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RESEARCH ARTICLE

STUDIES ON THE REPRODUCTIVE BIOLOGY OF AN ENDANGERED COLDWATER FISH GOLDEN MAHSEER, *TOR PUTITORA* (HAM.) FROM ANJI MAHSEER HATCHERY REASI OF JAMMU REGION

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ABSTRACT

Fecundity and Gonadosomatic Index (GSI) of *Tor putitora* (Hamilton) collected from Anji Mahseer Hatchery, Reasi was calculated monthly for a period of six months from (March 2011 to August 2011). The observations related to fecundity and GSI are based on 30 female specimens of *Tor putitora* ranging from 260mm to 550mm in total fish length and weight ranging between 280 gm to 800 gm. The mean value of fecundity was estimated as 5566 eggs for a fish with a mean total body length of 395mm and mean body weight of 455gm. The relationship of fecundity with other parameters such as Total length (TL), Total weight (TW) and Ovary weight (OW) were found to be linear, whereas, the values of GSI were found to increase from March onwards and reaching its peak values during the months of June, July and August. The highest value for GSI was calculated as 10.812 in the month of August indicating the spawning period of *Tor putitora*.

INTRODUCTION

The Putitora mahseer or the yellow fin mahseer occurs all along the base of Himalayas including Kashmir, Pakistan and Bangladesh. The population of this fish has been declining because of over fishing, habitat loss, introduction of exotic species and human modifications to the environment. One of the aspects of the environmental degradation is the altered ecology and destruction of breeding and feeding grounds due to the river valley projects. In Kashmir valley mahseer was the major fish having a major socio- economic role. But in recent years it has come under threatened category of fish species and are now rare in catches with dangers posed by construction of series of dams, barrages/ weirs across the river in one hand and over exploitation on the other hand. There are fish species living in different ecosystems of the state, which are severely threatened on account of altered weather pattern and high degree of toxic pollutants filling the rivers of Jammu and Kashmir like Tawi in Jammu and Jhelum in Kashmir valley, which has ultimately dwindled their numbers and the livelihood of those who are dependent on their catches. The alarming trend of its decline forced the JandK state Fisheries department to establish an exclusive mahseer hatchery at Anji (Distt. Reasi), where successful breeding programme of this species is being taken up since 1999. In view of the above, studies on reproductive biology of golden mahseer was taken to have extensive study on its breeding to prevent its endangerment and enhance recovery of this specie.

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Study area

The study site was selected at Anji Mahseer Hatchery (Reasi) of Jammu and Kashmir state. It is spread over an area of 36 kanals. It consists of a water filtration plant, Hatchery unit, five large concrete rearing ponds and a well equipped laboratory. Source of water to Anji mahseer hatchery is from Anji stream which is an important tributary of river Chinab. The environmental conditions and water parameters for breeding of mahseer was reported to be conducive where high percentage of hatching success is achieved. It has now restocked mahseer fishes in streams and rivers of Jammu and even in river Jhelum Kashmir but unfortunately it could not survive in Jhelum but thrives well in Jammu. Mahseer thrives well in Anus, Anji, PoniTawi, Radh nallah etc in Jammu division. Artificial breeding as well as propagation of Mahseer is being carried out from Aug, 2011. The establishment of Anji Mahseer Hatchery is an essential effort of the State Fisheries Department for the conservation and rehabilitation of this group of fish.

MATERIAL AND METHODS

Samples of *Tor putitora* were collected from Anji mahseer hatchery monthly for a period of six months from (March, 2011 to August, 2011), by using the pond collection net. In the field the fish were preserved in an ice box and brought to the laboratory for further investigation, where they were washed in running tap water to remove mucous and other extraneous matter before studying. Sexual dimorphism was studied by observing external characteristics and the samples were analyzed for fecundity and gonadosomatic index (GSI).

