

## ASSESSMENT OF FECUNDITY AND GONADO-SOMATIC INDEX OF POND REARED *CIRRHINUS MRIGALA* (HAM., 1822)

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(Received : 16.06.2015; Accepted : 10.01.2016)

Mean body weight for both the sexes was  $1270.9 \pm 10.96$  g with mean total length of  $473.95 \pm 11.92$  g. GSI (%) values ranged from 0.23 to 7.93 in male with peak value in July (7.93) and 0.83 to 16.9 in female with peak value in July (16.09). The gonads attained maximum weight of 472.5 and 124.41 g for females and males, respectively in the month of July and minimum in November. The fish has only one spawning season extended from May to August as indicated by the peaks of GSI with peak season between July-August. The relative and absolute fecundity varied from 69,244 to 2,15,680/kg and 74,783 to 4,14,416, respectively. Fecundity showed a significant positive correlation with total length (0.749), gonad weight (0.747) and body weight (0.807) of the sampled fish. *C. mrigala* exhibited maximum reproductive potential and fecundity in the month of July compared to June and August in the eco-climatic conditions of Eastern Uttar Pradesh.

Key words: Gonado-somatic index, fecundity, *Cirrhinus mrigala*, Eastern Uttar Pradesh.

### Introduction

*Cirrhinus mrigala* is an important constituent of Indian major carps locally known as 'Nain' in Uttar Pradesh. It is a popular food fish and an important aquacultured freshwater species throughout South Asia (Graff and Latif, 2002). It is natural inhabitant of rivers and streams of South East Asian countries and also a major component of carp polyculture. In natural waters this fish shows rapid growth in first four years of its life (Jhingran and Pullin, 1985). *C. mrigala* grows more slowly than two other major carps and attains 600-700g weight in first year under cultured conditions (Jena *et al.*, 1998). The rearing period in captivity is usually confirmed to a maximum of two years and the fish attains maturity in one to two years (Hora and Pillay, 1962; FAO, 2005; Iqbal and Kausar, 2009). Gonado-somatic index (GSI) and fecundity play a significant role to evaluate reproductive potential and spawning season of fish species. The estimation of fecundity is helpful for understanding of the

recruitment capacity of fish and stock stability (Pathak, 2013). Considerable work has been done on breeding aspects of number of fish species in India including fecundity and gonado-somatic index (GSI). Many authors have established a linear relationship between fecundity with length and weight of the fish and weight of ovary (Alikunhi, 1956; Das *et al.*, 1989; Desai, 1973; Chaturvedi, 1976; Natrajanand Reddy, 1980; Pathani, 1981; Mishra and Saksena, 2012; Sarkarand Pramanik, 1984). The fecundity and gonado-somatic index have also been studied in another major carp, *Labeo rohita* (Alam and Pathak, 2010). Iqbal and Kausar (2009) studied the fecundity and gonado somatic index of *C. mrigala* from Pakistan. *C. mrigala* is an important cultured fish species of Indian sub-continent and also of some other parts of the globe, but the knowledge regarding maturity, breeding and fisheries of the fish is still fragmentary. Therefore, the present study was undertaken to determine the spawning season and reproductive biology based on fecundity and GSI of *C. mrigala* from Eastern Uttar Pradesh.

## FECUNDITY AND GONADO-SOMATIC INDEX OF *CIRRHINUS MRIGALA*

### Materials and methods

Sampling was carried out for twelve calendar months biweekly (April 2011-March 2012). Each month thirty fishes *i.e.* total of 360 (167 male and 193 female) were collected during the study period from different ponds and tanks of Allahabad and Pratapgarh districts of Uttar Pradesh. The fishes were weighed and measured before dissection and removal of ovaries. The total length (TL) and weight (Wt) for each specimen were recorded. The ovary and testis of each fish was taken out very carefully and preserved in labelled vial containing 5% formalin for 24 hrs. Weight of the ovaries of each specimen was recorded in gram with the help of electronic balance.

Fish collected in the month of high GSI value were used for estimation of fecundity. For estimation of fecundity 1.0 gm each portion of the ovary from anterior, middle and posterior region of each lobe were taken. The total number of eggs in each sample were counted carefully and recorded for further calculations. Absolute fecundity was calculated according to formula by Lone and Hussain (2009);

$$F = nG/g$$

where F = fecundity; n = mean numbers of eggs in all sample; G = weight of ovary; g = weight of sample.

