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An overview on the biology of three fresh water fishes, *Oreochromis mossambicus, Pethia ticto* and *Salmophasia untrahi* in India

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Abstract

The biology of three freshwater fishes *viz*., *Oreochromis mossambicus*, *Pethia ticto* and *Salmophasia untrahi* in the lentic and lotic water bodies of India as worked out by various researchers is reviewed based on published literature. The biological aspects of fishes includes, length-weight relationship, relative condition factor, food & feeding habits, reproductive biology, fecundity, age and growth, sex ratio and biochemical constituents. The present review study is aimed at enhancing the knowledge regarding the biology of fishes and to enable the formulati on of suitable management measures towards a rational exploitation and management in water bodies in India. Several works have been carried out on the biology of these three fishes, but a consolidate information on biological aspects is still scarce. So this review study has been prepared which is needed to support the conservation of fishes in India. This review clearly indicates that certain timely measures have to be taken immediately to protect the fish fauna in India.

Keywords: biology, oreochromis mossambicus, pethia ticto, salmophasia untrahi, India

Introduction

Biological invasions are more and more identified as a most important risk to world biodiversity after habitat degradation and that can carry out irreversible adjustments in an aquatic habitat that can also lead to species extinctions (Nyman, 1991) [25]. Fishes are the most brought (624 species) and threatened group of aquatic animals globally (Singh and Lakra, 2011) [39]. *Oreochromis mossambicus* is native to Southeastern Africa with dull colored, the tilapia regularly lives up to a decade in its native habitats. It is a famous fish for aquaculture. Due to human introductions, it is now discovered in many tropical and subtropical habitats round the globe, the place it can turn out to be an wonderful species due to the fact of its robustness. It adapts to new habitat and has properly organoleptic quality.

Pethia ticto is a kind of 'barb' placed in aquariums. There is a silvery white staggering physique with a black mark on the caudal peduncle. The most dimension is round 10cm (Talwar and Jhingran, 1991) [40]. Aquarium lovers respect them due to the fact of their various dietary habits and sturdy nature. They are greater traumatic due to sexual dimorphism and seasonal shade modifications for the duration of the breeding season. This fish located in lentic and lotic water bodies with muddy bottoms. Crustaceans, insects, and plankton are their favorite foods. About one hundred fifty eggs are laid in a batch with about 20 batches at a time. They are usually located in Asia, Pakistan, India Nepal, Bangladesh and Myanmar (Abir Lal Dutta *et al*., 2013) [4]. Species belonging to the genus *Salmophasia* are disbursed all through the world. In India they are of frequent prevalence in the states of Karnataka, Madras, Kerala and Orissa. These smaller fishes happen in massive numbers and yield minor fisheries and most of them take baits. Hence, the current overview find out about centered on the biology of the fishes *O. mossambicus*, *Pethia ticto* and *Salmophasia untrahi* undertaken from Indian lentic and lotic water bodies labored out by using a variety of researchers.

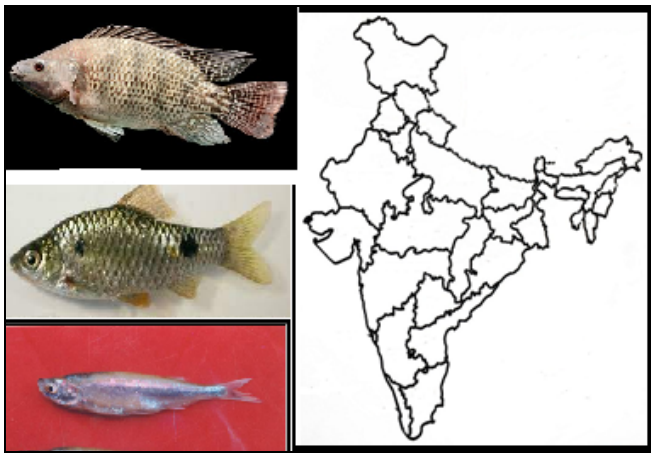

Fig 1: India map & views of *Oreochromis mossambicus, Pethia ticto and Salmophasia untrahi* fishes

Data collection

Secondary data is used to be gathered via referring journals, thesis, books and web references as carried out by using the exclusive researchers of India. The amassed records is compiled and written in the structure of review paper.

