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Study of gonado-somatic index (GSI) of male and female striated murrel *Channa striatus* (Bloch, 1793) in Etawah district

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Abstract
Snakehead fishes of family Channidae play an important role in fish biodiversity with 32 total species. *Channa striatus* is an important fish of Channidae family. It is very useful and economic important fish used as food, game, ornamental and pest controller fish in different regions. This is a native of Indian subcontinent, found in India, China, Pakistan, Sri Lanka, Bangladesh, Nepal, Vietnam and Malaysia etc. The culture production and conservation by aquaculture have much important for present scenario because the population of *Channa striata* fish species decline by several anthropogenic activities due to destruction of their natural habitats and over fishing. The reproductive biology has the important part of Gonado-somatic Index for the aquaculture production. It is direct effect to survival growth breeding mechanism and their technology formation. Present study provides the basic idea for the Gonad-somatic index which express the relative change in gonad weight to the percentage of body weight. Present study indicates the *Channa striatus* GSI in around Etawah District (Uttar Pradesh) India, during study period from January to June. GSI have increased with gonadal development and maturation of this fish. GSI value was minimum at January during pre spawning period was 0.274 ± 0.014 and maximum at peak maturation period during June 4.32 ± 0.24 in female and in male GSI is 0.138 ± 0.026 minimum and 0.230 ± 0.018 maximum.

Keywords: *Channa striatus*, gonado somatic index

Introduction
Family *Channidae* have an important role in faunal diversity mostly in fishes with 32 important species. This group of fishes are most important for food in tropical Asia, (Benziger *et al*., 2011) [2]. *Channa striatus* (Bloch, 1793) [3] is one of the important fish of this family. *Channa striatus* commonaly called Chevron snakehead striped murrel or striated murrel and it is a most economically important snakehead fish species inhibiting freshwater as well as brackish water (Bloch, 1793) [3]. This fish is locally known as 'sol'. This is mostly found in pond, lakes, rivers, canal, swamp, reservoir, wetland and other shallow water areas such as rice fields, irrigation canals, ditches and borrows pits due to its air breathing nature. (Jayaram, 1999) [9], it's found in river, canal swamp marshes, pond, Lake and reservoir etc. (Kilambi, 1986) [11]. It's have good taste, high nutritive value, medicinal qualities, and wound healing properties (Mat Jais, 1992) [12], high market price containing higher protein content (Anasari *et al*., 2012) [1], The fish received fetched high quality of flesh, low fat, less intramuscular spines and medicinal qualities (Haniffa and Marimuthu, 2004). Due to environmental change, high exploration rate, various anthropogenic activities and habitat degradation the population of this species decline rapidly so this fish put as an endangered fish (IUCN 1998) [8]. This fish need conservation immediately by induced reproduction and aquaculture production technology. The growth rate of fish is directly related with the reproductive status and breeding period (Gupta and Srivastava, 2001; Shankar and Kulkarni, 2005) [7, 15] capacity of any fish directly related with Gonado-somatic index (GSI) (Nibedita, and Biswas 2015) [6]. The reproductive status and GSI study help in the conservation of the fish through aquaculture (Ghaedi *et al*., 2013; Rheman *et al*., 2002; Rahman 2014)) [14, 13] Scientific study of GSI helps in the study of reproductive biology, captive breeding mechanism, aquaculture production and their conservation. This study of Gonado-somatic index expresses the relative change in gonad weight to the percentage of body weight. This study is done in the water bodies of Etawah district Uttar Pradesh during January to June 2021.

Material and Methods

Fish specimens for study were collected from local area ponds which are directly or indirectly connected to the river Chambal, Yamun, Pahuj, Kunwari and Sind in Etawah district Uttar Pradesh. All specimens were collected by dipnet, dragnet, dewatering and hand picking. Fishing of this fish were very tough by fishing net due to bottom dweller nature its easily not catch by nets. Collected specimens were different in size and weight. The specimens were collected during different seasons and time intervals from January 2021 to June 2021 so the size, weight and all fishes with various maturity stages. During study period total 88 fish specimens (48 female and 40 male) was collected in different time intervals. The sex determination and identification of specimens were done by examination of body morphology and anatomy of gonads. The collected fish specimens were transported by fish carrying containers and in polythene bags to the study place at laboratory of College of Fisheries Science and Research Centre in Etawah. The weights of sample fishes were taken by a digital balance with minimum capacity 10 gm. Weighed fishes were dissected for the collection of gonad at the ventral side from gonopore. The weights of gonad were taken by other digital balance with 0.05 gm. minimum capacity. The extracted gonad fixed in 5% formalin solution for further study. Weights of sample fish and their gonad were taken by monthly interval during January to June 2021. Later (GSI) % of gonads weight in relation to the total body weight was calculated by using the following formula.

$$\text{Gonado-somatic index} = \frac{\text{Weight of gonad}}{\text{Weight of fish}} \times 100$$

GSI *Channa striatus* was calculated with the relation of fish weight with gonads weight. Gonado-somatic index of fish *Channa marulius* have increase with reproductive maturation and its shows maximum during peak spawning period during May-June and declines after spawning and lowest during January.

