

# AN OVERVIEW ON BIOLOGY OF FRESH WATER FISHES IN THE LENTIC WATER BODIES OF SHIVAMOGGA AND CHIKMAGALUR DISTRICTS, KARNATAKA

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## ABSTRACT

*The biology of freshwater fishes in the lentic water bodies of Shivamogga and Chikmagalur districts is reviewed based on published literature. The biological aspects of fishes includes, length-weight relationship, relative condition factor, food & feeding habits, 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 formulation of suitable management measures towards a rational exploitation and management in lentic water bodies.*

**KEY WORDS:** *Biological study, Fresh water fishes, Shivamogga & Chikmagalur districts.*

## Introduction

Investigations on life-history patterns of important fishes of the reservoirs, habitat management etc., are need for restructuring fish populations and enhancing fisheries. The gradual erosion of commercial fish stocks due to overexploitation and alteration of the habitat is one reason and the other is more and more species coming under purview of culture, why the science fish biology came into existence (Royce, 1972). It is a well known fact that the knowledge on fish biology particularly on morphometry, length-weight relationship, condition factor, reproduction, food and feeding habit, etc., is important in the utility of the knowledge in increasing the technological efficiencies of the fishery entrepreneurs for evolving judicious pisciculture management.

Fisheries sector plays a predominant role not only in terms of contributing to our food basket, but also acts as cheaper source of animal protein supporting to our rural health and as an employment and income generating sector for our national economy. Out of 6.13 mt of total fish production, the share of inland fisheries sector has been estimated at 53.8% (3.3 mt) during 2001-02. It reveals that the share of fisheries sector to gross domestic production (GDP) has been raised to 1.2% recently. The Inland fish production system includes capture fisheries of the

ivers, reservoirs, estuaries and culture fisheries from various forms of intensive aquaculture in ponds, lakes and floodplain wetland(Somashekar,2008)

## Materials and Methods

The data on fresh water fish biological studies in few lentic water bodies of Chikmagalur and Shivamogga districts of Karnataka is collected as worked out by different researchers in the study area based on published literature

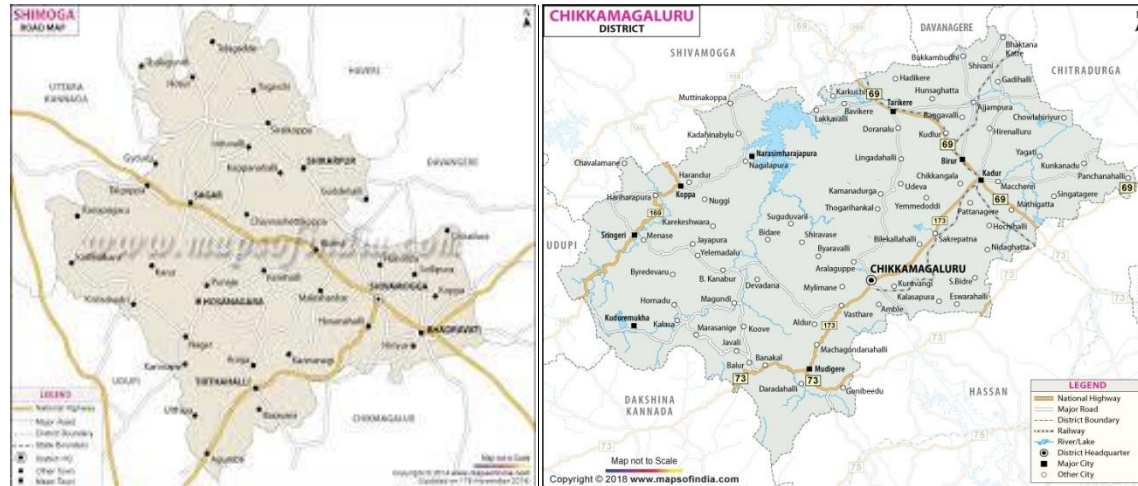


Figure 1: Study areas map (Source: www.mapsofindia.com)

## Results & Discussion

### Length-weight relationship and Food & Feeding habits

Harish Kumar et al (2006) worked on the length-weight relationship of cyprinid fish, *Rasbora daniconius* (Hamilton-Buchanan) from Sharavathi Reservoir, Karnataka. They reported that both the sexes exhibits allometric growth pattern.

