



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2023; 11(1): 47-51

© 2023 JEZS

Received: 23-10-2022

Accepted: 27-11-2022

Nusrat Waheed

Department of Zoology, School
of Agricultural and Natural
Sciences, CT University,
Ludhiana, Punjab, India

Reetu Bhanot

Department of Zoology, School
of Agricultural and Natural
Sciences, CT University,
Ludhiana, Punjab, India

Romisa Gull

Department of Industrial Fish
and Fisheries, Government
Degree College Boys Baramulla,
Jammu and Kashmir UT, India

Gonadosomatic index (GSI) fluctuations of *Cyprinus carpio communis* and *Carassius carassius* at different sites of Dal Lake Kashmir UT India

Nusrat Waheed, Reetu Bhanot and Romisa Gull

DOI: <https://doi.org/10.22271/j.ento.2023.v11.i1a.9149>

Abstract

The aim of the current study was to examine the gonadosomatic index fluctuations of *Cyprinus carpio communis* and *Carassius carassius* at different sites of dal lake Kashmir. The monthly fluctuations in gonadosomatic index in *Cyprinus carpio communis* ranged from a minimum of 2.49 ± 0.14 - 2.52 ± 0.10 in male in June and 3.30 ± 0.17 - 3.30 ± 0.17 in female in July and from a maximum of 9.84 ± 0.51 - 9.94 ± 0.46 in male and 15.29 ± 0.04 - 15.52 ± 0.06 in female in May. Seasonal fluctuations in gonadosomatic index in *Cyprinus carpio communis* ranged from a minimum of 3.56 ± 0.70 - 3.85 ± 0.85 in male and 3.84 ± 0.37 - 3.96 ± 0.41 in female in summer and from a maximum of 8.22 ± 0.96 - 8.93 ± 0.50 in male and 13.44 ± 0.62 - 13.61 ± 1.07 in female in spring. The monthly fluctuations in gonadosomatic index in *Carassius carassius* ranged from a minimum of 3.83 ± 0.30 - 3.91 ± 0.34 in male in October and 11.60 ± 0.48 - 11.89 ± 0.37 in female in April and from a maximum of 9.84 ± 0.51 - 15.29 ± 0.04 in male and 9.94 ± 0.46 - 15.52 ± 0.04 in female in April. Seasonal fluctuations in gonadosomatic index in *Carassius carassius* ranged from a minimum of 4.80 ± 0.31 - 4.98 ± 0.60 in male and 5.67 ± 1.14 - 5.85 ± 1.22 in female in winter and from a maximum of 8.70 ± 1.83 - 8.80 ± 1.89 in male and 8.90 ± 1.59 - 9.22 ± 1.62 in female in spring. The Gonadosomatic Index in both the species revealed a significant variation between sites, months, and seasons of Dal Lake.

Keywords: GSI, fluctuations, *Cyprinus carpio communis*, *Carassius carassius*, Dal lake

Introduction

The Communal carp (*Cyprinus carpio*) is one of the most prevalent freshwater fish species in the world (Vilizzi, 2018) [16]. Since its introduction to Kashmir in 1956, the common carp has displayed amazing adaptation in different water bodies, and it now represents a significant fishery in the Kashmir temperate flatlands (Fotadar and Qadri, 1974) [5]. It was discovered that *Cyprinus carpio var. communis* contributed the majority of the Dal Lake's overall catch (Sunder *et al.*, 1984) [15]. In terms of reproductive potential, *Cyprinus carpio* has reportedly surpassed the native fish of Kashmir (Das and Malhotra, 1964) [4]. Beautifully armoured *Carassius carassius* is used as food or as an ornamental fish in aquariums. It is an unusual fish native to Kashmir known as "Gang gaad" locally. It is more specifically known as Crucian carp and was introduced into Dal Lake along with common carp. Since then, it has successfully adapted to the lake's changing environmental conditions (Shafi *et al.*, 2012) [14]. It is a common cyprinid in Dal Lake Kashmir and has a wide range of habitats where it may thrive despite abiotic environmental constraints including low oxygen levels and water temperature swings (Holopainen and Hyvarinain, 1985). An indirect technique for determining a species' spawning season is the gonadosomatic index, also known as the maturity index (Biswas, 1993) [2]. Although the fish gonads are fully grown at the beginning of winter, but due to Kashmir's harsh winter, the gonads exhibit inactivity or gonadal diapause [Malhotra, 1966] [9], which lasts until the middle of February. Although the gonad were fully developed at the beginning of winter, the GSI in *Cyprinus carpio communis* reported that both sexes reach their peak in March and that spawning occurs in the spring (Raina, 1978) [13]. The GSI for *Carassius carassius* reached a maximum in April, when the fish were identified as having fully mature gonads, and a minimum in July (Shafi, 2012) [14].

