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**Assessment of Gonadosomatic index and
maturation of an Indian major carp *Cirrhinus
mrigala* (Ham.)**

Suday Prasad, CS Prabhakar and Ajay Kumar**Abstract**

Estimation of accurate maturity and spawning period play a significant role to evaluate reproductive potential of fish. It also helps to understand the dynamics of fish population, productivity trends and spawning stock biomass for successful and profitable aquaculture. In the present studies were undertaken on gonadal maturity and gonadosomatic index (GSI) of an Indian Major Carp (IMC) *Cirrhinus mrigala* (Ham.), in the spawning season from April 2018 to August 2018 were evaluated. Ovarian mean weight of the carp ranges from 77.50 to 131.50 g. The ovarian weight in fully mature fishes was almost 20% of the body weight. In this study, it has been found that the gonad of the fish increased with increase in size and weight of fish. The average weight and length of fish were ranged from 504.63 to 685.88 g and 31.16 to 38.05 cm, respectively. The gonads attained the maximum & minimum weight of GSI values 26.32 gm and 18.13 gm in the month of May and August, respectively. In the month of April, stages of ovaries were found advanced maturing and mature phase, whereas % of gonads in the body cavity ranges between 85-100%. The peak value of Gonadosomatic index was observed during May to June indicating the peak spawning period of the species. The fish has only one spawning season of short duration ranging from May to June. The result of the present study will help to plan an early seed production culture of *C. mrigala* in agro-climatic conditions of Bihar for better rural livelihood and nutritional security.

Keywords: *Cirrhinus mrigala*, (Ham.) gonadosomatic index, maturity, spawning, Bihar, India

1. Introduction

Due to ever increasing population, climate changes and industrialization, availability of agriculture land is reducing day by day and affecting the seasonal variation particularly biological processes is considered altering marine and freshwater food webs, with unpredictable consequences for fish production. Presently aquatic ecosystem of India is under considerable stress resulting in depletion of fish and prawn population (Prasad and Kaushal 2010) [10]. Moreover in a developing country like India, where 30% of population is still suffering severely by malnutrition and health hazards, fish food may also be useful providing proteineous and easily digestible food item (Ashwini and Grish, 2012) [11]. Fisheries and aquaculture is an important sector of food production, providing nutrition security to food basket, contribute to the agricultural export and engaging about fourteen million people in different activities as well (Prasad *et al.*, 2018) [11]. Carp culture is the largest and widely used practices of animal aquaculture over the world (Desilva, 2003) [5]. Indian Major Carp is a prized food fish of India but it is facing tough competition in Indian water against the exotic fishes. Gonadosomatic index (GSI) is one of the important parameters of the fish biology, which gives the detail idea regarding the fish reproduction and status of the species and also help to ascertain breeding period of fish (Shankar and Kulkarni, 2005) [16]. The percentage of body weight of fish that is positively correlated with the production of eggs is determined by the gonad somatic index. Saksena, (1987) [15] has reported the utility of gonadosomatic index and volume of the gonad as an indicators of the reproductive activity.

The GSI is considered as a percentage weight of ovary to the body weight has been used as a maturity index of fish. Environmental changes greatly influence the production of eggs varies not only among different species but also within the same species. It depends upon the length and weight of the gonads (Barmanh and Saikia, 1995) [3] Gonadosomatic index, an index of gonad size related to the fish size is a good indicator of gonadal development of fish and it measures the cyclic changes in gonad weight in relation to total fish weight. It can also be used to determine spawning periods Smith, (2008) [17]. In order to satisfy the aim and objective of the present study it would be imperative to was investigate the gonadosomatic index and stage of gonadal development, which in turn studying some aspects of the reproductive biology and also tracing accurate spawning period of *C. mrigala* in Bihar. This is reported in terms of gonadosomatic index which express the relative change in gonad weight to the percentage of body weight. It is hoped that the information obtained from this study will contribute the knowledge of the reproductive biology of *C. mrigala*, and will also be useful for the researchers in the field of fisheries and aquaculture production.

Materials and methods

Study area:

The present investigation was carried out on gonadosomatic index and maturation of *C. mrigala* Dumraon (Buxar) from April 2010 to August 2018. Dumraon, Buxar lies between 25° 55N Latitude and 84° 15 E Longitudes at the average elevation of 61 metres (200 feet). It is located 1.5 km South

of National High way (NH-44) (Arah- Buxar Highway). It is a sub-division of district Buxar and 100 km far-away from Patna.