Kiran et al (2006) worked on the length-weight relationship of fin fish, *Oreochromis mossambica* from Jannapura pond of Bhadravathi taluk, Karnataka. In male and female fishes “b” values ranged from 2.5225-2.5867 and 2.125-2.015 respectively. They reported that fishes exhibited allometric growth pattern in both the sexes.

Kiran ( 2015) worked on food and feeding habits and length-weight relationship of cyprinid fish, *Puntius sophore* (Hamilton-Buchanan) from Mudagodu tank of Karnataka.

Kiran and Puttaiah (2004) studied the food and feeding habits of *Salmostoma untrahi* from Bhadra Reservoir, India, during the period 1998-2000. It is observed that qualitatively, the food of males was similar to that of females but quantitatively there were some differences. The order of preference of the food items were: desmids, bluegreens, chlorococcales, diatoms and zooplankton. Desmids and bluegreens formed the major items of diet almost throughout the year. Desmids were dominant in size groups

of 111-115 mm, while, blue-greens, chlorococcales, diatoms, dinoflagellates and zooplankton were dominant in 91-95 mm, 76-80 mm, 96-100 mm, 106-110 mm and 96-100 mm respectively. Feeding intensity in relation to season as well as stages of maturity was studied in both sexes. Active feeding was observed during May and July in males and during January and December in females. Feeding intensity appears to be related to spawning activity, besides food abundance. The species of *S. untrahi* is a surface to column feeder.

Length-weight relationship and condition factor (K) of catfish, *Mysius cavasius* from Bhadra reservoir, Karnataka were studied by Venkateshwarlu et al (2007) on 200 fish specimens ranged from 11.7 cm to 22.6 cm in total length and 9.13 g to 76.9S g in weight, for I year from June 2004 to August 2005. The exponential value b significantly less than 3 (ideal isometric growth) indicating that the fish do not grow according to the isometric growth pattern. The coefficient correlation (r) was found to be 0.904 and 0.918 for male and female respectively which is positively significant. The higher values of K was observed during May, June and July reflecting the maturity of the fish. The length-weight relationship showed that the *M. cavasius* follow the allometric growth pattern.

Somashekar et al (2020) reported the length-weight relationship and Kn values of *Sperata aor* from Bhadra reservoir, Karnataka. The length-weight relationship of *S.aor* showed almost isometric growth pattern in adults whereas, fish do not follows cube law at young stages. The regression of weight on length between juveniles and adults and between males and females showed significant difference. These relations have been expressed separately for juveniles, females and males as :Juveniles:  $\text{Log W} = -0.9310 + 2.5384 \log L$  ;Males :  $\text{Log W} = -2.0481 + 2.8627 \log L$  ;Females:  $\text{Log W} = -2.4717 + 3.1947 \log L$  .The seasonal fluctuation in the Kn values of both the sexes could be attributed to the sexual cycle and intake of food and the relative condition cycle in *S. aor* is diphasic.

### **Age and Growth**

Kiran and Puttaiah (2005) studied the age and growth of *Salmostoma untrahi* from Bhadra reservoir region of Karnataka using length frequency analysis during July 1999 to June 2001. The growth increments were different between the sexes of *S. untrahi* and the growth rate decreased in both sexes with advancement of age. In general, 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.

### **Relative condition factor (Kn)**

The relative condition factor of cyprinid fish *Salmostoma untrahi* in Bhadra reservoir was studied by Kiran (2014). The total length and weight of both the sexes of fishes were recorded. The mean relative condition factor showed seasonal variation in both sexes. The mean relative

condition factor value was found to be highest in June & August for male and January & June for female during first year and highest in March for both the sexes during second year of study. The condition of the fish were coincided with the maturation stage of the fish.

