



### RESEARCH ARTICLE

#### COMPARATIVE STUDY OF GONADOSOMATIC INDEX (GSI) OF CAPTIVE REARED AND WILD BROODSTOCK OF *SCHIZOTHORAX RICHARDSONII* (GRAY, 1832).

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#### Abstract

An attempt was made to assess the gonadosomatic index (GSI) of an indigenous coldwater fish *Schizothorax richardsonii* commonly known as "Asela" in Uttarakhand is one of the most important sports fishery in the state. The fish inhabits in streams and rivers of Himalayan and Sub-Himalayan regions. The gonadosomatic index of both captive reared and wild stocks of both Female and Male *Schizothorax richardsonii* was calculated which ranges from 5.72% to 12.91% and 1.80% to 7.24% in captive reared Female and Male fish respectively. While in wild brooders ranges from 5.33% to 14.10% and 1.52% to 6.74% in Female and Male respectively. Gonadosomatic index will be helpful thus, gives an idea about maturity level in fishes as well as estimation of breeding season.

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#### Introduction:-

Fecundity of fish is one of the most important components of fishery biology as it has direct bearing on fish production, stock recruitment and stock management. For the production of healthy fish seeds normal gonadal development is very much essential. Gonads development can be assessed by taking weight of gonads obtained from fish is expressed as gonadosomatic index (GSI). Saksena (1987) has suggested the use of GSI and volume of the gonad as indicators of gonadal state. GSI will be helpful thus, gives an idea about maturity level in fishes as well as estimation of breeding season. The spawning potential and its success are determined by GSI and fecundity of a fish (Qasim, 1973; Chavan and Muley, 2014). The fecundity and GSI have been studied in different fish species like *Mystus gulio* (Sarker, et al., 2002), *Anabas testudineus* (Marimuthu, 2009) and *Labeo rohita* (Alam and Pathak, 2010). Monthly variations in GSI provide the reasonable indicator of reproductive seasonality of fish. The seasonal timing of reproduction, spawning time is often identified from changes in the GSI which determines the reproductive season of the fish (Arruda et al., 1993).

*Schizothorax richardsonii* (Gray, 1832) is one of the dominant genera in Schizothoracinae group commonly known as 'Asela' in Uttarakhand and is one of the important sports fishery in the state. The fish inhabits in streams and rivers of Himalayan and Sub-Himalayan regions. In the past, it is reported that the population of this species in this region has declined significantly (Das and Joshi, 1993; Sharma, 1989; Sehgal, 1999). Decline in Asela stocks in uplands could be ascribed to overfishing, destructive fishing and increased human pressure and the recent trends over the last 5 to 10 years indicate drastic declines in many areas of its range and the species is now categorized under vulnerable category (Vishwanath, 2010). Therefore, to uplift the status of the fish as a candidate species in hill

regions it is important to know the reproductive status of the fish by knowing the GSI of the species. Thus, the present investigation gives the comparison of GSI of wild and farm reared *Schizothorax richardsonii*.

### Material and Methods:-

The experiment was conducted at Directorate of coldwater fisheries research (DCFR), Bhimtal, Uttarakhand, India situated at a (Latitude 29°21' N, Longitude 79°34' E, altitude 1370m MSL). A total of 80 numbers of Female and male wild *Schizothorax richardsonii* weighing from 140 to 260 gm and length 110 to 290 mm, 40 to 97 gm and 156 to 350 mm respectively were collected from Kosi river Ramnagar, Uttarakhand (29° 29.038' N latitude, 79.08777' E longitude and altitude 410 m MSL) from May 2017 to December 2017. Fish stocks were fed with formulated feed @ 2-3% of body weight until the start of the experiment while farmed reared female and male fish weighing from 145 to 252 gm and length 120 to 285 mm, 45 to 90 gm and length 150 to 350 mm respectively were procured from Directorate of coldwater fisheries research (DCFR), Bhimtal, Uttarakhand. Ovaries and testes were taken out from female and male fishes respectively for the estimation of gonadosomatic index. GSI was calculated by using following formula.