Fecundity

Fecundity is the estimation of ova content in the ovary of a matured female specimen. The fish was dissected with the help of sterile blade and was exposed. The undisturbed mass of ovary was taken out in intact form. It was accurately weighed. Five different sections, each of 1 gm in weight was taken from the anterior, middle and posterior regions of ovary. Sections were weighed on electronic weighing device. Ova from these five small sections of ovary were separated by teasing and counted. As it was over, the individual number of these sections was added and made a sum total of it. Then the fecundity of the collected specimen was calculated.

$$F = \frac{W \times (n_1 + n_2 + n_3 + n_4 + n_5)}{(W_1 + W_2 + W_3 + W_4 + W_5)}$$

Where,
F = Fecundity
W = Total weight (g) of the ovary
$n_1 + n_2 + n_3 + n_4 + n_5$ =No. of ova in five sub samples of the ovary.
$W_1 + W_2 + W_3 + W_4 + W_5$ = weight of five sub samples of ovary in grams.

Gonadosomatic Index

A live ripe female specimen was collected. Its weight and total body length was accurately determined. It was dissected and finally the ripe ovaries were exposed and were taken out carefully in intact form. Weight of gonads was taken on the electronic weighing machine. Both the results were noted down. Ultimately GSI value of female specimen was calculated. GSI was calculated to know the maturity and to determine the breeding cycle of the fish. This was done as percentage of the gonad weight (GW) in terms of body weight (BW) of the fish.

$$GSI = \frac{\text{Weight of gonads}}{\text{Weight of fish}} \times 100$$

RESULTS

Sexual Dimorphism

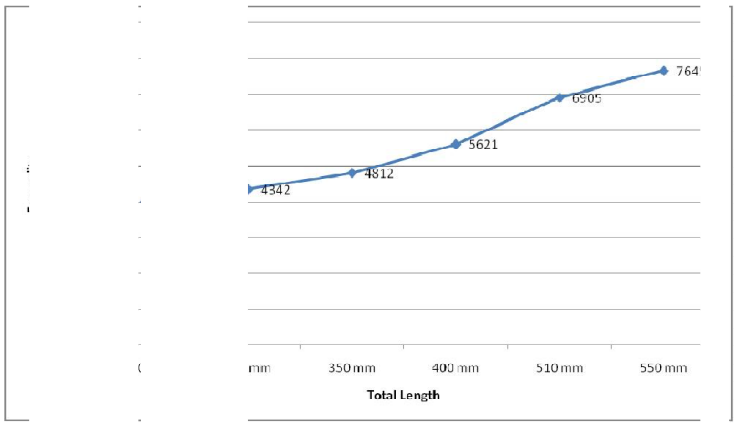
Secondary sexual characters in *Tor putitora* are quite pronounced during the spawning season. The male and female fishes can be easily distinguished by their shape, size and body colouration. Normally the males are bright in colour with elongated bodies as compared to the females having deep and dull coloured bodies with bright orange tinge on the anal fins. This differentiation is not always helpful to distinguish the sexes; however, it can be used with other diagnostic characters. The anal fin in the female fishes is opaque and shorter than pectoral fins. In the male fishes, the pectoral fins are rough and harder as compared to those in the females. Pathani (1978) observed that during breeding season a clear cut body streak starting from the tip of the snout and extending up to opercular bone on both the sides of the head appears in males. Tubercles are rarely seen in the male fishes. Most of the male fishes develop dark grey or black colouration on their bellies during the breeding season. The observations related to fecundity and Gonadosomatic index are based on 30 female specimens of *Tor putitora* ranging from 260mm to 550mm in total fish length and weight ranging between 280 to 800grams as shown in Table-1.The values given in the table are the mean values of five female specimens collected month wise. In the present study it was studied that the breeding season of *Tor putitora* in Anji mahseer hatchery was between July, August and september. As this fish breed several times during a year, the period between mid August to mid september is its peak spawning season in a year. The results from the present study reveals that the number of eggs varied from 4026 (for a fish with total length of 260mm and total weight of 280grams) to 7695 (for a fish with total length of 550mm and total weight of 800grams). The mean value of fecundity was estimated as 5566 eggs for a fish with a mean total body length of 395mm and mean body weight of 455grams. Gonadosomatic Index is widely used by biologists to indicate the maturity and periodicity of spawning and predicting the breeding season of a fish. Total 30 specimens of *Tor putitora* of size range between 260mm-550mm and weight ranged from 280 – 800 gm were used to calculate the Gonadosomatic as shown in Table -1. It was found that the values of gonadosomatic Index increase from March onwards reaching a peak in June. The peak was maintained in June, July and August. Highest value of GSI was found in the month of August i.e 10.812, which indicates spawning season of the fish. Average values of GSI are represented graphically in Fig 2. The values given in the graph are the mean of five female specimens collected month wise.