Harish Kumar and Kiran (2016) studied the relative condition factor of feather back fish *Notopterus notopterus* (Pallas) in Jannapura pond, Karnataka. The fish specimens were collected during the period August 2002 to July 2003 and the total length and weight of both the sexes of fishes were recorded. The mean Kn showed seasonal variation in both sexes. The mean Kn value was found to be highest in April & lowest in December for both the sexes. The reduction in the Relative condition factor (Kn) during spawning phase may be because of the fish becoming exhausted due to spawning activity. The condition of the fish was coincide with the maturation cycle of the fish. The mean Kn values for different months and length groups indicated good conditions of the fishes.

### **Gonado-Somatic Index(GSI)**

Kiran (2015) 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 (I year- 0.3621 and 0.4913; II year-0.3832 and 0.6665) while, maximum of it was recorded in monsoon season for male and female respectively (I year- 1.0300 & 3.4691; II year-0.8939 and 3.6858). Hence, the *Salmostoma untrahi* has 3 active spawning seasons in a year

### **Sex ratio**

A total of 1432 specimens of *Chela untrahi* belonging to various size ranges were examined by Kiran et al (2003) for sexuality of fishes at backwaters of Bhadra reservoir. Dominance of male was noticed in most of the size groups. Significant chi-square values were obtained in fishes of size between 81 and 100 mm during 1998-99 and 81 and 115 mm for 1999-2000. The overall male:female ratio was found to be 1:0.5057 and predominance of male was noticed all through the year.

### **Reproductive Biology**

The reproductive biology of *Mystus cavasius* (Ham.) was studied by Ashashree et al (2011) in Bhadra Reservoir, Western Ghat, Karnataka, India. A total of 205 male fishes were collected and analysed by them. Gonadal maturation of the specimens was analyzed through macroscopic characteristics of the gonads. The peak of advanced maturation/ mature stages occurred from January to August and of spawned/ spent from August to December. The spawning of *M. cavasius* was identified as monsoon type.

Kiran and Puttaiah (2003) studied the fecundity of the cyprinid fish, *Chela untrahi* from Bhadra reservoir, Karnataka. The fecundity was found to ranged from 6729 to 26952 eggs, the average being 18130 eggs. Log linear relationships were noticed between fecundity and length-weight of

fish as well as gonad weight. They opined that the ovary weight was found to be a better index of fecundity than total length or total weight of the fish.

Ashashree (2007) studied length-weight relationship, condition factor, seasonal changes in the GSI, HSI, gonadal morphology, spawning, minimum size at spawning, seasonal histological changes and biochemical changes during the annual reproductive cycle in *Mystus cavasius*. The length-weight relationship indicates that the value of "b" was less than 3 and the fish do not showed isometric growth pattern. Morphology observation of the testes revealed that the testes was fringed type and situated in the posterior part of the body cavity ventral to the kidneys. There was a fare degree of correspondence between maturity stages, GSI values and histological events. The GSI values increased gradually and marked enhancement of the index occurred from April to July. The increase was almost linear and during September there was marked fall in GSI values and the index continued to be low during remaining period. Seasonal changes in the hepato somatic index of *Mystus cavasius* indicated that the liver underwent more or less parallel changes in weight throughout the year. The HSI and GSI values exhibited inverse relationship suggesting that the liver supports the spermatogenic activity.

Ashashree (2007) made an attempt to correlate the testicular activity with environment factors such as temperature, seasonal rainfall and photoperiod. It appeared that the increase in natural photoperiod probably triggered testicular growth and decrease in the day-length or photoperiod resulted in regress of testicular activity. The over all variation in the photoperiod in Bhadra reservoir area was only 1.8 hrs. Therefore, it appears that *Mystus cavasius* does not depend much on the micro level changes in the natural photoperiod for timing its annual reproductive cycle. Thus, in *Mystus cavasius* the spermatogenesis occurred during premonsoon and monsoon periods and the fish completely spawned towards the end of the monsoon season (September-October). However, Bhadra reservoir provide proper environmental conditions for the growth and reproductive activity of the fish, *Mystus cavasius*.