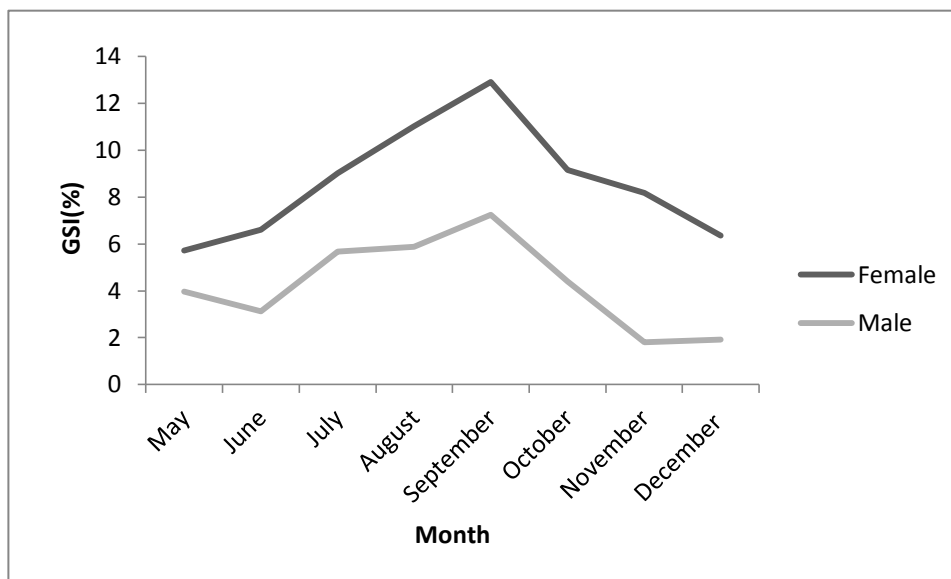
$$\text{GSI (\%)} = \frac{\text{Weight of gonad (g)}}{\text{Weight of the fish (g)}} \times 100$$

**Table 1:-**Gonadosomatic index (GSI) of captive reared brooders of *Schizothorax richardsonii*

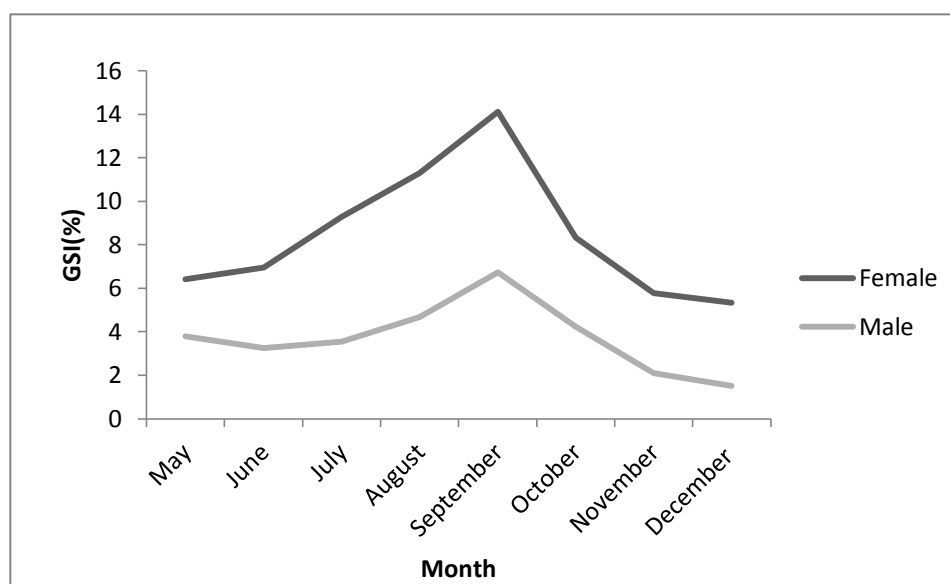
S.no	Month	Female fish		GSI (%)	Male fish		GSI (%)
		Body weight (gm)	Gonad weight(gm)		Body weight (gm)	Gonad weight (gm)	
1.	May	176.5	10.11	5.72	70.6	2.80	3.96
2.	June	186.3	12.32	6.61	77.8	4.43	3.12
3.	July	192.6	17.34	9.01	82.1	4.67	5.68
4.	August	198.7	21.89	11.01	90.4	5.32	5.88
5.	September	252.8	32.65	12.91	45.8	3.32	7.24
6.	October	213.5	19.54	9.15	58.7	2.59	4.41
7.	November	166.4	13.62	8.18	60.5	1.09	1.80
8.	December	145.6	9.27	6.36	65.2	1.26	1.93