Biology of *Oreochromis mossambicus*

Table-1 depicts the work on biological aspects of *Oreochromis mossambicus, Pethia ticto* (Syn. *Puntius ticto)* and *Salmophasia untrahi* carried out by various researchers from India.

Ujjania and Sharma (1999) [42] reported a linear relationship between length and weight of *Oreochromis mossambicus* occurring in lake Jaisamand, Rajasthan. They found that the relative condition factor vary between 0.99 to 1.00.

Shendge (2005) [37] studied the length- weight relationship and relative condition factor in *Oreochromis mossambicus* of Bhima river. The fish exhibited isometric growth. The correlation coefficient showed a good relationship. The mean relative condition factor indicated the well-being of the fish.

Dede and Deshmukh (2019) [7] were undertaken the length weight data and Ponderal index of *Oreochromis mossambicus* from Bhima river tal. Pandharpur district of Solapur. The total length recorded ranged from 10 to 25 cm. The weight of fish varied 23 to 286 gm. The Ponderal index value is greater than 1. Their results indicates the negative allometric growth and good condition of fish growth.

Kiran *et al* (2006) [16] worked on the length-weight relationship of *Oreochromis mossambicus* from Jannapura pond, Bhadravathi taluk, Karnataka. In male and female fishes "b"values ranged 2.5225-2.5867 and 2.125-2.015 respectively. Both the sexes exhibited allometric growth.

Ujjania *et al* (2013) examined the scales of 90 tilapia *Oreochromis. mossambicus* individuals from commercial catch from Jaisamand Lake, Udaipur (India). In their study population, age composition varied between 1+ to 4+ year class and 3+ age group was dominated. The growth constant and average growth constant during the initial year of life is high indicate that the fish had active growth period during first year.

Mushtaq Ahmad Ganie *et al*, (2013) [24] investigated the population characteristics of non-indigenous tilapia, *O. mossambicus* in stretch of Yamuna river in India. The gonado-somatic index (GSI) and the presence of all 06 gonadal stages confirmed that *O. mossambicus* has established a breeding population. The GSI for females indicated increased spawning intensity in March to April and July to August. Males ranged from 142-280.0 mm total length and females from 130-265.0 mm TL. Small juvenile fishes were collected by them in the Yamuna river. Adult *O. mossambicus* consumed primarily detritus and plant matter, though the food of juveniles, was found to be carnivorous.

Sakhare and Jetithor (2016) [34]. analysed gut content of 80 fishes of *Oreochromis mossambicus* from Borna Reservoir, Maharashtra, India revealed that the food of juveniles mainly consisted of rotifers followed by copepods Chlorophyceae, Bacillariophyceae and aquatic insects. While the food of adults were Chlorophyceae followed by Bacillariophyceae, rotifers, copepods and aquatic insects. They found that the juveniles feed on zooplankton and adults on phytoplankton respectively. Severe feeding was noticed during summer season and juveniles were active feeders.

Singh and Shukla (2014) [38] studied the feeding intensity with rise in water temperature and the medium fishes being more active feeder than larger ones. Indira *et al*. (2013) [11] noticed decline in feeding intensity with increment in size of *O. mossambicus.*

Indira *et al* (2013) [11] gathered the examples of *O. mossambicus* month to month during January 2010 to December 2010 utilizing gillnets of various cross section sizes from Pichavaram Mangrove territory. It was found to utilization of an assortment of substances of plant and animal inceptions. A sum of 10 diverse food segments were recorded in the gut of *O. mossambicus*. The diverse food materials were noticed, for example, scavanger, fish, zooplankton, phytoplankton, polychaetes, nematodes, gastropods, bivalves, sand and various. The gonadosomatic index (GSI) of the species changed from the male was 4.93±0.17 to 7.93±0.17 and the female was shifted from 5.78±0.36 to 8.73±0.36. The feeding intensity was varied consistently and the base was seen during June and August like the generating time frame. Aravindan (1980) [1] and Panikker (2000) [26] detailed the omnivorous feeding habit of *O. mossambicus.*

Sakhare and Chalak (2019) [35] worked on the fecundity of the *Oreochromis mossambicus* from reservoirs of Beed region, Maharashtra, India. The fertility expanded with the increment in size of fish.