Corresponding Author:**Nusrat Waheed**

Department of Zoology, School
of Agricultural and Natural
Sciences, CT University,
Ludhiana, Punjab, India

Materials and Methods

In the present study a total number of 288 specimen of both species of *Cyprinus carpio communis* and *Carassius carassius* were collected from four sites (Nehrupark site, Nishat site, Tailbal site and Nageen site) of Dal lake in the early morning hours on monthly basis with the help of local fisherman using cast net, gill net and also from the local fish market nearest to Dal lake and were transported to labouratory in ice packed insulated boxes to estimate Gonadosomatic Index of the fish species. The fish samples of *Cyprinus carpio communis* and *Carassius carassius* were then moved to the laboratory for further morphometric measurements. The fishes were then dissected, and the gonads (both ovaries and testies) were carefully removed and weighed on a digital balance to estimate the gonadosomatic index. The gonadosomatic index was calculated using the formula provided by (Desai, 1970) [17].

$$\text{GSI} = \frac{\text{Weight of gonads (gram)}}{\text{Total weight of fish (gram)}} \times 100.$$

Results and Discussion

The Gonadosomatic Index of both the species i.e. *Cyprinus carpio communis* and *Carassius carassius* at four sites i.e. (Nehrupark site, Nishat site, Tailbal site and Nageen site) of Dal lake had shown a significant difference ($p < 0.05$) among

months and seasons as shown in the below mentioned tables and figures. The Gonadosomatic Index in *Cyprinus carpio communis* ranged from a minimum of 2.49 ± 0.14 - 2.52 ± 0.10 in male in June and 3.30 ± 0.17 - 3.30 ± 0.17 in female in July at Tailbal and Nishat sites and from a maximum of 9.84 ± 0.51 - 9.94 ± 0.46 in male and 15.29 ± 0.04 - 15.52 ± 0.06 in female at Nehrupark and Nageen Sites in May. Seasonal fluctuations in Gonadosomatic Index in *Cyprinus carpio communis* ranged from a minimum of 3.56 ± 0.70 - 3.85 ± 0.85 in male to a minimum of 3.84 ± 0.37 - 3.96 ± 0.41 in female in summer at Nishat and Tailbal sites and from a maximum of 8.22 ± 0.96 - 8.93 ± 0.50 in male to a maximum of 13.44 ± 0.62 - 13.61 ± 1.07 in female in spring at Nehrupark and Nageen sites. The Gonadosomatic Index in *Carassius carassius* ranged from a minimum of 3.83 ± 0.30 - 3.91 ± 0.34 in male in October and 11.60 ± 0.48 - 11.89 ± 0.37 in female in April at Nishat and Tailbal sites and from a maximum of 9.84 ± 0.51 - 15.29 ± 0.04 in male and 9.94 ± 0.46 - 15.52 ± 0.04 in female at Nehrupark and Nageen Sites in April. Seasonal fluctuations in Gonadosomatic Index in *Carassius carassius* ranged from a minimum of 4.80 ± 0.31 - 4.98 ± 0.60 in male to a minimum of 5.67 ± 1.14 - 5.85 ± 1.22 in female in winter at Nishat and Tailbal sites and from a maximum of 8.70 ± 1.83 - 8.80 ± 1.89 in male to a maximum of 8.90 ± 1.59 - 9.22 ± 1.62 in female in spring at Nehrupark and Nageen sites.

