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RESEARCH ARTICLE

GONADOSOMATIC INDEX AND FECUNDITY OF AN INDIAN MAJOR CARP *LABEO ROHITA* (HAM)

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ABSTRACT

A study was conducted to determine the gonadosomatic index (GSI) and fecundity of *Labeo rohita* during the period of March 2013 to February 2014. From this study it has been shown that fecundity of fish increases with increase in size, weight of fish and gonad weight. The fecundity of *Labeo rohita* varied from 19,950 eggs in fish of 155mm length (TL) to 2,01,150 in fish of 300 mm length (TL). The gonads attain the maximum weight 5.75 ± 0.78 and 11.5 ± 1.45 for males and females respectively in July and minimum (0.55 ± 0.25 male and 1.05 ± 0.18 female) in November. The fish has only one spawning season of short duration running from June to August as indicated by the peaks of gonadosomatic index and Ova diameter.

INTRODUCTION

Carp culture is the largest and most wide spread practice of animal aquaculture in the world (Desilva, 2003). The number of eggs contained in ovary of a fish is termed as fecundity. The term fecundity denotes the egg laying capacity of a fish or it refers to the number of ripe eggs produced by a fish in one spawning season. Fecundity is one of the most important biological aspects of a fish. This must be known to assess the productive potential and to evaluate the commercial potentialities of a fish stock (Das et al., 1989). For efficient fish culture and effective management practices it is prime important to know the fecundity of fish (Mian and Dewan 1984). The fecundity and gonadosomatic index have also been studied in *Mystus gulio* (Sarker et al., 2002), in *Anabas testudineus* (Marimuthu, 2009) and in *Labeo rohita* (Alam and Pathak, 2010). Gonadosomatic index (GSI) is one of the important parameters of the fish biology, which gives the detail idea regarding the fish reproduction and reproductive status of the species and help in ascertaining breeding period of fish (Shankar and Kulkarni, 2005). The gonadosomatic index measures the cyclic changes in gonad weight in relation to total fish weight, and can be used to determine spawning periods (Smith, 2008). A clear knowledge of GSI and fecundity plays a significant role to evaluate reproductive potential of fish and for estimated spawning season of a species. The gonad weight gives an easily measured quantitative record of changes in the condition of gonads.

The gonadosomatic index, as a percentage weight of ovary to the body weight has been used as a maturity index of fish. In view of that the present study was undertaken to determine the fecundity and gonadosomatic index of *Labeo rohita* and to establish a relationship between the fecundity and standard length, body weight, gonadal length and gonadal weight of the fish. Many works has been done on the fecundity of different fishes by Shalaka Sadekarpawar & Pragna Parikh (2010), M.R. Islam and N. Siltana, (2012), Nandikeswari and Anandam (2013).

MATERIALS AND METHODS

Healthy mature fishes were collected from fish farm, situated at Orathanadu, Thanjavur Dt, Tamilnadu. The study was carried out for a period of March 2013 to February 2014 to determine the gonadosomatic index and fecundity. They were brought to the laboratory and were thoroughly washed with water and blotted completely to remove excess of water and each fish was weighed using electrical balance and dissected to remove the gonads. The weight of individual fish and its gonads were recorded and GSI was calculated using the formula.

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

For fecundity, total fifteen matured fishes were used randomly from June to September. Gravimetric method was used to determine the fecundity of fish. By using this method, the

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external connective tissues were removed from the surface of the ovaries. Moisture of ovaries was removed with the help of blotting paper. Weight of the ovaries of each fish was recorded in gram with the help of electronic balance. Then 0.01 g of each ovary was taken separately from anterior, middle and posterior portions of each lobe. The number of matured eggs for each portion were sorted out separately and counted. The mean number of eggs in 0.01 g was determined and then multiplied by the total weight of the ovary, which gave the total number of eggs *i.e.*, the fecundity of respective fish. Diameter of the eggs at different stages of maturity was measured with the help of an objective micrometer. In this study, 100 ova were taken randomly per month from the mixed sample of eggs of three portions of each ovary. Measurements of ova diameter were taken along the longest axis of the ova. The relationship between fecundity and standard length, body weight, gonad length and gonad weight were determined with the help of a SPSS program.

