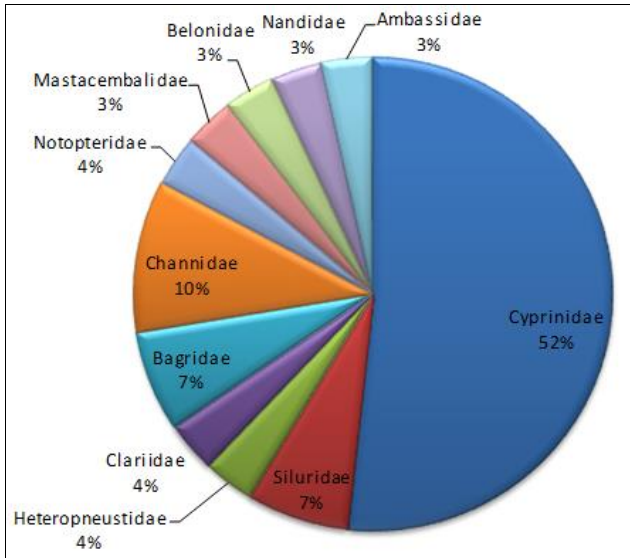


Fig 3: Family wise representation of species in Kotwal reservoir

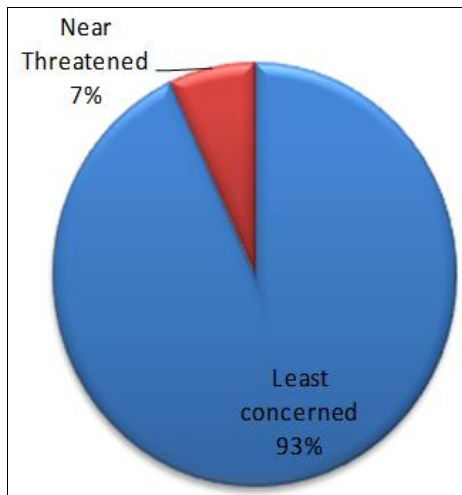


Fig 4: Conservation status of fishes of Kotwal reservoir

3.1 Seasonal fish catch and abundance

Environmental factors such as temperature, sediment composition, and inundation are the main factors influencing the distribution of faunal communities in tropical reservoirs. Those factors vary seasonally and alter the faunal composition and total biomass. Generally maximum abundance and diversity occur in the warmest months owing to higher metabolic rate, and low temperature in winter season reduce the biomass, although this is not true at all latitudes. Much of the seasonal fluctuation is more evident for individual species

than for the fish community as a whole, and the seasonal appearance and disappearance of migrants can be very marked. The temporal distribution of the species in the study is depicted below:

Round the year: *Labeo rohita*, *Labeo gonius*, *Catla catla*, *Cirrhinus mrigala*, *Labeo calbasu*, *Ctenopharyngodon idella*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*

Winter: *Wallago attu*, *Notopterus notopterus*, *Ompok bimaculatus*, *Xenentodon cancila*, *Parambassis ranga*, *Nandus nandus*, *Mystus cavasius*, *Sperata seenghala*, *Clarius magur*, *Mastacembelus armatus*

Summer: *Labeo bata*, *Cirrhinus reba*, *Heteropneustes fossilis*, *Puntius sarana*, *Puntius sophore*, *Salmostoma bacaila*, *Salmostoma clupeoides*, *Amblypharyngodon mola*, *Channa marulius*, *Channa striata*, *Channa punctate*.

The study showed fish production in summer season comprises almost 60-62% of the total catch, which was higher than that of winter season (Table 2). There was no fishing during the rainy season as it is declared as closed season for fishing activities in every year (16th June to 15th August).

Table 2: Seasonal variation of fish production in Kotwal Reservoir

| S. No. | Season | Fish production(in Kg)/day |
|--------|--------------|----------------------------|
| 1. | Summer | 800-1000 |
| 2. | Winter | 500-600 |
| 3. | Rainy season | Closed season |

3.2 Crafts and gears in Kotwal reservoir

Knowledge of fish distribution in a reservoir provides valuable information for devising more efficient methods of harvesting the fish crops. Most of the studies on the distribution of fish have dealt with fish collected by several methods such as trawls, gillnets, cast nets, traps etc. The present survey also includes the study of crafts and gears used in the Kotwal reservoir for fishing. Crafts are used to carry fishermen to the fishing ground while the gears are used for fishing.