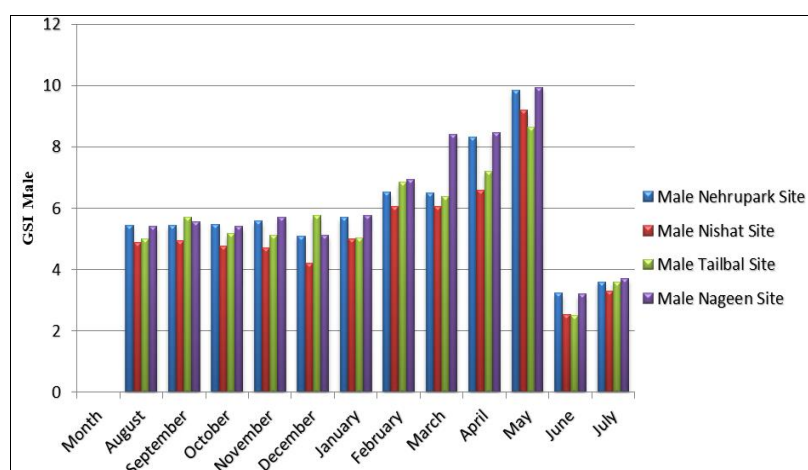


Fig 1: Monthly variations in Gonadosomatic Index (Male) of *Cyprinus carpio communis* at different sites of Dal Lake

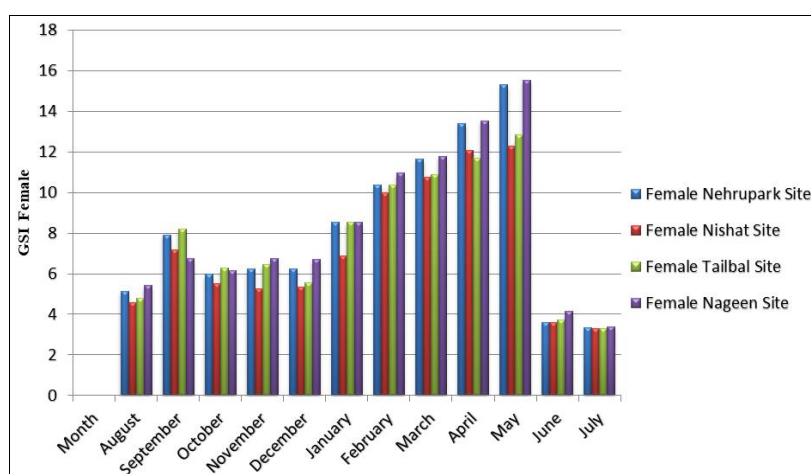


Fig 2: Monthly variations in Gonadosomatic Index (Female) of *Cyprinus carpio communis* at different sites of Dal Lake

The present study revealed that there was found a significant difference ($p < 0.05$) during seasonal fluctuations in

Gonadosomatic Index of fish *Cyprinus carpio communis* collected from different sites of Dal Lake.

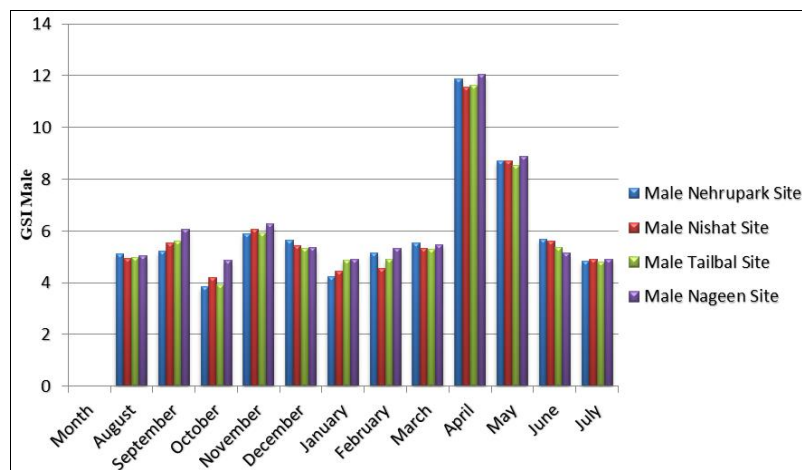


Fig 3: Monthly variations in Gonadosomatic Index (Male) of *Carassius carassius* collected from different sites of Dal Lake