The numbers of eggs/kg body weight of the fish (relative fecundity) and number of egg per fish (absolute fecundity) was also calculated by using simple algebraic formula. Gonadosomatic index (GSI) was calculated by the equations.

$$GSI = \text{Weight of gonad (g)} / \text{Weight of fish (g)} \times 100.$$

### Results and discussion

A total of 360 brooders of *C. mrigala* was studied during the period. Mean body weight for both the

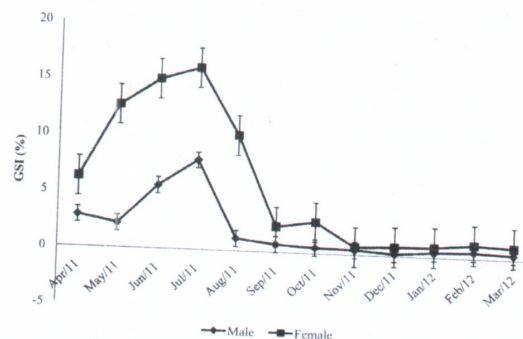


Fig. 1 Average GSI of male and female *C. mrigala*

sexes was  $1270.9 \pm 10.96$  g with mean total length was  $473.95 \pm 11.92$  g. GSI (%) values ranged from 0.23 to 7.93 in male and 0.83 to 16.9 in female. The GSI values showed increasing trend from April to July in female with a peak value in July (16.09) decreasing from August (10.22) while in male it showed increasing trend from May to July and a peak of July (7.93) (Fig. 1). After extrusion of ripe gonads, the gonads were reduced in size and weight. GSI has been considered as reliable estimate for gonadal maturity and spawning of any species. The GSI increased with the maturation of fish and reaches to its maximum at the peak period of maturity. Its abrupt decrease indicates beginning of spawning. Study revealed that *C. mrigala* has only one breeding season running from April-May to August as indicated by the peaks of GSI. The ambient water temperature in the ponds of Eastern Uttar Pradesh rises more than  $30^{\circ}\text{C}$  during May-June. The photoperiod is also maximum in these months. The water temperature and photoperiod have been correlated to the gonad weights and GSI (Iqbal and Kausar, 2009; Mananos *et al.*, 1997; Mylonas and Zohar, 2007; Lone and Hussain 2009). Peak value of GSI in *C. mrigala* of Hatnoor reservoir were observed in June and lowest values during October to January (Shaikh and Lohar, 2011). *C. mrigala* spawns for a short period hence showed great variations in GSI. Increase in the GSI in *C. mrigala* was also noted

Table 1. Body parameters (mean± sd.) of female *Cirrhinus mrigala*

Sample (n=360)	Body length (mm)	Body weight (g)	Gonad length (mm)	Gonad weight(g)	GSI
Apr-11	427.77±3.18	972.77± 10.62	145.33±1.6	70.10 ± 3.0	6.26±3.51
May-11	507±11.55	1296±6.8	279.4±2.6	161.36±8.21	12.68±1.98
Jun-11	538±3.24	1887±11.27	295.6±6.23	276.04±2.84	15.03±2.49
Jul-11	575±9.49	2285±4.76	352.5±6.26	374.21±3.9	16.09±3.44
Aug-11	487.85±11.52	1996.5±12.58	172.71±8.92	178.05±1.33	10.22±5.77
Sep-11	438.57±10.84	872±12.5	145.14±3.0	17.63±4.97	2.26±2.3
Oct-11	435±5.35	729±12.83	145±2.07	21.12±3.60	2.76±1.32
Nov-11	498.12±16.94	1454.37±6.18	135.87±7.42	12.05±6.9	0.69±0.51
Dec-11	446.25±14.22	1088±10.3	118±4.31	13.19±8.3	0.82±0.46
Jan-12	468.75±5.13	1250±8.68	145±7.85	10.55±5.29	0.875±0.42
Feb-12	466.66±12.14	1800±10	133.33±3.81	21.89±8.3	1.19±0.39
Mar-12	460±6.14	1339.5±8.63	124.5±6.25	14.25±7.455	1.025±0.25

with the advancement of ovary and testes development. Similar results were earlier reported by Joshi and Joshi, (1989) and Manna *et al.* (2010). There was sudden decrease in gonad weight from August was also observed, indicated by the decline of GSI after spawning. The body parameters of *C. mrigala* and fecundity are given in Table 1 and 2.