**Table2:-**Gonadosomatic index (GSI) of wild brooders of *Schizothorax richardsonii*

S.no	Month	Female fish		GSI (%)	Male fish		GSI (%)
		Body weight (gm)	Gonad weight(gm)		Body weight (gm)	Gonad weight (gm)	
1.	May	192.4	12.35	6.41	72.98	2.76	3.78
2.	June	206.5	14.39	6.96	76.43	2.49	3.25
3.	July	218.8	20.31	9.28	90.3	3.21	3.55
4.	August	220.5	24.90	11.29	96.9	4.53	4.67
5.	September	262.8	37.08	14.10	47.6	3.21	6.74
6.	October	234.9	19.56	8.32	54.7	2.32	4.24
7.	November	188.4	10.89	5.78	62.3	1.31	2.10
8.	December	179.3	9.56	5.33	70.6	1.08	1.52



**Fig.1:-**GSI value of captive reared Female and Male *Schizothorax richardsonii*



**Fig 2:-** GSI value of wild collected Female and Male *Schizothorax richardsonii*

### Result and Discussion:-

Understanding reproductive behavior of fishes is not only important for elucidating the basic biology of the fishes but it can also help in their management and conservation. The present study of gonadosomatic index (GSI) for brooders of *Schizothorax richardsonii* both female and male procured from farm and wild is given in tables 1 and 2. The GSI value of farm reared *Schizothorax richardsonii* female were ranging from 5.72% to 12.91%. The GSI value was in peak in the month of September (12.91%) while a decrease value was observed in the month of May i.e. (5.72%). In Male, the GSI value was found in the range of 1.80% to 7.24% maximum GSI was found in the month of September i.e. 7.24% while minimum was observed in the month of May which suggest that these are maturing and spawning phases of the fish.

In comparison to farm reared *Schizothorax richardsonii* the GSI values of female fishes collected from wild ranges from 5.33% to 14.10%. The maximum GSI was found in the month of September with a value of 14.10% which

indicate maximum gonadal growth and minimum value of 5.33% in the month of December. While, in male brooders the GSI value was recorded in the range of 1.52% to 6.74%. The maximum GSI was observed in the month of September with a value of 6.74% and minimum value of 1.52% in the month of December.

GSI is an indicator of fish spawning in temperate and tropical region. Its value increases with the maturation of the fish and become maximum during peak of maturity and decreases abruptly and sharply when the fish becomes spent and females generally exhibit comparatively higher GSI than males (Khan, 1945; Ganpatti and Chako, 1954; Pathak and Jhingran, 1977; Piska and Devi, 1993). Our findings of GSI value was almost similar with the findings of (Joshi *et.al.*, 2016), who reported maximum and minimum GSI value in the month of September (14.65) and April (0.13) respectively in *schizothorax richardsonii*. According to (Khanna, 2003) GSI can not only be used to predict the breeding season but also indicate the maturity status and periodicity of spawning of a fish. (Sunder, 1984) reported similar observation in *Schizothorax longipinnis* as the GSI was lowest in July and started increasing till September. In this view, the study may serve as a baseline data for the vulnerable *S. richardsonii* in this region and the information on the important aspects of conservation biology will be useful for managing this species in its distributional range.