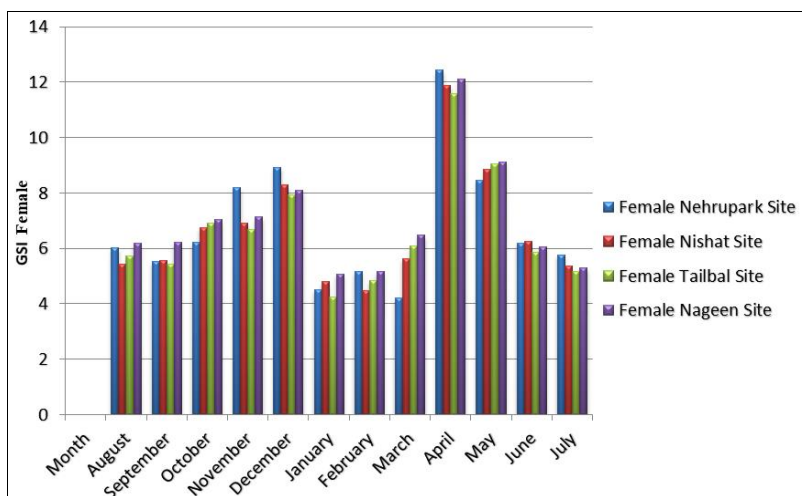


Fig 4: Monthly variations in Gonadosomatic Index (Female) of *Carassius carassius* collected from different sites of Dal Lake

Table 1: Seasonal fluctuations in Gonadosomatic Index of *Cyprinus carpio communis* collected from different sites of Dal Lake

Season Site	Autumn (Sept to Nov)	Winter (Dec to Feb)	Spring (March to May)	Summer (June to Aug)
Male				
Nehrupark Site	5.50±0.04 ^{a1}	5.76±0.41 ^{a1}	8.22±0.96 ^{b2}	3.85±0.85 ^{b2}
Nishat Site	4.80±0.07 ^{b2}	5.08±0.54 ^{a1}	7.27±0.96 ^{a1}	3.56±0.70 ^{b2}
Tailbal Site	5.32±0.18 ^{a1}	5.88±0.52 ^{a1}	7.40±0.66 ^{a1}	3.94±0.54 ^{b2}
Nageen Site	5.55±0.08 ^{a1}	5.94±0.53 ^{a1}	8.93±0.50 ^{b2}	4.09±0.66 ^{c3}
Female				
Nehrupark Site	6.70±0.60 ^{a1}	8.38±0.64 ^{b2}	13.44±0.62 ^{c3}	4.01±0.56 ^{b2}
Nishat Site	5.98±0.60 ^{a1}	7.41±1.36 ^{a1}	11.69±0.48 ^{b2}	3.84±0.37 ^{c3}
Tailbal Site	6.96±0.62 ^{a1}	8.15±1.40 ^{a1}	11.79±0.56 ^{b2}	3.96±0.41 ^{c3}
Nageen Site	6.54±0.20 ^{a1}	8.73±1.22 ^{b2}	13.61±1.07 ^{c3}	4.28±0.61 ^{c3}

Values expressed as Mean ± SE

Different superscripts (a-c and 1-3) represents significant difference ($p < 0.05$) among seasons

Table 2: Seasonal fluctuations in Gonadosomatic Index of *Carassius carassius* collected from different sites of Dal Lake

Season Site	Autumn (Sept to Nov)	Winter (Dec to Feb)	Spring (March to May)	Summer (June to Aug)
Male				
Nehrupark Site	4.98±0.60 ^{c3}	5.01±0.40 ^{b1}	8.70±1.83 ^{a1}	5.20±0.25 ^{a1}
Nishat Site	5.26±0.55 ^{b1}	4.80±0.31 ^{c3}	8.52±1.80 ^{a1}	5.16±0.22 ^{a1}
Tailbal Site	5.14±0.62 ^{b1}	5.03±0.14 ^{b1}	8.48±1.82 ^{a1}	5.04±0.17 ^{a1}
Nageen Site	5.72±0.44 ^{b1}	5.19±0.15 ^{b1}	8.80±1.89 ^{a1}	5.03±0.06 ^{a1}
Female				
Nehrupark Site	6.63±0.80 ^{b1}	6.20±1.37 ^{b1}	8.36±2.37 ^{a1}	5.99±0.12 ^{b1}
Nishat Site	6.40±0.43 ^{b1}	5.85±1.22 ^{b1}	8.78±1.80 ^{a1}	5.67±0.28 ^{b1}
Tailbal Site	6.34±0.46 ^{b1}	5.67±1.14 ^{b1}	8.90±1.59 ^{a1}	5.58±0.20 ^{b1}
Nageen Site	6.80±0.29 ^{b1}	6.11±0.99 ^{b1}	9.22±1.62 ^{a1}	5.84±0.28 ^{b1}