Fecundity in *O.mossambicus* is truly factor as detailed by various examiners. As per Hora and Pillay (1962) [8], the female tilapia lays 75-250 eggs all at once. Vaas and Hoftstede (1952) found that the fertility of *T.mossambica* went from 80 to 300 ova for fish with length that goes from 8 to 11 cms in complete length. Kulkarni (1984) revealed the absolute number of ova in fluctuated from 169 to 772 in species going from 103 to 179 cms long. Mironova (1969) [22] revealed that the fecundity of tilapia went from 80 to 1000 eggs for each female. De Silva and Chandrasoma (1980) discovered fruitfulness of *O. mossambicus* going from 360 to 1775 eggs for every female for going from 20 to 31.9 cm in all out length.

There are 06 maturity stages in *O. mossambicus* and Gonado-somatic index indicated that the breeding season extended from March to October. Ova-diameter frequency polygon showed 4 times of spawning of the fish. First maturity observed at 5 -10 cm in female and 10-15 cm in male. Absolute fecundity was 100 to 850, Relative fecundity found to be 6 to 16. Positive correlation between GSR and condition factor (r = 0.88). High correlation was observed between fecundity and total length and fecundity and body weight (Hatikakoty and Biswas, 1999).

Manivannan *et al* (2019) [21] studied the gonads revealed the existence of 05 maturity stages of *O. mossambicus.* The first sexual maturity was observed in female than in male. They concluded that the 50% of male individual were mature than females which was assessed through histological analysis of the species.

Roshni and Renjithkumar (2020) [31] studied the reproductive ecology of fish *Oreochromis mossambicus* from Vembanad Lake, Kerala. The sex ratio was 1:1.40. Males and females in reproductive activity occurred throughout the year, the peak spawning occurred between May to August and November to December.

Prakash Shobha *et al* (2020) carried out the biochemical composition of *Oreochromis mossambicus*, *Lepidocephalichthys thermalis* and marine fishes; *Sardinella lemuru* and *Stolephorus indicus* fishes. Carbohydrate was high in *Oreochromis mossambicus*. Their results revealed that among the four tested fishes, the high amount of carbohydrate content present in the fish *Oreochromis mossambicus***.** The meat had elevated moisture with 81.34% and low lipid < 1% content. Sathisha Gouda *et al* (2021) [36] have reviewed the biology of exotic fish, *Oreochromis mossambicus* from fresh water bodies of India.

Pethia ticto*/*Puntius ticto

Pankaj Bahuguna *et al*. (2010) [30] investigated the sexual dimorphism of *Puntius ticto* within the Kumaun Himalaya, India. They noticed significant sexual dimorphism. The

dorsal and ventral fins of the male bear a little black blotch. The male features a distinct dark pink color the lower half his body. ted with other observations, females have a somewhat pinkish and dark yellow tint on each side.

In Tripura, Banik *et al*. (2012) [5] investigated the reproductive physiology and biology of *Puntius ticto*. a number of the most factors researched thus far in reproductive physiology include gonad development in connection to length and weight, gonado-somatic index, maturity stages in reference to age, fecundity and breeding periodicity, and so on. With in the field of feeding biology, research is being conducted on the analysis of varied digestive enzymes during adulthood, growth and development in reference to age, RLG, and condition factor assessment.