RESULTS

Gonadosomatic index (GSI)

For the GSI study 280 males and females (140 each) *Labeo rohita* were examined to determine the GSI and fecundity. GSI values ranged from 0.55 to 5.75 in male and 1.05 to 11.05 in female and showed one peak in July (Table 1). During the present study the higher values of GSI were observed from June to August, it ranged between 4.20 to 5.75 and 8.80 to 11.05 for males and females, respectively. After extrusion of ripe gonads, the gonads were reduced in size and weight. Table 1 shows sudden decrease in gonad weight from October to January as indicated by the decline of GSI after spawning to minimum indices during October and November 0.55 ± 0.21 and 0.65 ± 0.09 respectively (Table 1). Therefore, it was observed that fish spawned once a year with one spawning peak highest in the month of July as indicated by the values of ova diameter (0.305 mm) and gonadosomatic index.

Table 1. Month-wise changes in ova diameter and gonadosomatic index of a carp, *Labeo rohita* from fishponds, Orathanadu, Thanjavur (Dt), Tamilnadu, India

S.No	Month	Ova diameter (mm)	%GSI	
			Male	Female
1	March	0.080	1.20	2.25
2	April	0.120	1.45	2.95
3	May	0.182	2.25	5.35
4	June	0.242	4.20	10.25
5	July	0.305	5.75	11.05
6	August	0.285	3.25	8.80
7	September	0.170	1.45	3.22
8	October	0.007	0.55	1.25
9	November	0.013	0.65	1.05
10	December	0.022	0.85	1.33
11	January	0.035	1.25	1.88
12	February	0.065	1.16	2.03

Maturation of ova

The data on ova diameter of *Labeo rohita* from the fishpond of Orathanadu, Thanjavur (Dt) is presented in Table 1. During the period of twelve months (March 2013 to February 2014) diameter of ova found in the ovaries of *Labeo rohita* was

recorded. The diameter of ova of 80% ranged from 0.285 to 0.305 mm June to August, while 20% ova were found ranged from 0.120 to 182. All the ova (80%) were measured and found to be spherical and uniform in diameter, this indicated that the majority of the eggs were shed in a single batch during the peak period of spawning June to August (Table 1). No evidence was found to show that the resting oocytes in mature females would reach maturity during the current spawning season.

Fecundity

The estimate of fecundity in the present study was based on 15 specimens of mature females of *Labeo rohita* sampled during June to September 2013. These individuals ranged in size from 155 to 300 mm in total length. The estimation of ova, in the present study ranged from 19,950 to 201,150 eggs. The maximum fecundity was observed from a fish with a total length of 300 mm and 130.5 g in weight and the minimum was observed from a fish with a total length of 155 mm and 45.6 g in weight (Table 2). It was noted that the fecundity increased with the increase in total length, gonad weight and body weight of the fish (Figs. 1-2). The fecundity-total length shows relationship, while gonad weight and body weight with fecundity.

Table 2. Total length, body weight, gonad weight and fecundity *Labeo rohita*

S. No.	Length of fish (mm)	Weight of fish (grams)	Gonad weight (grams)	Fecundity
1	155	45.6	1.6	19,950
2	160	64.8	3.2	53,988
3	280	125.2	5.4	1,90,200
4	185	68.0	3.0	54,500
5	200	75.5	3.9	73,380
6	212	81.0	4.0	78,920
7	183	68.0	3.2	54,000
8	162	42.5	1.5	22,500
9	300	130.5	6.2	2,01,150
10	205	72.3	3.2	56,185
11	170	59.4	2.9	40,220
12	196	66.4	3.0	43,250
13	218	80.2	4.0	76,450
14	238	88.2	4.4	101,255
15	276	100.5	4.6	118,200