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### Reference:-

1. Alam, M. and Pathak, J.K. 2010. Assessment of fecundity and gonadosomatic index of commercially important fish, *Labeo rohita* from Ramganga river. *Internat. J. Pharma Bio. Sci.* **1**(3):1-6.
2. Arruda, L.M., Azevedo, I. N., Neto, A.I. 1993. Abundance, age structure and growth and reproduction of *Gobies* in the Riade Averio Lagoon (Portugal) Estuar coast and Shelf Sci. **37**:509-523.
3. Chavan, V.R and Muley, D.V. 2014. Study of gonadosomatic index and fecundity of fish *Cirrhinus mrigala* (Ham.). *The Bioscan.* **9** (1):167-169.
4. Das, P and Joshi, K.D. 1993. Why sustainable fish harvesting? *Intensive Agricult.* **31**: 18-22.
5. Ganpatti, S.V and Chako, P.J. 1954. Some observations on the spawning of Indian carps in the 'Bundhs' of Bengal. *Indian Geospatial Journal*, **27**:1-17.
6. Joshi, K.D., Das, S.C.S., Khan, A.U., Pathak, R.K and Sarkar, U.K. 2016. Reproductive biology of snow trout, *Schizothorax richardsonii* (Gray, 1832) in a tributary of River Alaknanda, India and their conservation Implications. *Internat. J. Zool Inves.* **2**(1):109-114.
7. Khan, H. 1945. Observation on the spawning behavior of carp in Punjab. *Proceedings of National Institute of Science of India*, **11**:315-320.
8. Khanna, S.S. (2003). Reproduction and development, In: An introduction to fishes. Central book depot, Allahabad, India, pp 280-283.
9. Marimuthu, K., Arumugam, J., Sandragasan, D. and Jegathambigai, R. 2009. Studies on the fecundity of native fish climbing perch, (*Anabas testidineus* Bloch) in Malaysia. *Am. Eurasian. J. Sustain. Agric.* **3**(3): 266-274.
10. Mishra, S. and Saksena, D.N. 2012. Gonadosomatic index and fecundity of an Indian Major carp *Labeo calbasu* In Gohad Reservoir. *The bioscan* **7**(1): 43-46
11. Pathak, S.C and Jhingran, A.G. 1977. Maturity and fecundity of *Labeo calbasu* (Hamilton) of Loni reservoir. *Madhya Pradesh Journal Inland Fish. Soc.*, **9**:72-83.
12. Piska, R.S and Devi, R. 1993. An account of fecundity in the freshwater catfish *Heteropneustes fossilis* (Bloch) of lower Manair reservoir, Karimnagar. *Biojournal*, **5**:127-129.
13. Qasim, 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.
14. Saksena, D.N. 1987. On the use of gonadosomatic index and volume of the gonad as indicators of gonadal state in Indian fresh water goby, *Glossogobius giurinus* (Ham.) with a note on the role of temperature in fish reproduction. *Intl. J. Ichthyol.* **8** (1):1-8.
15. Sarker, P.K., Pal, H.K., Rahman, M.M and Rahman, M.M. 2002. Observation on the fecundity and gonadosomatic index of *Mystus gulio* in brackishwaters of Bangladesh. *Online journal of biological sciences*, **2**(4):235-237.
16. Sehgal, K.L. 1999. Coldwater fish and fisheries in the Indian Himalayas; Culture. FAO Fisheries Tech. Paper, No.385. FAD, Rome: 89-102.

17. Sharma , B.P. 1989. Status of *Schizothorax* sp. in the Indian-Chinese sub continent, FAO Fisheries Report. No.405 (Suppl.) Rome, FAO: 90-94.
18. Sunder,S.1984. Studies on the maturation and spawning of *Schizothorax curvifrons* Heckel from River Jhelum, Kashmir. *J. Indian InstituteSci*, **65**:41-51.
19. Vishwanath, W. 2010. *Schizothorax richardsonii*. The IUCN Red List of Threatened Species 2010: e. T166525A6228314. Downloaded on 20<sup>th</sup> June 2016.