

## **Study of Gonado-Somatic Index of Cyprinid Fish, *Salmostoma Untrahi* (Day) from Bhadra Reservoir, Karnataka**

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**Abstract:** *The Cyprinid fish Salmostoma untrahi (Day) from Bhadra reservoir near Narasimharaja pura of Chikmagalore district (Karnataka) was studied for a period two years from July 1998 to June 2000 to evaluate the Gonadosomatic index (GSI). 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). Based on GSI values the fish Salmostoma untrahi has three active spawning seasons in a year.*

**Keywords:** *Bhadra reservoir, GSI, Salmostoma untrahi, spawning.*

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### **1. INTRODUCTION**

The gonado-somatic index, abbreviated as GSI, is the calculation of the gonad mass as a proportion of the total body mass. It is represented by the formula:  $GSI = [Gonad\ Weight / Total\ Body\ Weight] \times 100$ . It is a tool for measuring the sexual maturity of animals in correlation to ovary development and testes development (en.wikipedia.org).

Gonadosomatic index and fecundity studies are useful for making total population estimates, population dynamics or productivity. While gonado-somatic index is the ratio of fish gonad weight to body weight. It measures reproductive strain of fishes by measuring general body weight ratios. It is one of the important parameter of fish biology, which gives the detail idea regarding the fish reproduction and reproductive status of the species particularly in indentifying seasons of spawning. The spawning potential and its success is determined by GSI and fecundity of a fish (Qasim, 1973; Chavan and Muley. 2014).

The present study was undertaken in order to determine the spawning season and to know reproductive biology based on gonado-somatic index values.

### **2. MATERIALS AND METHODS**

#### **2.1. Material**

In the present study, the samples of *Salmostoma untrahi* were obtained from backwaters of Bhadra reservoir at Narasimharajapura near Kalgudda, Chikamagalore district (Karnataka). Random samples were taken for biological analysis of the *Salmostoma untrahi*. A total of 1432 of *Salmostoma untrahi* were examined, of which 951 were males and 481 were females. The size (total length) range of species varied between 71 mm and 135 mm. The period of study was from July 1998 to June 2000. Samples were collected once in a month. The gears used commonly for the capture were Gill nets of size 16 mm.

The total length was recorded to the nearest of 0.1 mm using a fish measuring board. The individual weight of the fish was noted using electronic balance and corrected to the nearest 0.01gm. The gonads removed were preserved in 5% formaldehyde for further analysis.

#### **2.2. Gonado-Somatic index (GSI)**

The weight of the individual fish was noted and the male and female fish gonads were removed carefully and weighed in a electronic balance after removing the excess of moisture using a blotting paper. The method of June (1953) and Yuen (1955) was employed to calculate the percentage gonad weight or gonado-somatic index by using the formula, gonado-somatic index

$GSI = \text{Weight of Gonad} / \text{Weight of Fish} \times 100$

The average values of GSI were plotted against months for males and females separately.

### 3. RESULTS AND DISCUSSION

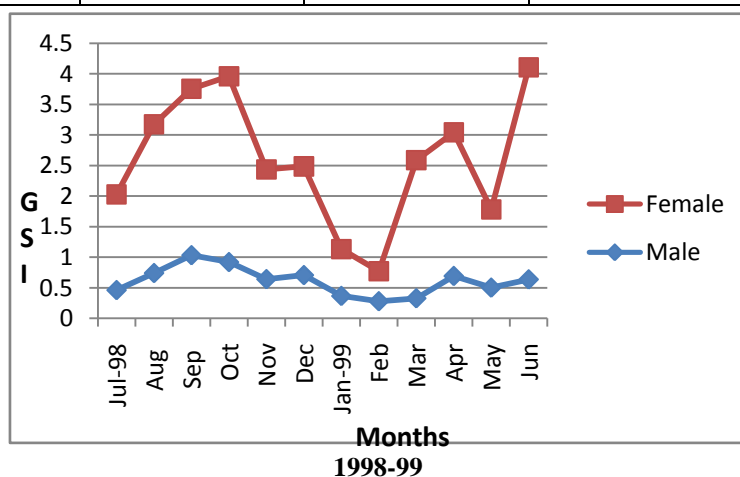
The percentage gonad weight in total weight, also termed as the gonado-somatic index (GSI), was calculated for each month. The results are tabulated in Table 1 & 2. On plotting the average relative gonad weight against months (**Fig.1**), resulted in a monthly change in gonado-somatic index of males and females. During 1998-99, in males, the value of GSI showed a moderate level in July 1998 (0.4579), and in next two months August and September it increased to 0.7374 and 1.0300. From October the value of GSI showed alternate increase and decrease in the months of October 1998, November, December and January 1999. Subsequently, the value of GSI was found to be 0.2751 in February 1999 and again increase in March and April and further decreased in May (0.4980) and later increased in June (0.6336). The highest value of GSI was found in the month of September 1998 (1.0300) and the lowest in February 1999 (0.2751).