Jothi Srigowri (2007) investigated on aspects such as length weight relationship, condition factor, seasonal changes in the GSI, HSI, gonadal morphology, spawning, minimum size at spawning, seasonal histological changes and biochemical changes during the annual reproductive cycle of female fish *Mystus cavasius*. She made an attempt to correlate these cyclic activities with changes in environment factors such as temperature, rainfall and photoperiod. The length weight relationship indicates that the value of "b" was less than 3 and fish do not follow isometric growth pattern. Seasonal change in the GSI was found to be high prior to spawning and declined after spawning. Seasonal changes in HSI showed that the values of HIS was higher during the resting period and during maturing stages and lower values of HSI was noticed when the gonads are in ripened stage suggesting that the liver supports the vitellogenic activity. Morphological observation of the ovary revealed that the ovary was paired and sac like organs situated in the posterior part of the body cavity ventral to the kidneys. Seven stages of oocyte formation was noticed according to the nature of spawning, *Mystus cavasius* spawns only once during the breeding season. The fecundity of *Mysttis cavasius* was 14,200 to 64,500. In *Mystus cavasius* the rate of increase of fecimdity was much higher with the increase in weight of the

ovary, but lesser with the increase in length and weight of the fish. Seasonal variation in the biochemical composition such as glycogen, protein, lipid and cholesterol was studied in different tissues viz., liver, muscle, and ovary during different phases of the annual reproductive cycles. The muscle glycogen was found to be high during preparatory and pre-spawning phase and declined during spawning phase. The glycogen content of the liver was found to be high upto preparatory phase, where as the glycogen of the ovary was high in pre-spawning phase during the peak period of ovarian activity. The protein level of muscle and liver was high during the preparatory phase and in the ovary the peak period of ovarian activity. The lipid content of muscle and liver was high in preparatory phase, in the ovary its level was high during prespawning phase and during ripening of ovary. Cholesterol was high in muscle and liver during resting and preparatory phases where as in the ovary its level was high during prespawning stage. Histological studies of ovaries showed 8 oogenetic stages, the first three stages were recorded in the ovary through out the year while the later stages were observed only during the maturing and mature period.

JothiSrigowri (2007) reported the process of vitellogenesis in female fish *Mystus cavasiu* and it occurred from March to July during pre-spawning phase and the number of vitellogenic oocytes increased upto early July along with the subsequent increase in GSI values. The late vitellogenic oocytes were also distinguished by the presence of migratory nucleus oocytes during the month of July, indicating peak ovarian activity. Thus in *Mystus cavasius* oogenesis occurs during pre monsoon period and spawning occurs at the end of monsoon. In the present study the mechanism of ovarian cycle in relation to environmental factors shows photoperiod and temperature influences significantly on ovarian maturation. It was observed that spawning in freshwater fish, *Mystus cavasius* from the present area occurs during the months of August to September, Somashekar (2008) worked on the length-weight relationship, Relative Condition Factor, Gonado-Somatic Index (GSI), Hepato-Somatic Index (HSI), Food and Feeding Habits, Sex Ratio, Stages of Maturity, Fishery and production of *Aorichthys aor* of Bhadra reservoir. The length-weight relationship of *A. aor* showed almost isometric pattern growth in adults whereas fish do not follows cube law at its young stages. The regression of weight on length between juveniles and adults and between males and females showed significant difference. Food of the fish consisted chiefly of weed fishes followed by insects, prawns and molluscs. Juveniles of carps were rarely recorded in the gut and probably the fish is not inimical to carp fishing. Higher feeding activity in *A. aor* was observed during June to August. Fishes with empty stomachs were found in all months. Seasonal change in the GSI was found to be high prior to spawning and declined after spawning. Seasonal changes in HSI showed that the values of HSI was higher during the resting period and during maturing stages and lower values of HSI was noticed when the gonads are in ripened stage suggesting that the liver supports the vitellogenic activity. The fecundity of, *A. aor* was 27,600 to 98,200. In *A. aor* the rate of increase of fecundity is much higher with the increase in weight of the ovary, but lesser with the increase in length and weight of the fish. The sex ratio in this stock is significantly different from 1:1 ratio in all months. The data of sex ratio of *A. aor* showed that in all the months females dominated over males. *A. aor*