3.2.1 Crafts: Flat bottom tin boats (Fig. 5) are mostly used for fishing in the reservoir. Machua sahkari samiti, Kishanpur, Morena has 50 flat bottom tin boats and one motor engine boat having 6 seated capacities (Fig. 6). Size of flat bottom tin boats have various lengths of 18 ft, 16 ft and 14 ft and width 4-5 ft which can carry 4-6 fishermen.



Fig 5: Flat bottom boats in Kotwal Reservoir



Fig 6: Motor boat used in Kotwal reservoir

3.2.2 Gears: Different types of gears used for fishing in the reservoir are:



Fig 7, 8: Fishing Traps used in Kotwal reservoir

3.2.2.3 Hooks and line: This is an active gear catches the fish by offering a baited hook. In a “hand line” one or more hooks are attached at the end of a cotton line (*Dori*). A long line consists of a main line and several branch lines. It is locally known as *Bansi* and *Kanta*. Hooks and lines are mainly used to catch carnivorous fishes like *Channa* species and *Wallgo attu* in the reservoir.

3.2.2.4 Cast net: Locally known as *Ghumaua jaal*. It is circular in shape and looks like umbrella, with a strong rope attached to the apex and sinkers are affixed to the footrope. The net is made up of nylon twine. The diameter is 4m and

the mesh size 2.5cm.

3.2.2.5 Gill net: Locally known as *Fande* or *Fasla jaal*. The gill net is a large wall of net set in water and is passively operated to catch the fish. The net consists of a head rope with floats attached to it, and a foot rope with sinkers. It is also made up of nylon twines. The net of mesh size is variable ranging from 2, 4 or 6 inches. The net is set in the evening and hauled the next morning to collect the entangled fish. Size of gill nets used in Kotwal reservoir is 100m, 200m, 250m, 500m in length and 3- 4mts. in width (Fig., 9).



Fig 9: Gill net used in Kotwal reservoir

3.2.2.6 Drag net: Locally known as *Mahajal*. Dimensions of the drag net used for fishing in this reservoir are 400 mts. in length, 6mt. width with a mesh size of 5cm.

3.3 Marketing and cold chain: The catch is brought to landing centers where the representatives of the Fisheries Federation receive the fish and keep daily records on the category and species of fishes in the presence of a Fisheries Officer.

There are two landing centre of Kotwal reservoir i.e., (1) Kishanpur village and (2) Pilua village. Machuasahkari samiti Kishanpur, Morena (M.P.) supply their fish to Ladhedi wholesale fish market Gwalior and Islampura wholesale fish market Morena. Sometimes the fishes are also sent to wholesale fish markets of Agra and Delhi as they fetch higher prices there. The table shown below (Table 3) depicts the seasonal availability of fish that is supplied to the local markets.

Table 3: Season wise catch supplied to wholesale markets of Gwalior and Morena, M.P.

| S. No. | Season | Quantity of fish supplied to wholesale fish market Gwalior (in Kg) | Quantity of fish supplied to wholesale fish market Morena (in Kg) |
|--------|--------------|--|---|
| 1. | Winter | 500 | 100 |
| 2. | Summer | 700-800 | 150-200 |
| 3. | Rainy season | Close season | Close season |

3.3.1 Fish packing: Fishes are packed in thermocol boxes with a capacity of 50 kg fish and 30 kg of ice for exporting in local markets. The shelf life of fish in these boxes ranges 2-3

days, which may extend to 7 days. Cost of this box is Rs.80 per pc. These thermocol boxes are used only for one time fish packing (Fig 10, 11).