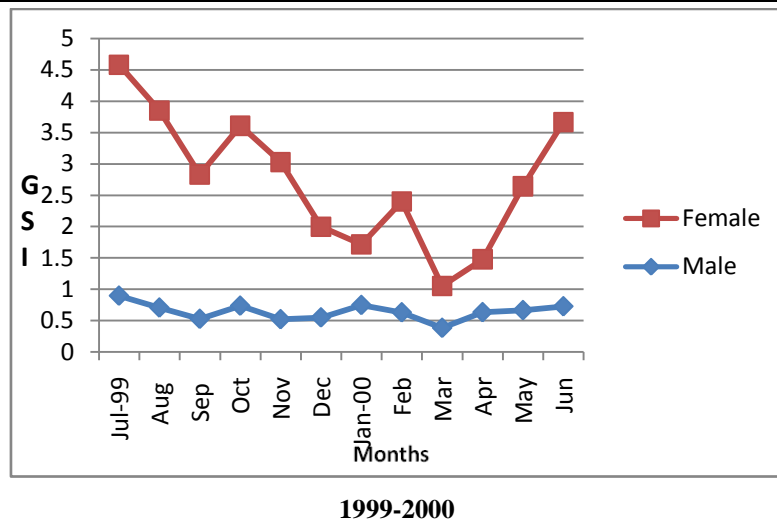
**Table1.** Monthly variations in Gonado – somatic index (GSI) of *Salmostoma untrahi* - July 1998 to June 1999

MONTHS	MALE		FEMALE	
	Number of fishes	GSI	Number of fishes	GSI
JUL 1998	18	0.4579	19	1.5660
AUG	31	0.7374	29	2.4328
SEP	30	1.0300	30	2.7227
OCT	37	0.9173	23	3.0392
NOV	59	0.6375	14	1.7940
DEC	42	0.7038	27	1.7783
JAN 1999	45	0.3621	15	0.7663
FEB	45	0.2751	15	0.4913
MAR	47	0.3241	13	2.2604
APR	48	0.6895	12	2.3520
MAY	34	0.4980	16	1.2772
JUN	43	0.6336	27	3.4691

**Table2.** Monthly variations in Gonado-somatic index (GSI) of *Salmostoma untrahi* - July 1999 to June 2000

MONTHS	MALE		FEMALE	
	Number of fishes	GSI	Number of fishes	GSI
JUL 99	16	0.8939	44	3.6858
AUG	30	0.7048	30	3.1441
SEP	48	0.5259	12	2.3041
OCT	14	0.7350	46	2.8717
NOV	29	0.5200	11	2.5058
DEC	53	0.5487	7	1.4459
JAN 2000	43	0.7462	5	0.9666
FEB	39	0.6298	15	1.7669
MAR	45	0.3832	8	0.6665
APR	54	0.6321	11	0.8435
MAY	45	0.6641	11	1.9774
JUN	56	0.7253	41	2.9396





**Fig1.** Monthly variations in gonado –somatic index of *Salmostoma untrahi*

In females, the value of GSI increased progressively from July to October 1998. In November the value of GSI was gradually decreased (Table 1) till February 1999 and further increased in March (2.2604) and April (2.3520) and again decreased in May and reached the maximum in June 1999 (3.4691). The lowest GSI value was found in February 1999 (0.4913).

Similarly, during 1999-2000, in males the value of GSI showed 0.8939 in July 1999 and thereafter the values showed alternate increase and decrease in the months of August, September, October and November 1999 (Fig. 1) and again gradually increased to 0.5487 and 0.7462 during December 1999 and January 2000 and further decreased in February and March 2000. Subsequently the value of GSI gradually increased from April to June 2000. However, highest value was observed in the month of July 1999 (0.8939) and the lowest in March 2000 (0.3832).

In females, the value of GSI decreased progressively from July to September 1999 and again increased in October (2.8717) and further decreased from November 1999 to January 2000. In February 2000 it increased to 1.7669 and again decreased in March, thereafter showing increased trend in the month of April, May and June 2000. The peak value of GSI was found in the month of July 1999 (3.6858) and the lowest in March 2000 (0.6665).