Table 1. Mean Fecundity & mean Gonadosomatic index (GSI) of five female specimens of *Tor putitora* collected monthly from March, 2011 to August, 2011

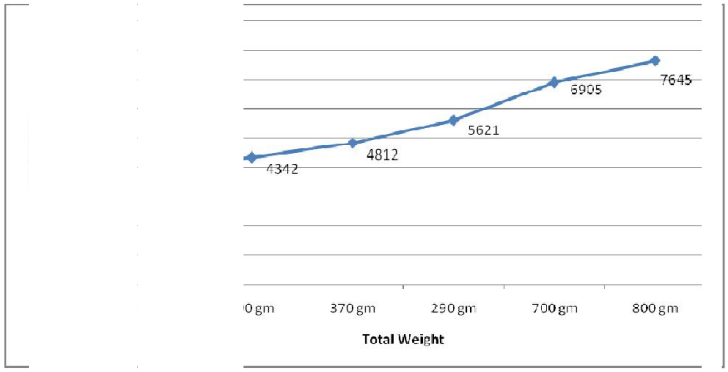
Month	Length of specimen (mm)	Wt. of specimen (g)	Total weight of ovary (g)	Fecundity	GSI
March,2011	550 mm	800	45	7645	5.625
April,2011	510 mm	700	42	6905	6.143
May,2011	400 mm	290	25	5621	8.612
June,2011	260mm	280	30	4026	10.714
July,2011	300 mm	290	30	4342	10.344
August,2011	350 mm	370	40	4812	10.812

DISCUSSION

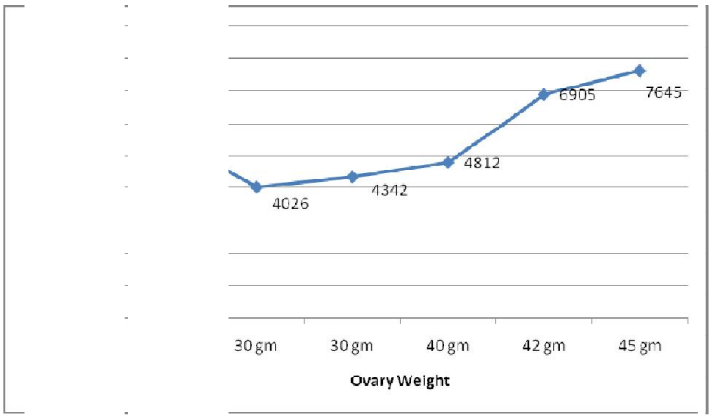
Variation in the fecundity among the fishes of same as well as different species is very common depending upon the various factors such as size of fish, age and condition of the fish and also depends upon the space and food intake by the fish. It was found that bigger sized fish have higher fecundity and smaller sized fish have low fecundity. In the present investigation the lowest fecundity was found in the specimen of mean length 260 mm and 280 grams mean weight while the highest fecundity was recorded from the fishes of mean length 550 mm and 800 grams of mean weight. Variation in the number of eggs was recorded from the fishes of same size also. It was concluded that fecundity of *Tor putitora* was significantly correlated with Total length (TL), Total weight (TW) and Ovary weight (OW) and the relationship of fecundity with the



(A)



(B)



(C)

Fig 1. Showing the relationship of Fecundity with (A) Total length of the fish (B) Total weight of the fish (C) Ovary weight