Fig 10, 11: Packing of fish with ice before marketing

3.3.2 Livelihood: There are 338 members in this co-operative society, mainly the traditional fishers. The fishermen are involved in capturing fish for their livelihood, whereas, the fisherwomen are involved in net repairing, sorting of fish (species and weight-wise) and packing etc. Around 80-90 fishermen families residing near Kotwal reservoir at village Kishanpur district- are mostly involved in fishing activities.

3.4 Management and Remedial measures for augmenting production: With a view to enforce effective management and formulate a concerted approach of fisheries development

in the reservoirs it is governed under district administration of Fisheries Department. According to M.P. Government's the Kotwal reservoir has been granted a 10 year lease to Machua Sahakari Samiti Maryadit Kishanpur, Morena M.P.

3.4.1 Ranching

Ranching of fish seed, particularly with fingerlings of *Labeo rohita*, *Catla catla*, and *Cirrhinus mrigala* is a common practise in the month of August-September in Kotwal reservoir. The details of ranching program are summarized in Table 4.

Table 4: Year wise fingerling stocking in Kotwal reservoir in Ranching programme

| S. No | Year | No of Fingerling stocking (lakh) | Stocked species |
|-------|---------|----------------------------------|---|
| 1. | 2015-16 | 5.0 | <i>Labeo rohita</i> , <i>Catla catla</i> , and <i>Cirrhinus mrigala</i> |
| 2. | 2016-17 | 4.24 | .. |
| 3. | 2017-18 | 3.98 | .. |

3.4.2 Government schemes: A number of schemes aided by the Department of Fisheries, Govt. of Madhya Pradesh are operational for improvement of fish yield from Kotwal reservoir under the vigilance of Fisheries Officers of the state. Some of them are summarized below:

3.4.2.1 Subsidy of fishermen co-operative society: M.P. fisheries department provides financial assistance of Rs 1.50

lakh during 10 year lease period on inputs, such as, fish seed, boats, nets, lease amount) to the fishermen co-operative society.

3.4.2.2 Saving cum relief scheme: The department provides financial assistance of Rs 3000/ fishermen for their livelihood during the period of 2 month fishing ban every year.

3.4.2.3 Fishermen credit card: The department provides financial assistance of Rs.8000/fishermen to 148 members of Machua sahkari samiti, Kishanpur, Morena every year at a zero interest rate through the district Central Cooperative Bank.

3.4.2.4 RKVY sponsored scheme on subsidy on Boat & Nets: The fisheries department provides 50% subsidy with a maximum of Rs 4000 for purchasing boats or nets as an individual or an unit registered with any Cooperative Society under the RKVY project. Fisheries department has already provided 25 boats to Machua Sahkari Samiti, Kishanpur, Morena to increase the catch per unit effort in fishing.

3.4.2.5 Training to fishermen: The department conducts training programmes on good management practice, reservoir development, exposure visits for the fishermen. Total 38 members of this co-operative have been trained till now.

3.4.2.6 Establishment of Chinese circular hatchery: Under blue revolution scheme, the fisheries department provided financial assistance of Rs. 10.0 lakh for establishment of Chinese circular hatchery for the in-situ seed rearing to boost the culture based capture fisheries of the reservoir (Fig. 12). Since last year (2017), the hatchery has been running successfully by the members of Co-operative society and the details of spawn and fry production are annexed herewith (Table 5).

Table 5: Spawn and fry production at Chinese circular hatchery managed by the cooperative society

| S. No | Year | Spawn production (in lakh) | fry production (in lakh) |
|-------|---------|----------------------------|--------------------------|
| 1. | 2017-18 | 25.0 | 5.0 |
| 2. | 2018-19 | 45.0 | 90.0 |