Rayal *et al* (2021) [32] used the Gonado-Somatic Index and Dobriyal Index in *Puntius ticto* as comparison to other observations, the Dobriyal Index was more accurate than the Gonado-Somatic Index in predicting sexual maturity. Diet of *Puntius ticto* has been reported by Pethiyagoda *et al*. (2012) [29], and it's herbivorous consistent with Mitra *et al*. (2011).

Ashish Kumar Maurya *et al* (2018) [2] described the length-weight relation of small fish Pethia ticto from Gomti River, Sultanpur district of Uttar Pradesh, India. Their analysis showed that the allometric coefficient is on the brink of isometric value of 3.0. Allometric growth indicates a more rotund population of fish when the values of growth coefficient are above 3.0 (b>3). Isometric growth indicates that the form of fish doesn't change because it grows (b=3). The coefficient of determination was also found significant (=0.97). Fulton's factor ranged 1.041 to 1.660 shows the well-being. Their study was helpful in providing relevant information within the assessment of stock and estimation of the fish condition. The condition factor about fishes was found to be comparatively less for middle length groups (40-49 to 70-79mm) in comparison to initial and final length groups.

The similar findings has been reported by Sarkar *et al*. (2013) [33] in *P.ticto* from the river Ganga. The factors such as sexual category, size, seasons and gonadal maturity in fishes have affected the K values (Heincke, 1908) [9]. Ecological factors, food supply and parasitism, have a big influence on the well-being of the fish (Le Cren, 1951) [20].

Ashashree and Kiran (2021) [36] have reviewed the biology of cyprinid fishes *viz*., *Pethia ticto*, *Systomus sarana* and *Puntius sophore* in the fresh water habitats of India.

Salmophasia untrahi Syn. Salmostoma untrahi

Kiran and Puttaiah (2004) [13] analysed the gut content of *Salmostoma untrahi* from Bhadra Reservoir, India. The preference of the food items were: desmids, bluegreens, chlorococcales, diatoms and zooplankton. Desmids and cyanophycean algae formed the major items of diet throughout the year. This fish is a surface to column feeder.Feeding intensity related to spawning activity.

Kiran and Puttaiah (2005) [14] studied the age and growth of *Salmostoma untrahi* from Bhadra reservoir region of Karnataka using length frequency. The growth rate decreased in both sexes with advancement of age. A sigmoidal growth pattern was observed. Male and female fishes attained 117.89mm and 120.99mm at the end of first year and 128.89mm and 139.48mm at the end of second year respectively. Fluctuations in the growth rate were probably due to the influence of various factors such as geographical, quality and quantity of food, and population density. The life span of the fish was about 1-2 years.

The relative condition factor of *Salmostoma untrahi* in Bhadra reservoir was studied by Kiran (2014). The mean relative condition factor showed seasonal variation in both sexes. The condition of the fish were coincided with the maturation stage of the fish.

Kiran (2015) [17] evaluated the Gonadosomatic index (GSI) of *Salmostoma untrahi* from Bhadra dam. The minimum GSI values in both male and female fishes were observed in winter while, maximum of it was recorded in monsoon season for male and female respectively. This fish has 3 active spawning seasons in a year.

The fish *Chela untrahi* belonging to various size ranges were examined by Kiran *et al* (2003) [15] for sexuality of fishes at backwaters of Bhadra reservoir. Dominance of male was noticed in most of the size groups. The overall male: female ratio was found to be 1:0.5057 and predominance of male was noticed all through the year.

Kiran and Puttaiah (2003) [15] have deliberate the fecundity of *Chela untrahi* from Bhadra reservoir, Karnataka. The fecundity was found to ranged from 6729 to 26952 eggs. They opined that the ovary weight was found to be a better index of fecundity than total length or total weight of the fish.

Kiran (2018) [18] studied the biochemical constituents of raw and dried specimens of the freshwater fish *Salmophasia untrahi* from Bhadra reservoir. The dried fish has maximum biochemical constituents during various seasons is attributed to variation in feed intake, water quality, gonadal stage, spawning and breeding activity.