Values expressed as Mean ± SE

Different superscripts (a-b and 1-3) represents significant difference ($p < 0.05$) among seasons

The present study revealed that there was found a significant difference ($p < 0.05$) during seasonal fluctuations in Gonadosomatic Index of fish *Carassius carassius* collected from different sites of Dal Lake. The gonadosomatic index is considered as an indirect method for spawning season estimation of a species (Biswas, 1993) [2]. In *Cyprinus carpio communis* the GSI was low during late summer i.e (August, September, October, November and December) and shows a sudden decline in June and July in both males and females. The highest GSI was measured in May and had a value of 9.5 ± 4.58 in males and 16.3 ± 1.12 in females. In contrast, the value for females ranged from 3.5 ± 4.013 (June) to 16.3 ± 1.12 with the mean GSI value for females ranging from 2.5 ± 0.728 (June) to 9.5 ± 4.58 (May). Females did not exhibit any significant changes from August to December ($p = 0.131$) or from January to March ($p = 0.612$). But from April to July, there were noticeable changes ($p = 0.00096$). For males, there was no statistically significant change from August to December ($p = 0.4619$), but there was a significant change from January to March ($p = 0.049$) and from April to July ($p = 0.00026$) (Mohamad *et al.*, 2020) [11]. In *Cyprinus carpio* the GSI of the male fishes ranged from 2.5 ± 0.728 to 9.5 ± 4.58 whereas in the female fishes it ranged from 3.5 ± 4.03 to 16.3 ± 1.12 . The GSI in *Cyprinus carpio communis* to be in the range of 3.67 to 37.93%, 2.302 to 11.363% and 13.97 to 17.01% (Abera *et al.*, 2015; Parameswaran *et al.*, 1972; Shafi *et al.*, 2012) [1, 10, 14]. In GSI, substantial difference was found and seasonal influences have a significant impact on how the ovary matures, changing the gonads and body weights in a series of subsequent modifications (Lincoln *et al.*, 1980-2001) [7]. The GSI was lower in males and higher in females and in males GSI show rise from february and start declining from may and in females GSI starts rising from January and show decline from May (Shafi *et al.*, 2012) [14]. In *Cyprinus carpio communis* the GSI in both the sexes was at peak in the month of march and it was reported that spawning takes place during spring although the gonad were fully mature at the start of winter (Raina, 1978) [13]. While studying the reproductive biology of Common carp, *Cyprinus carpio* under temperate conditions in Kashmir, observed that the fishes of both the sexes breed from April to June. But the current study's GSI levels in the month of May and subsequent decline after June suggest that the fish continue to reproduce beyond that (Abera *et al.*, 2015) [1]. Male GSI values ranged from December to May, while female GSI values increased from January to April. (Parameswarn *et al.*, 1974) [12]. The GSI rises when the fish reaches adulthood and then suddenly drops off, Oogonia and primary oocytes begin to regenerate in January in females and February in males, after which the oocyte grows and spawning occurs in May, when the ovary reaches its maximum size and has the greatest number of mature follicles. Regression of the ovary occurs after the spawning cycle (Lone *et al.*, 2009) [8]. From July through August, the GSI and ovarian weight decreased, and by October, the ovaries had already started to retreat (Kiran, 2015) [6]. The GSI also declined gradually in female Cyprinid fish, *Salmostoma untrahi*, from July to September, increased once more in October, and then decreased once again from November to January. The GSI for *Carassius carassius* reached a maximum of 12.82 in April, when the fish were identified as having fully mature gonads, and a minimum of 5.35 in July. In different months of the year, it was discovered that males' GSI was, on average, lower than that of females (Shafi, 2012) [14]. The GSI of *Carassius carassius* showed

higher values in females than in males. The low value for GSI in males is due to lower energy investment in gamete production than that spent by females. (Buxton, 1990) [3].