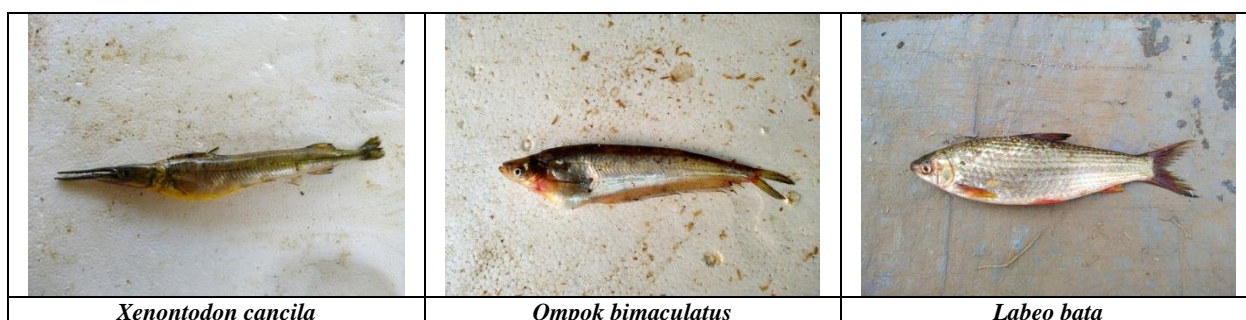
Fig 12: Chinese Circular hatchery managed by the Cooperative Society members

3.4.2.7 Cage culture: Under blue revolution scheme, the fisheries department has been proposed cage culture with an unit cost of Rs. 36.0 lakh along with a subsidy of 40% in the year 2019-20 by fisheries department in this reservoir.

4. Discussion

Documentation of biodiversity has been an interest of biologists and ecological engineers to predict the impact of climate change and increasing anthropological interference in the ecosystem as a whole. Fish biodiversity, in particular being the indicator of healthy aquatic ecosystem, increases the economic success of the ecosystem and implies that the area has become more efficient (Dubey and Chauhan, 2017) [6].

Madhya Pradesh, owing to its huge landmass shrouded by forests and dotted with numerous rivers and reservoirs is definitely a hotspot for the biodiversity enthusiasts. Bose *et al* (2019) [4] surveyed Chambal river basin in central India and documented a total of 56 fish species belonging to 09 orders, 18 families and 39. Group-wise distribution of fishes showed that catfishes were the most dominant (23.21%) and as per total relative abundance of the river was *Glossogobius giuris* (6.84%). The abundance of fishes was found to be highest in winter. Dubey and Chauhan (2017) [6] reveal the occurrence of 27 species of fish belonging to six orders, nine families with the dominant family as Cyprinidae in Rangwan Dam Chhatarpur Madhya Pradesh. Mustafa *et al.*, (2017) [11] recorded 23 fish species under 6 order and 7 families from Halali reservoir. The sequence of the species abundance was Cypriniformes>Siluriformes>Perciformes>Anguilliformes>Beloniformes>Osteoglossiformes. Similarly, total 51 species were recorded belonging to 33 genera, 16 families and 7 orders by Prakash (2015) [12] and 52 species of fishes were identified belonging to seven orders, 17 families and 36 genera at Harsi Reservoir, Bhitwar Tehsil, District Gwalior by Ahad and Rao (2019) [1]. In corroboration to previous study, our investigations on the Kotwal reservoir recorded 29 species of fishes, belonging to 21 genera, 11 families and 7 orders. The largest representation was recorded from Cypriniformes order comprising of 1 family, 9 genera and 15 species. The IUCN red list includes *Wallago attu* and *Ompok bimaculatus* in the Near Threatened category and the seasonal abundance data showed that these fishes are mostly available in winter catch. It is essential to keep close observation of their recruitment pattern and catch composition for better conservation.