Fecundity is one of the important indicators of fish breeding biology. Fishes which were collected during the month of July (month of highest GSI value) were used for estimation of fecundity. The estimation of fecundity in the present study was based on 17 fully mature female (remaining 13 male, out of 30 samples) of *C. mrigala* collected during month of July. The female brooders ranged in size (total length) from 460 to 610 mm. The relative and absolute fecundity varied from 69,244 to 2,15,680 and 74,783 to 4,69,105 respectively. The maximum fecundity was observed a fish with a total length of 560 mm and 2175 g in weight and the minimum from a fish with a total length of 460 mm and 1080 g in weight (Table 2). Fecundity has significance in population and production studies of a species. Knowledge of fecundity of cultivable fishes becomes very useful in culture

fishery for assessing the targets of spawn production. Fecundity has significance in population and production studies of a species. Estimated fecundity of *C. mrigala* ranges from 100000 to 200000 eggs/kg body weight (Khan and Jhingran, 1979). The individual fecundity was relatively higher than observed by Jhingran and Pullin, (1985). Fecundity of *Cirrhinus reba* from Cauvery and Bharni river was studied by Rao *et al.* (1972) and it was reported to be maximum in July. The highest number of eggs (215680) was carried by female with a body weight 560 g and the lowest number of eggs (69244) was observed in *C. mrigala* with a body weight 460g. Unlike this, fecundity in coldwater fishes *viz.* golden mahseer, snow trout and rainbow trout was recorded very low (Pathani, 1981; Joshi, 2004 and Joshi 2009). The change in fecundity may be due to the environmental factors in which these populations live. In the present study fecundity increased with increase in body length, body weight and gonad weight. Similar observations were reported in *Cirrhinus reba* by Mathialagan and Sivakumar (2012). Increasing trend in fecundity was observed with increasing total length, gonad weight and body weight. Fecundity showed a significant positive correlation

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Table 2. Total length, body weight, gonad weight and fecundity for 17 specimen of matured *C. mrigala*

Length of fish (mm)	Weight of fish (g)	Gonad wt. (g)	Relative Fecundity	Absolute fecundity
460	1080	48.17	69244	74783
470	1140	197.2	93263	102944
480	1280	240	139860	179020
500	1397	261	156543	198765
510	1650	265.27	186683	308026
530	1735	269.3	190234	326781
540	1892	266.1	200182	336529
550	2080	270	190720	396697
540	2084	267	201287	402348
560	2104	271	210922	423421
560	2175	275	215680	469104
580	2210	282	198763	435783
590	2250	330	184185	414416
600	2100	310	178908	402892
540	2020	276	174195	351873
570	2107	289	192022	345011
610	2550	472.5	185907	454062

( $r$ ) with total length (0.749), gonad weight (0.747) and body weight (0.807) of the sampled fish. Many workers have reported similar relationship between fecundity and total length, fish weight, and gonad weight in *C. mrigala* and other fishes (Iqbal and Kausar, 2009; Chaudhuri, 1963; Chakraborty and Singh, 1963; Joshi, 2008). The fecundity of individual females varies in relation to many factors including age, size, species and environmental conditions, such as food availability, water temperature and salinity (Simpson, 1951). It is believed that moderate fecundity in *C. mrigala* in the present study might be due to the genetic makeup of fish stock, overstocking or improper and underfeeding of fish in the water bodies which affected growth and indirectly gonadal development. The study emphasizes the direct attention to the hatchery managers to use healthy, good quality and riverine brooders for fish seed production (Iqbal and Kausar, 2009). Ambient water temperature and longer photoperiod play a key role in onset and completion of the spawning in the fishes like carps which spawn in summer

(Sen *et al.*, 2002; Dey *et al.*, 2004; Iqbal and Kausar, 2009). The present study revealed that the *C. mrigala* has high reproductive potential in the month of July in the climatic conditions of Eastern Uttar Pradesh.

### Acknowledgements

The present study was a part of the project under National Initiatives under Climate Resilient Agriculture (NICRA) of Indian Council of Agricultural Research (ICAR) New Delhi, the authors are grateful to the NICRA and ICAR for funding. The authors also express their gratitude to Prof. A. P. Sharma, Ex. Director ICAR-Central Inland Fisheries Research Institute, Barrackpore for his guidance and the facilities provided.

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