From the above observations, it is quite evident that the highest value of GSI were obtained in September 1998 (1.0300) and July 1999 (0.8939) for males and June (3.4691) and July 1999 (3.6858) for females during the study period. Here, the highest value of GSI indicates the peak occurrence of mature individuals of *Salmostoma untrahi*. Recently, peak values of GSI in female *Silonia childreni* were recorded by Vinci (1984) and highest values of GSI in female *Barilius barana* were recorded during June and July by Dobriyal *et al.* (2000). Johal *et al.* (2000) recorded the highest values of GSI in female *Cyprinus carpio* during June coinciding with the peak breeding season from Gobindsagar (Himachal Pradesh) reservoir. Ashwini G. Ghanbahadur and Girish R. Ghanbahadur (2012) reported that active spawning takes place from July to August and January to March in cyprinid fish *Cyprinus carpio* which are similar to observations recorded in *Ethmalosa dorsalis* (Salzen, 1958; Brewer *et al.*, 2008).

The seasonal factors greatly influence the maturation of ovary resulting in the successive changes in the gonads and body weights (Lincoln *et al.*, 1980; Sunita Kapil *et al.*, 2011). Gonadal development and maturation observed in major carp *Labio rohita* was influenced positively by increasing day length and temperature (Kumar *et al.*, 2003; Singh *et al.*, 2005). In the present study, it is concluded that the gonado-somatic index of gonads of cyprinid fish *Salmostoma untrahi* increased at rainy season whereas lowest GSI in winter and intermediate status in summer season

Sivakami (1982) recorded peak values of GSI during February, June and November, also coinciding with occurrence of increased percentage of the mature females during these months, thereby suggesting that the breeding is more intense during these months in *Puntius dorsalis*. However, Bhimasena Rao and Karamchandani (1986) opined that low values of GSI in *Ompok bimaculatus* suggesting the ovaries to be in resting and maturing stages and higher values of GSI indicating the

ovaries to be in maturing, mature and ripe stages. Bhat and Pathak (1992) have recorded that the GSI increases from June to September for the *Putitora* mahseer collected from Sarju (Kumaun) which may be due to small sized mahseer (Immature) collection only from limited sites of Sarju. The monthly and seasonal fluctuations of GSI in relation to spawning season of the fish have also been recorded by Piska and Waghary (1986) and Dobriyal and Singh (1987). The gonado-somatic index studies have given important indications on the spawning of *Salmostoma untrahi*. The pattern of fluctuations in the gonado-somatic index are identical in both female and male fish. The highest values of gonado-somatic index for females are seen in the months of October, April and June during 1998-99. Similarly, higher gonado-somatic index peaks were seen at July, October, February and June during 1999-2000. This indicates that *Salmostoma untrahi* has three active spawning seasons in a year.

In *Barbus* (Tor) *Putitora*, Qasim and Qayyum (1961) observed several batches of eggs maturing simultaneously and that the species spawns several times during a prolonged breeding period. *Salmostoma untrahi* can be included in category IV of Qasim and Qayyum (1961) with respect to its spawning periodicity.

#### **4. CONCLUSION**

Gonado-somatic index (GSI) has been considered as estimate for gonadal maturity and spawning of fish. Its abrupt decrease indicates beginning of spawning. The GSI increased with the maturation of fish and reaches maximum at the peak period of maturity. The present investigation, concluded that the gonado-somatic index of freshwater fish *Salmostoma untrahi* increased at rainy months whereas lowest rates in winter season.