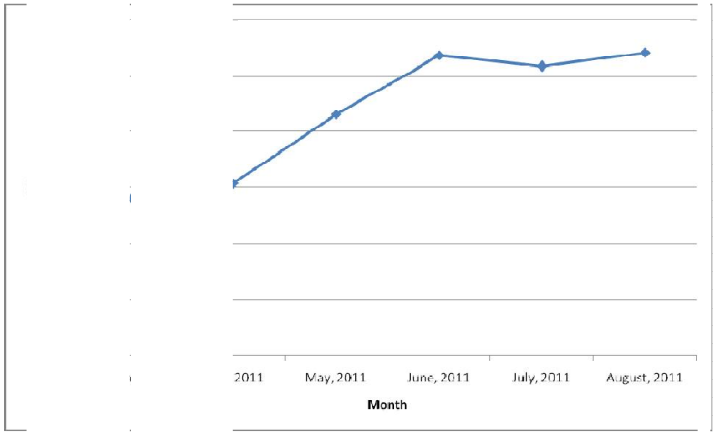


Fig 2. Gonadosomatic index of *Tor putitora* from Anji Mahseer Hatchery, Reasi. Each month represents the mean value of five specimen

above parameters is shown in Fig 1. The mean value of fecundity of *Tor putitora* was estimated as 5566 eggs for a fish with a mean total body length of 395mm and mean body weight of 455grams. Pathani (1981) also reported that fecundity of *Tor putitora* ranged between 7076-18525, in the size range 33.90-51.70 cm total fish length and it increased with the increase in size. According to Alam and Pathak (2010), the mean value of fecundity of *Labeo rohita* collected from Ramganga River was estimated as 66823.70 ± 4312.39 eggs with a mean total length of 183.06±5.60mm and total body weight of 315.64±16.59grams. During (1982-1987), the egg production of *Tor putitora* from the wild population of Bhimtal lake ranged 6250-113620 (average 2957) eggs per female (Joshi, 1987). The development of gonads can be represented by an index called Gonadosomatic index. The GSI is widely used by the biologists to indicate the maturity and periodicity of spawning and predicting the breeding season of the fish. The average values of GSI are represented graphically in Fig 2. From the figure it is evident that the values of GSI were found to increase steadily from March onwards reaching peak in August. Increase in GSI value indicates development of the gonads during March to August. The GSI of fishes increases with the maturation of the fish, being maximum during the peak period of the maturity. In the present investigation the value of GSI reached at the peak in the month of August. According to Mahapatra and Vinod (2005), GSI of ripe female of chocolate *Neolissocheilus hexagonolepis* (Mc Clelland) mahseer was 16.19 and the fecundity factor was 70.18. Pathani (1974) reported that GSI range from 2.02-9.90 in lotic water system of Kumaun region and concluded that spawning period lies between May and September and in lacustrine collection it ranged from 1.80 to 8.50. The value of GSI was low in resting period (December to February) and a bit high in early maturing phase (March to April). It was very high in mature phase (May to September) of the reproductive cycle of fish. Similar results were obtained from the present study also that the values of gonadosomatic Index increase from March onwards reaching a peak in June. The peak was maintained in June, July and August. Highest value of GSI was found in the month of August i.e 10.812, which indicates spawning season of the fish. Pathani (1983) reported the occurrence of spent females in October from Bhimtal Sandhu; et al (1990) observed that *Tor putitora* completes the spawning in August as individuals with immature eggs were collected in November and December. The fecundity of mature specimen ranging from 46.00-61.00cm in total fish length and weighing between 730 and 2100gm varied from 3270 to 24808 eggs. De Silva, et al (2004), calculated number of stripped eggs from two Tor species, which ranged from 30-2150/kg and 45-4460 eggs/kg from empurau and semah respectively.

Bhat and Pathak (1992) have recorded that the GSI increases from June to September for the putitora mahseer collected from Sarju (Kumaun). The monthly and seasonal fluctuations of GSI in relation of spawning season of the fish have also been recorded by Piska and Waghary (1986) and Dobriyal and Singh (1987). Alam and Pathak (2010) found in *Labeo rohita* that the value of GSI reached at the peak in the month of August, which indicated the spawning period of *Labeo rohita.* Similar results were observed during this study that highest value of GSI was found in the month of August i.e 10.812, which indicates spawning season of the fish.

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