Results and Discussion

The GSI of *Channa striatus* in Etawah district Uttar pradesh, estimated monthly during study period from January to June 2021 in both sex male and female. The present GSI study determined the maturity and peek breeding season of *Channa striatus*. The GSI value of female and male were expressed in table number 1, and 2. The value of GSI was increases from January to June. May and June were the peak period for spawning that's showing different maturity stages but mature ova were more in number. March to April was the vittelogenic period or active cum quiescent period. In case of female the GSI value was minimum at January during pre spawning period (0.274 ± 0.014) and maximum at peak maturation period during June (4.32 ± 0.247) and in case of male the minimum GSI was (0.138 ± 0.019) and maximum was GSI (0.230 ± 0.018) maximum in male. *Channa striatus* were spawning during May-June at the spawning seasons. Similar results was shown by (Gaikwad MV *et al.* 2009) [4] in *Channa punctatus.* Yadav K.C. *et al*. 2016 obtains about similar result in *Channa maruliu* and similar result obtained by Tiwari *et al.* (2014) [16]. He observed GSI (0.20 to 2.20) in male and (0.230 ± 0.018).

Table 1: Gonado-somatic index of female *Channa striatus* during January to June.

Month	No.	Mean ± SEM	Min.	Max.
January	4	0.274 ± 0.014	0.27	0.32
February	9	0.296 ± 0.053	0.26	1.64
March	9	1.305 ± 0.189	0.35	2.49
April	9	2.636 ± 0.332	1.47	3.96
May	10	3.46 ± 0.368	1.78	4.62
June	8	4.32 ± 0.247	2.45	5.61

Table 2: Gonado-somatic index of male *Channa striatus* during January to June.

Month	No.	Mean ± SEM	Min.	Max.
January	4	0.138 ± 0.019	0.016	0.162
February	6	0.152 ± 0.023	0.022	0.234
March	6	0.174 ± 0.010	0.035	0.168
April	8	0.196 ± 0.012	0.044	0.209
May	9	0.110 ± 0.016	0.056	0.208
June	7	0.230 ± 0.018	0.62	0.214

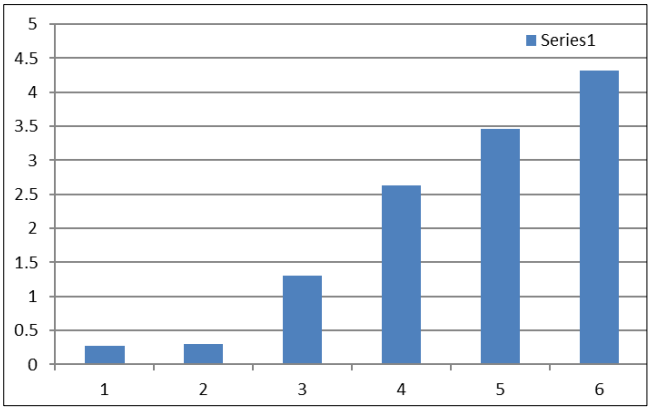

Fig 1: Gonado-somatic index of female *Channa striatus* during January to June

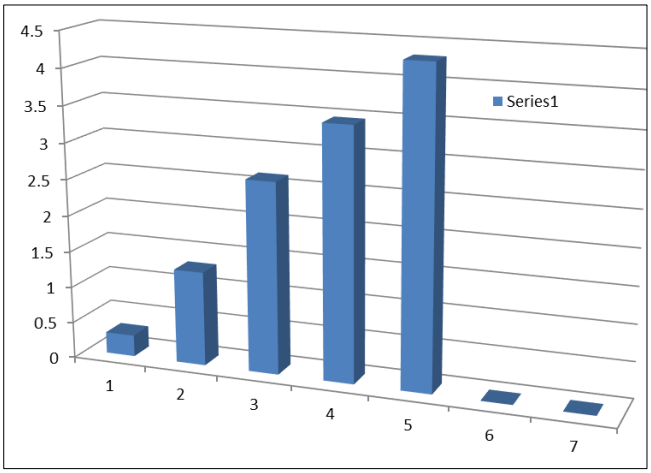

Fig 2: Gonado-somatic index of male *Channa striatus* during January to June

Conclusion

The study provides the valuable information related to the reproductive biology and gonado-somatic index of *Channa striatus* have shown positive response during seasonal gonadal changes. Highest GSI was recorded during May-June (4.32 ± 0.247) in female and (0.230 ± 0.018) in male. Its information is very helpful in the aquaculture technology

development for the snakehead fishes and also helpful in aquaculture diversification. The Trai belt area is water rich area which provides the lots of livelihood support to the poor people and this study will provide help to breeding of this fish for aquaculture production. The present study is also helpful in the conservation of this fish which are decline from the natural habit and habitats.

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