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#### **REFERENCES**

- [1] Ashwini G. Ghanbahadur and Girish R. Ghanbahadur .2012. Study of Gonadosomatic index of fresh water fish *Cyprinus carpio*. Trends in Fisheries Research Vol 1(1):32-33.
- [2] Bhat, S.D. and Pathak, J.K. 1992. *Himalayan Environment*. Shree Almora Book Depot. Almora.
- [3] Bhimasena Rao, J. and Karamchandani, S.J. 1986. On the spawning Biology of *Ompok bimaculatus* (Bloch) from Kulgarhi reservoir of Madhya Pradesh. *J. Inland Fish. Soc. India* 18 (2): 40-47.
- [4] Brewer S. K., Rabeni C. F. and Papoulias D. M. (2008). Comparing histology and gonadosomatic index for determining spawning condition of small-bodied riverine fishes. *Ecol. Freshwater Fish.* 17(1): 54-58.
- [5] Chavan V.R. and D. V. Muley. 2014. Study of Gonadosomatic index and Fecundity of fish *Cirrhinus mrigala* (Hamilton) .The Bioscan 9(1): 167-169, 2014
- [6] Dobriyal, A. K., Neeraj Kumar, Bahuguna, A. K. and Singh, H. R. 2000. Breeding ecology of some cold water minor carps from Garhwal Himalayas. In: *Cold water Aquaculture and Fisheries*. (Ed. Singh, H.R. and Lakra, W.S.). Narendra publishing house, Delhi: 177-186.
- [7] Dobriyal, A.K. and Singh, H.R. 1987. The reproductive biology of a hillstream minor carp *Barilius bendelisis* from Garhwal Himalaya, India. *Vest cs. Spolec. Zool.*, 51: 1-10.
- [8] Johal, M.S., Tandon, K.K. and Sandhu, G.S. 2000. Maturity, Fecundity and Sex ratio of an endangered cold water fish, Golden mahseer, *Tor putitora* (Ham.) from Gobindsagar. (H.P.), India. In: *Coldwater Aquaculture and Fisheries*. (Ed. Singh, H.R. and Lakra, W.S.). Narendra publishing house, Delhi: 265-278.
- [9] Johal, M.S., Tandon, K.K. and Sharma, V.K. 2000. Reproductive biology of the common carp, *Cyprinus carpio* Var. *Communis* Linn. From Gobindsagar, Himachal Pradesh (India). In: *Coldwater Aquaculture and Fisheries*. (Ed. Singh, H.R. and Lakra, W.S.). Narendra publishing house, Delhi: 169-176.
- [10] June, F.C. 1953. Spawning of yellow fin tuna in Hawain waters. *U.S. Fish. Wildl Serv. Fish. Bull.*, 54 : 47-64.

- [11] Kumar, A., Singh, I. J. and Ram, R. N. 2003. Annual reproductive cycle of male rohu, *Labio rohita* (Ham) In Tarai region Uttaranchal. *Indian J. Fish.* 50: 231-241.
- [12] Lincoln, G. A., Racey, P. A., Share, P. J. and Kland, H. 1980. Endocrine changes associated with spring And Autumn sexually of rook. *Corvus frugilegus* J. 2001. 190: 137-153.
- [13] Piska, S.P. and Waghary, S. 1986. A note on fecundity of *Amblypharyngoden mola* (Ham.). *J. Indian Inst. Sci.*, 66: 85-88.
- [14] Qasim, S.Z. and Qayyum, A. 1961. Spawning frequencies, and breeding seasons of some freshwater fishes with special reference to those occurring in the plains of northern India. *Indian J. Fish.*, 8(1): 25-43.
- [15] Quasim, S. Z.1973. An appraisal of the studies on maturation and spawning in marine teleosts from the Indian waters. *Indian Journal of Fisheries* 20(1):166-181.
- [16] Salzen E.A. (1958). Observations on the biology of the West African shad., *Ethmalosa dorsalis*. *Bull. Inst. Fr. Afr. Noire.* 20:1388-1426.
- [17] Singh, A. K., Kumar, A., Singh, I. J. and Ram, R. M. 2005. Seasonal ovarian cycle in Freshwater teleosts *Labio rohita* (Ham) in Tarai region of Uttaranchal. *J. Environ. Biol.* 26(3): 557-565.
- [18] Sivakami, S. 1982. On the biology of *Ompok bimaculatus* (Bloch) from Bhavanisagar reservoir (Tamil Nadu). *Geobios Reports* 1: 111-119.
- [19] Sivakami, S. 1982. Studies on some biological aspects of *Puntius dorsalis* (Jerdon) from Bhavanisagar reservoir (Tamil Nadu). *J. Inland Fish. Soc. India* 14(2): 61-72.
- [20] Sunita Kapil, K. M. Kulkarni, S. S. Gijare and V. T. Tantarapale. 2011. Seasonal changes of gonadosomatic index observed in the freshwater fish *Channa punctatus*. *The Bioscan* 6(4) : 571-573, 2011:
- [21] Vinci, G.K. 1984. Some aspects of the biology of *Silonia childreni* (Sykes) from Nagarjunasagar reservoir, Andhra Pradesh, India. *J. Inland Fish. Soc. India* 16 (1 &2): 25-31.
- [22] Yuen, H.S.H. 1955. Maturity and fecundity of big eye tuna in the pacific. *Spec. Sci. Rep. U.S. Fish Wildl. Serv.*, 150: 30.
- [23] [https://en.wikipedia.org/wiki/Gonadosomatic\\_Index](https://en.wikipedia.org/wiki/Gonadosomatic_Index)