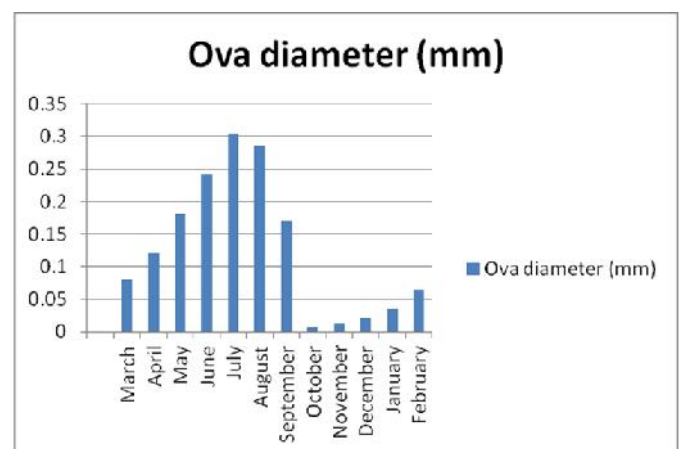


Fig: Monthly variation of mean value Ova diameter of *Labeo rohita*

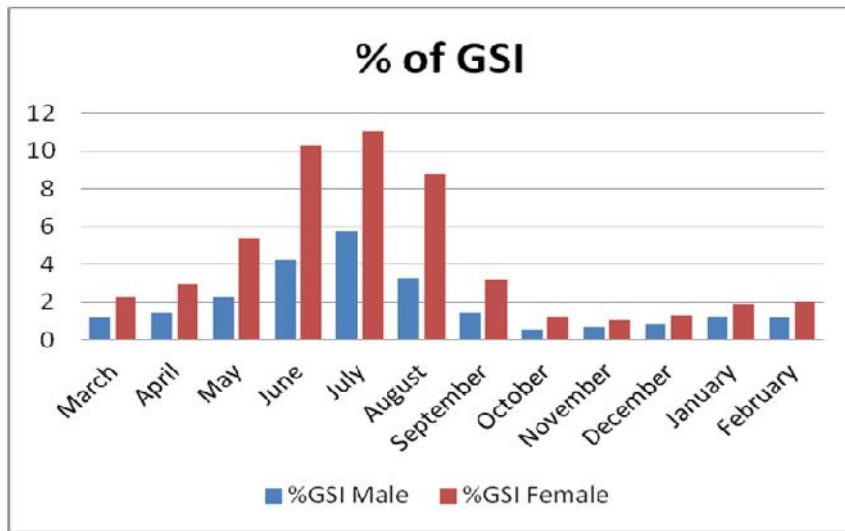


Fig: Monthly variation in GSI of male and female *Labeo rohita*

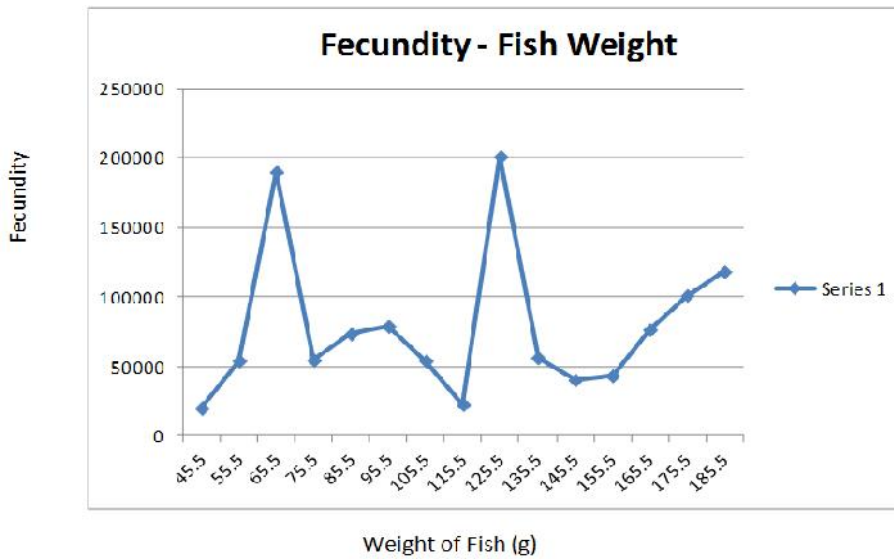


Fig. 1. Relationship between Fecundity and total length of *Labeo rohita*

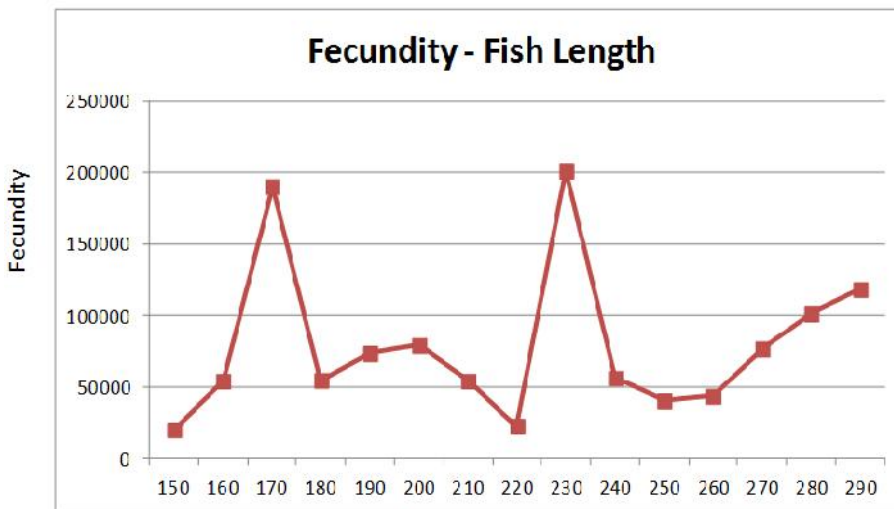


Fig. 2. Relationship between Fecundity and bodyweight of *Labeo rohita*

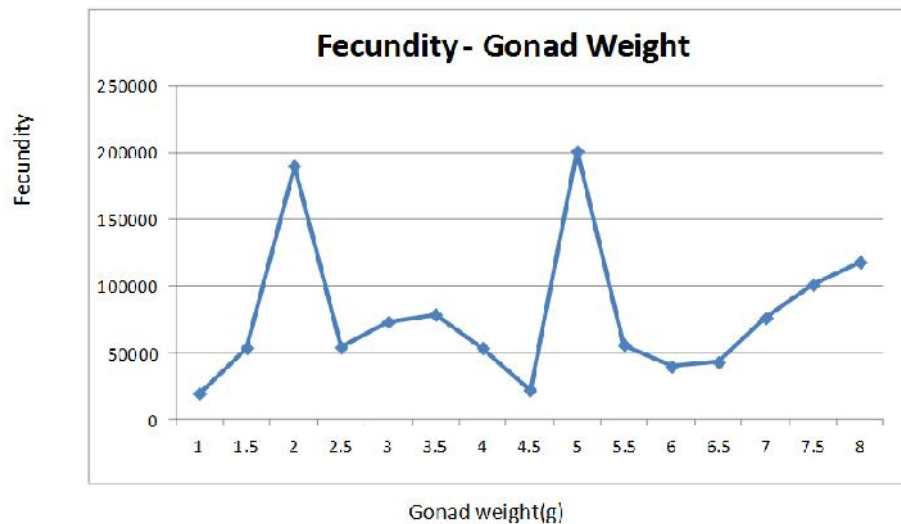


Fig. 3. Relationship between Fecundity and Gonad weight of *Labeo rohita*

DISCUSSION

The gonadosomatic and fecundity study of a carp, *Labeo rohita* from fishpond of Orathanadu, Thanjavur District were described for twelve months from March 2013 to February 2014. It was observed that the fish *Labeo rohita* have only one breeding season of short duration running from June to August, with a peak in July. Similar observations have been made by Rao *et al.* (1972) and Gupta (1975) in *C. reba* from Cauvery, Bhavani Rivers and Muzaffar nagar (U.P) India, respectively. The maximum size of the mature egg found during the present study was 0.305 mm, which is in accordance with the findings of Gupta (1975) in *C. reba* during the month of July. The GSI during the present investigations shows one peak during summer in the month of July (5.07 ± 0.78 and 11.5 ± 1.45 for males and females, respectively). The range of fecundity observed during the present findings was from 19,950 to 20,1150 eggs and size of the egg ranges from 155 mm to 300 mm in total length respectively. This is little lower than that of reported by Khan (1986) as 22,356 to 437,400 eggs from a fish measuring from 152 to 320 mm (TL) in *C. reba* from Baigul reservoir (U.P) India. According to Simpson (1951) the fecundity of an individual female varies according to many factors including age, size, species, and environmental conditions (such as food availability, water temperature and salinity), that supports the present findings. The present investigation clearly indicates that fecundity increased based upon the increase in total length, body weight and gonad weight in *Labeo rohita*.

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