Collection of specimens and measurements

The month wise healthy mature fish samples of *C. mrigala* were collected (A total of 20 collections) from fish ponds and fish markets, Dumraon, Buxar. Gonad of Indian Major Carp (IMC) *C. mrigala* (ovary) were collected and weighed at the sampling site and also observed their maturity stage individually. The standard length and weight of fish were noted nearest accuracy by measuring centimeter scale and weighing balance along with visual observation. A total of 100 samples collected during the study period and simple random sampling technique was used (Cochran, 2004) [4]. The specimens of *C. mrigala* were careful dissected with revealed that the posterior aperture opened in to coelomic cavity and examined Fig-1. Gonads were removed from the fish. Thereafter dissected fish were also weighted. Gonads were kept in a transparent glass sheet. The ovaries were examined by using a hand lens. Their degree of maturation was judged by the naked eye on the basis of color and size. The appearances of ova, at different stages of ovary were examined microscopically and classified them in different groups according to Nikolsky, (1963) [9]. Weights of the fish gonads (ovary) were measured using a weighing balance (Kurl model). The gonads were preserved in 5% formalin and they were brought to the department of Entomology and Zoology, laboratory at VKS College of Agriculture, Dumraon for further investigation.



Fig 1: Mature specimen, posterior aperture opened in to coelomic cavity of *C. mrigala*

Gonadosomatic Index (GIS):

The gonadosomatic index was calculated using the formula as follows.

$$GIS = \frac{\text{Weight of gonad (g)}}{\text{Weight of fish (g) - Gonad weight (g)}} \times 100$$

Table 2: Mean morphometric data with gonad weight ovary position % and Gonadosomatic index (GSI) of *C. mrigala* collected in different months

Months	B.Lt. (cm.)	B. Wt. gm	H.Lt. (cm)	Girth (cm.)	Gonad (gm)	F. wt. After dissect	Ovary (%)	G.S.I
April	31.79	504.63	5.65	6.03	77.50	426.63	94.43	18.75
May	33.41	550.25	6.84	9.04	117.50	433.50	98.75	26.32
June	36.84	501.53	7.74	9.49	139.50	639.00	97.50	21.33
July	31.16	685.88	6.36	9.21	108.88	576.00	93.13	18.83
August	38.05	685.00	6.36	9.15	104.13	576.00	93.13	18.13