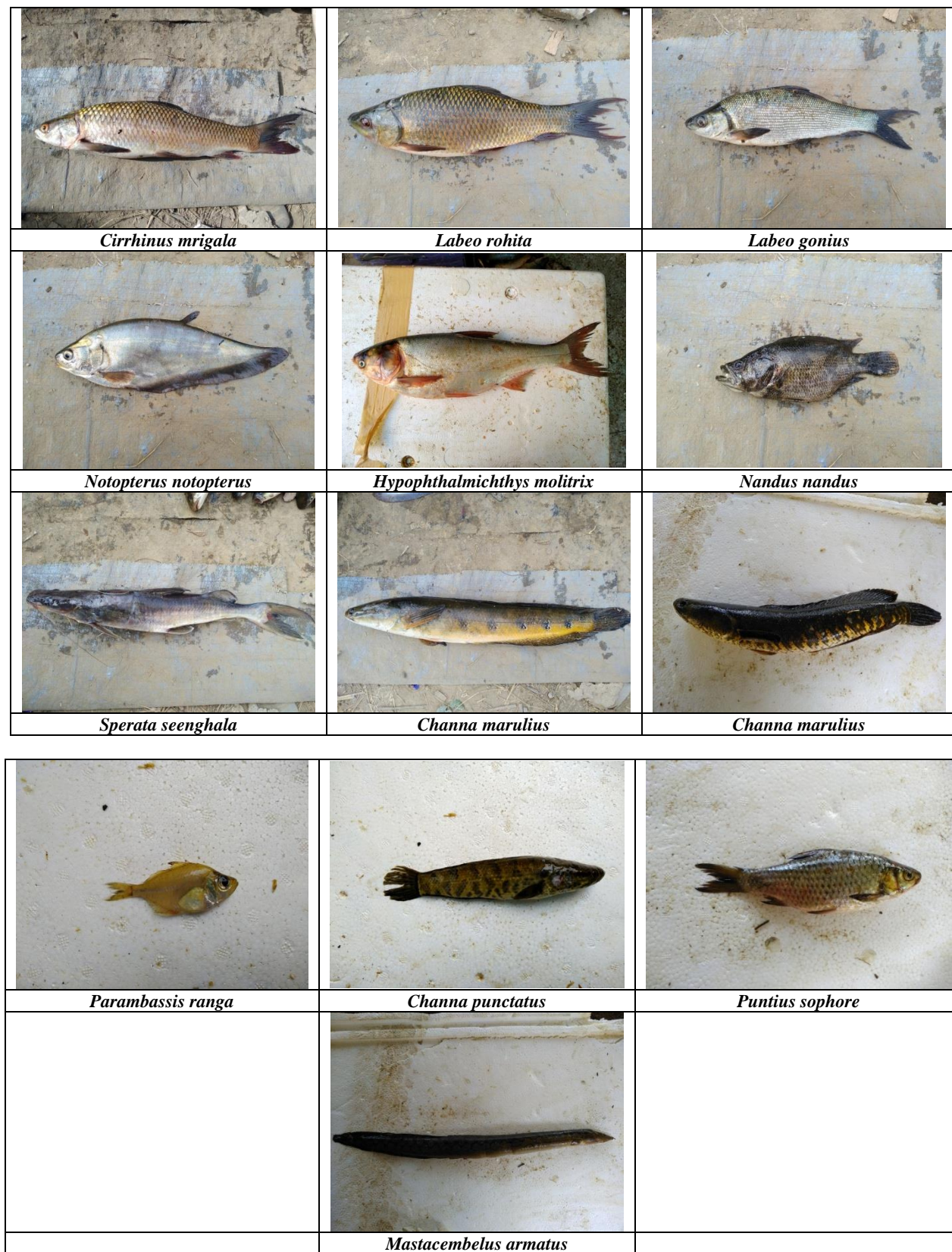


Fig 13: Photographs of commonly available fishes at Kotwal Reservoir

Conclusion

The present study is the first documentation of the ichthyofaunal diversity of the fishes present in the Kotwal Reservoir. This study provides a valuable insight towards the documentation of the involvement of the Fisheries Department, Govt. of Madhya Pradesh towards enhancement of the capture fisheries from this reservoir and provides the baseline data for future studies documenting the enhancement

in fish production from this reservoir. The study also promotes responsible use of fishing crafts and gears pertinent to the Code and Conduct of responsible fisheries and desists the use of destructive fishing gears like use of small meshed gill and drag nets, dynamite fishing etc. The proposal of inducting cage culture in this reservoir is a need of the hour welcome step by the Fisheries Department so that the high value catfishes like *Ompok bimaculatus*, *Clarias magur*,

Heteropneustes fossilis may be resurfaced in the local markets at an affordable prices to meet the goals of nutritional security in coming days.