Table 1: Biology of *Oreochromis mossambicus*, *Pethia ticto* & *Salmophasia untrahi* in the lentic and lotic water bodies as worked out by different researchers of India

Sl No.	Fish species	Parameters	Water body	References
1	*Oreochromis mossambicus*	Age and growth	Jaisamand lake	Ujjania *et al*.,2013
2	*Oreochromis mossambicus*	Relative condition factor, GSI, Food and feeding habits	Yamuna river, Uttar Pradesh	Mushtaq Ahmad Ganie *et al*.,2013
3	*Oreochromis mossambicus*	Bio invasion	Jaisamand lake	Ujjania *et al*.,2015
4	*Oreochromis mossambicus*	Fecundity	Water bodies in Beed district (Maharashtra)	Sakhareb and Chalak,2019
5	*Oreochromis mossambicus*	Reproductive biology	Nazira pond, Assam	Hatikakoty and Biswas,1999
7	*Oreochromis mossambicus*	Food and feeding behaviour	Borna reservoir (Maharastra)	Sakhare and Jetithor,2016
8	*Oreochromis mossambicus*	Food and feeding habit	Pichavaram mangrove area	Indira *et al*.,2013
9	*Oreochromis mossambicus*	Length-weight relationship & Relative condition factor	Bhima river, Maharastra	Shendge,2005

10	*Oreochromis mossambicus*	Length-weight relationship and Ponderal index	Bhima river, Maharastra	Dede and Deshmukh,2019
11	*Oreochromis mossambicus*	Length-weight relationship	Jannapura pond,Karnataka	Kiran *et al*.,2006
12	*Oreochromis mossambicus*	Biochemical aspects	-	Prakash Shobha *et al*.,2020
13	*Oreochromis mossambicus*	Biology	Marathwada water bodies	Kulkarni,1984
14	*Oreochromis mossambicus*	Length-weight relationship and Relative condition factor	Jaisamand lake	Ujjania and Sharma,1999
15	*Oreochromis mossambicus*	Reproductive ecology & sex ratio	Vembanad Lake, Kerala.	Roshni and Renjithkumar,2020
16	*Puntius ticto*	*Sexual dimorphism*	*Kumaun Himalaya*	*Pankaj Bahuguna et al.,2010*
17	*Puntius ticto*	*Reproductive physiology and Biology*	*Tripura*	*Banik et al.,2012*
18	*Puntius ticto*	*Sexual maturity*	-	*Rayal et al.,2021*
19	*Pethia ticto*	*Length-weight relationship & Condition factor*	*Gomti river, Uttar Pradesh*	*Ashish Kumar Maurya et al.,2018*
20	*Puntius ticto*	*Length-weight relationship*	*Ganga river*	*Sarkar et al.,2013*
21	*Salmostoma untrahi*	Food & feeding habits	Bhadra reservoir	Kiran & Puttaiah (2004)
22	*Salmostoma untrahi*	Age & Growth	Bhadra reservoir	Kiran & Puttaiah (2005)
23	*Salmostoma untrahi*	Relative condition factor	Bhadra reservoir	Kiran (2014)
24	*Salmostoma untrahi*	Gonado Somatic Index	Bhadra reservoir	Kiran (2015)
25	*Chela untrahi*	Sex ratio	Bhadra reservoir	Kiran *et al*. (2003)
26	*Chela untrahi*	Fecundity	Bhadra reservoir	Kiran & Puttaiah (2003)
27	*Salmophasia untrahi*	Biochemical constituents	Bhadra reservoir	Kiran.(2018)
28	*Salmostoma untrahi*	Food & feeding habits	Bhadra reservoir	Kiran & Puttaiah (2004)

Conclusion

The life preference is an important for a making sure of the species suitability for aquaculture, since, it can help to determine the suitable species blend in culture systems with an inter species completion for natural food substances. The normal environment providing the information on the biological profile of the species, it is mainly useful the species for small and large scale culture ones and maintain schedule of feeding their avoiding diseases and be capable of benefit the environment.

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