contributed an annual average forming 18.12%. Studies on fish catch in different sectors indicated variation in the distribution of species in time and space.

### **Biochemical composition**

Kiran (2018) studied the biochemical constituents of raw and dried up specimens of the freshwater fish *Salmophasia untrahi* from Bhadra reservoir. The dried fish showed maximum and minimum moisture, protein, fat/lipid, carbohydrate and ash contents during various seasons is attributed to variation in feed, water quality, gonad stage, spawning and breeding activity.

Ashashree et al. (2013) worked on the biochemical constituents of body of the freshwater fish *Mystus cavasius* were greatly influenced by the breeding activity. There was an increase in protein in testes during maturation was observed by them and it was related to simultaneous decrease in the liver and muscle. Although, in immature and preparatory stage, it was found to be the storage phase of protein in muscle and liver. Depletion of protein in muscle and liver and is transferred to testes during maturation has been found to be significant.

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**Table 1: Biology of Fresh water Fishes worked by various researchers in Shivamogga and Chikmagalur Districts of Karnataka**

Sl.No	Name of the fish	Field of Research	Habitat	References
1	<i>Rasbora daniconius</i>	Length-weight relationship	Sharavathi reservoir	Harish Kumar et al.(2006)
2	<i>Oreochromis mossambica</i>	Length-weight relationship	Jannapura pond	Kiran et al.(2006)
3	<i>Puntius sophore</i>	Length-weight relationship	Mudagodu tank	Kiran (2015)
4	<i>Salmostoma untrahi</i>	Food & feeding habits	Bhadra reservoir	Kiran & Puttaiah (2004)
5	<i>Salmostoma untrahi</i>	Age & Growth	Bhadra reservoir	Kiran & Puttaiah (2005)



6	<i>Salmostoma untrahi</i>	Relative condition factor	Bhadra reservoir	Kiran (2014)
7	<i>Mystus cavasius</i>	Length-Weight relationship & condition factor	Bhadra reservoir	Venkateshwarlu et al.(2007)
8	<i>Notopterus notopterus</i>	Relative condition factor	Jannapura pond	Harish Kumar & Kiran.(2006)
9	<i>Salmostoma untrahi</i>	Gonado Somatic Index	Bhadra reservoir	Kiran (2015)
10	<i>Chela untrahi</i>	Sex ratio	Bhadra reservoir	Kiran et al. (2003)
11	<i>Mystus cavasius</i>	Reproductive Biology	Bhadra reservoir	Ashashree et al.(2011)
12	<i>Mystus cavasius</i>	Biochemical constituents	Bhadra reservoir	Ashashree et al.(2013)
13	<i>Chela untrahi</i>	Fecundity	Bhadra reservoir	Kiran & Puttaiah (2003)
14	<i>Salmophasia untrahi</i>	Biochemical constituents	Bhadra reservoir	Kiran.(2018)
15	<i>Mystus cavasius (Male)</i>	Biology	Bhadra reservoir	Ashashree(2007)
16	<i>Mystus cavasius (Female)</i>	Biology	Bhadra reservoir	Jothi Srigowri (2007)
17	<i>Aorichthys aor</i>	Biology	Bhadra reservoir	Somashekar(2008)
18	<i>Sperata aor</i>	Length-Weight relationship & relative condition factor	Bhadra reservoir	Somashekar et al.(2020)