Conclusion

The Gonadosomatic Index in both the species (i.e *Cyprinus carpio communis* and *Carassius carassius*) was found minimum at Nishat and Telebal sites and was found maximum at Nehrupark and Nageen sites. The Gonadosomatic Index of both the species i.e. *Cyprinus carpio communis* and *Carassius carassius* at four sites (Nehrupark site, Nishat site, Tailbal site and Nageen site) of Dal lake had shown a significant difference ($p < 0.05$) among months and seasons.

References

1. Abera L, Getahun A, Lemma B. Some aspects of reproductive biology of the Common carp (*Cyprinus carpio* Linnaeus, 1758) in Lake Ziway, Ethiopia: Global Science Research Journals. 2015;3(3):51-157.
2. Biswas SP. Manual of Methods in Fish Biology. 2nd Edn., South Asian Publishers, New Delhi; c1993, p. 157.
3. Buxton CD. The reproductive biology of *Chrysoblephus laticeps* and *C. cristiceps* (Teleostei: Sparidae): J Zool. 1990;220:497-511.
4. Das SM, Malhotra YR. Studies on the comparative fecundity of some fresh water fishes of India with a note of new concept of comparative fecundity: Ichthyologica. 1964;3:33-36.
5. Fotedar DN, Qadri MY. Fish and Fisheries of Kashmir and the impact of carp *Cyprinus carpio* on the endemic fishes: Journal of Science. University of Kashmir. 1974;12:1-2.
6. Kiran BR. Study of Gonado-Somatic Index of Cyprinid Fish, *Salmostoma Untrahi* (Day) from Bhadra Reservoir, Karnataka: International Journal of Research in Environmental Science (IJRES). 2015;1(1):6-10.
7. Lincoln GA, Racey PA, Share PJ, Kland H. Endocrine changes associated with spring And Autumn sexually of rook: *Corvus frugilegus* J. 1980-2001;190:137-153.
8. Lone PK, Hussain A. Seasonal and age-related variations in the ovaries of *Labeo rohita* (Hamilton, 1822). A detailed gross and histological study of gametogenesis, maturation and fecundity: Pakistan J Zool. 2009;41:217-234.
9. Malhotra YR. Breeding in some fishes of Kashmir valley. Ichthyologia. 1966;5(1, 2):53-58.
10. Parameswaran S, Radhakrishnan S, Selvaraj C, Bhuyan BR. Fish yields from Assam ponds kept under different experimental conditions. Indian Journal of Fisheries. 1972;18:67-83.
11. Mohamad I, Bhat AF, Balkhi MH, Shah HT, Bhat AB, Shah FA, *et al.* Annual cyclical changes in the gonadosomatic index of *Cyprinus carpio* var. *communis* in Dal Lake, Kashmir: Journal of Entomology and Zoology studies. 2020, 8(4).
12. Parameswarn SCS, Radhakrisshnan S. Observation on the biology of *Labeo gonius* (Hamilton). Ind. J of Fish. 1974;21:54-75.
13. Raina HS. A biological note on the introduced common carp in the temperate waters of Kashmir: Indian Journal of Fisheries. 1978;34(1):114-119.
14. Shafi S, Yousuf AR, Parveen M. Study of fecundity of *Cyprinus carpio* var. *communis*: International Journal of

Scientific and Research Publications. 2012;2:1-5.

15. Sunder S, Kumar K, Raina HS. Food and feeding habits and length weight relationship of *Cyprinus carpio* specularis of Dal Lake, Kashmir: Indian Journal of Fisheries. 1984;31(1):90-99.
16. Vilizzi L. Age determination in common carp *Cyprinus carpio*: history, relative utility of ageing structures, precision and accuracy: Rev Fish Biol Fisheries. 2018;28:461-484.
17. Desai SN. Rāmāyaṇa-An Instrument of Historical contact and cultural transmission between India and Asia. The Journal of Asian Studies. 1970 Nov;30(1):5-20.