B. Lt. = Body length, B. wt. = Body weight, H. Lt.= Head length, F. wt. = Fish weight after dissection.

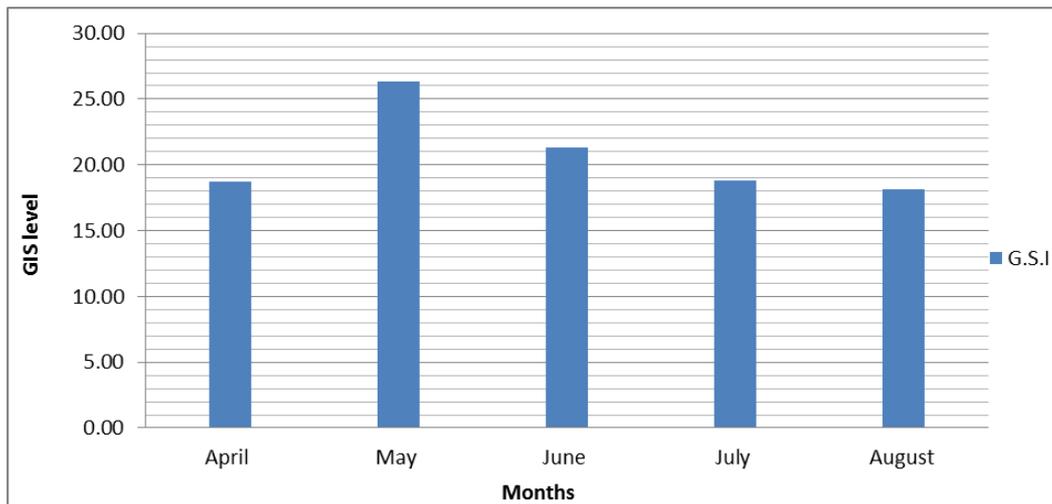


Fig 2: Mean Gonado Somatic Index level in different months for *C. mrigala*

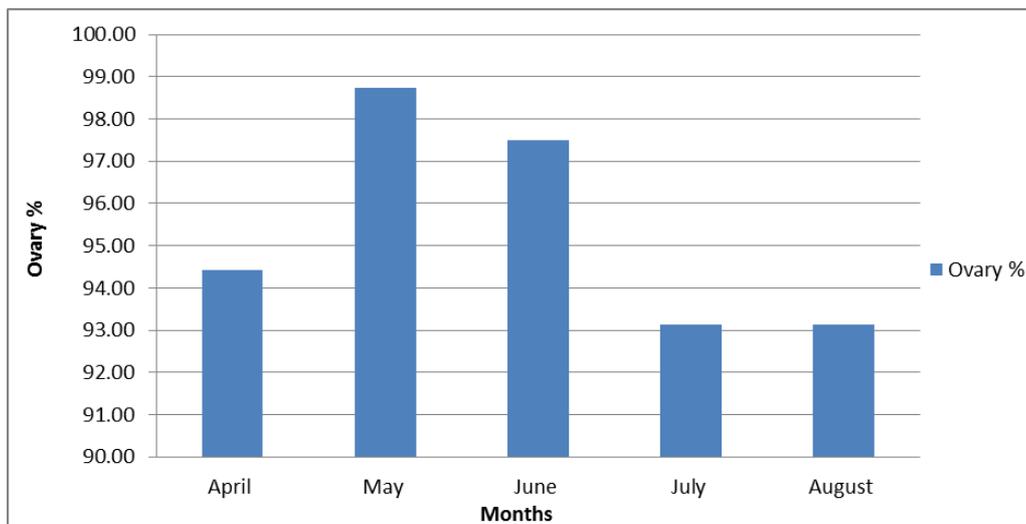


Fig 3: Mean ovary percentage of *C. mrigala* in different months

Results and discussion

The ovaries of the *C. mrigala* are paired elongated sac like structures, lying along the kidneys in the abdominal cavity. Gonadal development was studied by using the gonado somatic index of fishes. Variation in gonad weight observed month wise and sample of Indian Major Carp, *C. mrigala* have been analyzed and computed the facts and figure of samples are shown in Table-1 and Fig- 2 & 3. In the present investigation most of the ovaries were found in the month of April in matured phase ranges between 85 to 100%, whereas % of gonads in the body cavity was recorded in mean value 94.43%. High gonadosomatic indices were recorded for *C. mrigala* in this study from April to June which in turn suggested that the spawning period of *C. mrigala* was April to June, the peak value being in May to June. More or less similar observations have been made by (Rao *et al.*, 1972) [13] and Gupta (1975) [7] in *C. reba* respectively. In present investigation in the month of May mean body weight 550.25 and gonad weight 117.50 were recorded, where as GSI value was 26.26. This was highest and spawning period of this month. In Indian major carp *Labeo calbasu* the mean gonado somatic index increased gradually from May and reach to peak in July and then decreases in August as reported by (Mishra and Saksena, 2012) [8]. The GIS of *C. mrigala* was estimated month wise for females and the values are expressed in percentages. It increases from 18.75 in April to 21.33 in June indicating the peak period of the maturity.

There is gradual decrease in GIS from 18.83 in July to 18.13 in August indicating the onset of spawning and most of the ovaries were found in reabsorbing condition. According to (Al-ogaily and Hussain 1990) [2] high GSI were recorded for trout sweet lip grunt, *Plectorhynchus pictus* from March to May. This was in contrast to the results obtained in this study. Priyadharshini *et al.*, (2015) [12] reported higher values of GSI from June to August ranged between 8.80 to 11.05. After extrusion of ripe gonads, the gonads were weighted from July to August indicate the decline of GSI after spawning. Females having matured & pre-spawning phase of gonads were first observed in the month of April, with 94.43% ovaries approaching maturity during pre spawning period, their volume and vascular supply increases significantly. The gonadosomatic index increased with the maturation of fish and reaches to its maximum at the peak period of maturity. Its sharp decline decrease indicates the beginning of spawning. During spawning period, the ovaries grow considerably in size occupying larger area in the posterior half of the body. It increased from 26.32 to 21.33 in the month from May to June respectively. Ovaries became very large, fill the entire peritoneal cavity and contain fully matured oocytes laden with yolk. However, Gadekar, (2013) [6] had seen few oocytes at peri-nucleolar and yolk vesicle stage which was present in the peripheral areas of the ovary. The percentage of maturation of ovary & eggs increased sharply from May to June during the spawning periods. Percent values of the ovaries rises from

April to the turn of 94.43% to 98.75-97.50% in May to June during the spawning phase. This is peak of the spawning period. After that it gradually decreases to 93.13% in the month of July & August. Our study confirms and support the observations of earlier workers like Saksena (1987)^[15]; Selvaray *et al.*, 1989^[14]; Priyadharshini *et al.*, 2015^[7]. The present investigation clearly indicates that the fish has only one spawning season of short duration ranging from May to June as indicated by the peak of gonadosomatic index and percent maturation of ovary.

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