Acknowledgement

The authors are grateful to the Dr. Gopal Krishna, Director, Central Institute of Fisheries Education, Mumbai, for providing facilities for carrying out the dissertation work under Post Graduate Diploma Inland Fisheries & Aquaculture Management programme. First Author acknowledges the support of Fisheries Department, Govt. of Madhya Pradesh for providing necessary permission to complete the course of Post Graduate Diploma in Fisheries at ICAR-CIFE, Kolkata centre for the period of 2018-19.

References

- Ahad N, Rao R. Assessment of fish diversity of Harsi reservoir, Madhya Pradesh, India. *International Journal of Zoology and Applied Biosciences*. 2019; 4(1):466-471.
- Antonio RR, Agostinho AA, Pelicice FM, Bailly D, Okada EK *et al*. Blockage of migration routes by dam construction: can migratory fish find alternative routes?. *Neotropical Ichthyology*. 2007; 5(2):177-84.
- Bhat H, Rao RJ. Studies on fish diversity of Tighra reservoir Gwalior, Madhya Pradesh, India. *International Journal of Zoology Studies*. 2018; 3(2):68-73.
- Bose R, Bose AK, Das AK, Parashar A, Roy K. Fish Diversity and Limnological Parameters Influencing Fish Assemblage Pattern in Chambal River Basin of Madhya Pradesh, India. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*. 2019; 89(2):461-73.
- Casazza MLCT, Overton TVD, Bui JM, Hull JD, Albertson VK, Bloom *et al*. Endangered species management and ecosystem restoration: finding the common ground. *Ecology and Society*. 2016; 21(1):19.
- Chauhan AK. Role of Biodiversity in Human and Environmental Challenges: Fish Diversity in Rangwan Dam at Chhatarpur, In Madhya Pradesh, India. *Global Journal of Multidisciplinary Studies*. 2017; 30:6(7).
- Day F. Fauna of British India, including Ceylon and Burma. *Fishes*. 1889; 1:1-548.
- ENVIS.
<http://www.mpervis.nic.in/index2.aspx?slid=1800&sublinkid=797&langid>. 2019.
- Kadam CP, Dandolia HS, Kausik S, Saksena DN, Shrotriya VP. Biodiversity of Zooplankton in Pillowa Reservoir District Morena Madhya Pradesh, India. *International Journal of Life Sciences*. 2014; 2(3):263-267.
- Mahor P, Shrivastava S. Water quality status of Kotwal reservoir Morena district, Madhya Pradesh. *International Journal of Advanced Research and Development*. 2017; 2(6):459-466.
- Mustafa G, Khan MA, Hussain S. Ichthyofaunal diversity of Halali reservoir Vidisha, (MP). *Journal of Entomology and Zoology Studies*. 2017; 5(3):1500-1503.
- Prakash SV. Biodiversity and conservation assessment of freshwater fishes of Harsi Reservoir, Madhya Pradesh, India. *Int. J Life Sci*. 2015; 3(1):27-35.
- Sarkar UK, Lakra WS. An overview of the diversity and conservation status of freshwater fishes of central India. In: *Proceeding of the Workshop on Conservation Assessment of Freshwater Fish Diversity for Central India*. (Eds W.S. Lakra and U.K. Sarkar). National Bureau of Fish Genetic Resources (NBFGR), Lucknow (U.P.), India, 2007.
- Srivastava GJ. *Fishes of Uttar Pradesh and Bihar*, Vishwavidyalaya Prakashan, Varanasi, India, 1968.
- Sugunan VV. Ecology and fishery management of reservoirs in India. *Hydrobiologia*. 2000; 430(1-3):121-147.
- Vié JC, Hilton-Taylor C, Pollock C, Ragle J, Smart J, Stuart SN *et al*. The IUCN Red List: a key conservation tool. In: J.-C. Vié, C. Hilton-Taylor and S.N. Stuart (eds). *The 2008 Review of the IUCN Red List of Threatened Species*. IUCN Gland, Switzerland, 2008.
- Wani OA, Gupta US. A study on Ichthyofaunal diversity of Sagar Lake, Madhya Pradesh, India. *International Journal of Biodiversity and Conservation*. 2015; 7(3):126-9.