STUDIES ON THE REPRODUCTIVE CAPACITY AND SEX RATIO IN A HILL-STREAM LOACH FISH *NOEMACHEILUS DENISONI* DAY FROM RIVER MANDAL OF GARHWAL HIMALAYA

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The study is related to the reproductive capacity and sex ratio of a beautiful hill-stream loach fish *Noemacheilus denisoni Day* from river Mandal in Garhwal Himalaya. The maximum fecundity is 3729 calculated for a fish measuring 83mm and weighing 5500mg whereas the minimum fecundity was 300 in the fish measuring 63mm and weighing 2601mg respectively. It is observed that fecundity highly dependent on fish length than any other body parameters. The sex ratio was quite natural one for *N. denisoni*.

Key words : Reproductive capacity, sex ratio, *Noemacheilus denisoni* Day, Mandal river.

INTRODUCTION

The study of reproductive capacity, an important branch of fishery science, is useful in several applied aspects of fishery, including its management. The fecundity term considered as the number of eggs likely to be spawned by a fish during one year. *Noemacheilus denisoni* Day, a beautiful hill stream loach of Garhwal Himalaya, inhabits the small streams or rivers. Some important contributions to the reproductive capacity of Indian fishes have been done by Das (1964), Hanumantha Rao (1974), Singh *et al.* (1982), Agrawal, *et al.* (1988), Dobriyal *et al.* (2000), Dobriyal (2005), Kumar *et al.* (2006) and Bahuguna *et al.* (2007). Present paper deals with the reproductive capacity and sex ratio in hill streams loach fish *Noemacheilus denisoni Day* from river Mandal of Garhwal Himalaya.

MATERIALS AND METHODS

Fishes for this study were collected during May 2007 to April 2008 from the Mandal River at Banja Devi sampling spot. The fish were brought to the laboratory in fresh condition and their morphometric data were recorded for each fish. Gravimetric method was used for fecundity count. Total fecundity was calculated by the formul :

$$F = S \times OW / 100$$

Where F= Fecundity, S = Average number of eggs obtained from the three different samples of 100mg each, OW = Total Weight of the ovary.

For the estimation of relationships between fecundity and independent body parameters (Fish length, Fish Weight, Ovary length and Ovary weight), the method of least square was used as :

$$Y = a + bx$$

Table I : Data on the reproductive capacity of *Noemacheilus denisoni Day* (* : Min- Max; Average : ± SD).

S. No.	Size Groups (mm)	Number Of Fish	Fish Length (mm)	Fish Weight (mg)	Ovary Length (mm)	Ovary Weight (mg)	Fecundity
1.	60 – 65	06	63 – 65 64.25±0.99	2601-2780 2690.5±126.57	15 – 16 15.50±0.70	300 – 310 304.5±6.36	300 – 441 370.5±99.7
2.	66 – 70	08	66 – 70 67.20±1.92	2900 – 3407 3089.25±224.46	16 – 18 17.00±0.81	330 – 415 356.3±40.31	256 – 560 408±214
3.	71 – 75	09	71 – 75 73.14±1.57	4201 – 5105 4786.42±585.3	20 – 30 23.14±3.28	312 – 874 506.2±81.3	444 – 2097 1273±670
4.	76 – 80	07	76 – 80 78.14±1.34	4302 – 5904 51702±621.9	21 – 32 27.50±4.52	402 – 1390 1008.2±318.06	572 – 3078 2170.3±890
5.	81 – 85	09	81 – 85 82.00±.81	4708 – 5500 5010.1±318	29 – 39 33.42±4.42	850 – 1380 1137±295.45	964 – 3729 2296±1148

Table II : Sex ratio in *Noemacheilus denisoni* during 2007 to 2008 from river Mandal.

Month	Total no of fish examined	No. of Male fish	No. of Female fish	% of Male fish	% of Female fish	Sex (M)	Ratio (F)	Chi-Square (X^2)	Remarks
May	26	10	16	38.46	61.54	1.00	1.60	1.38	NS
June	19	07	12	36.84	63.16	1.00	1.71	1.31	NS
July	16	05	11	31.25	68.75	1.00	2.20	2.25	NS
August	04	02	02	50.00	50.50	1.00	1.00	0.00	NS
September	08	05	03	62.50	37.50	1.66	1.00	0.50	NS
October	08	04	04	50.00	50.00	1.00	1.00	0.00	NS
November	10	06	04	60.00	40.00	1.50	1.00	0.40	NS
December	12	07	05	58.33	41.67	1.40	1.00	0.33	NS
January	11	05	06	45.45	54.55	1.00	1.20	0.09	NS
February	11	04	07	36.36	63.64	1.00	1.75	0.82	NS
March	9	05	04	55.55	44.45	1.25	1.00	0.11	NS
April	15	06	09	40.00	60.00	1.00	1.50	0.60	NS
Total	149	66	83	44.29	55.79	1.00	1.25	1.94	NS

X^2: Values are not significant at either level (d. f .1 on p= 0.05 is 3.84.); M = Male, F = Female.

Where Y = Fecundity (dependent variable), x = Body parameters (independent variables), a = Slop and b = Intercept. Sex ratio was noted for entire period of study and its signification was tested by chi-square test (X^2).

OBSERVATIONS

The Length : Length of fishes, which were considered for the present study ranged from 63mm to 85mm. Data on the reproductive capacity of *Noemacheilus denisoni Day* are presented in the Table I. These relationships were traced with the help of regression analysis. The fish were in a range of 63 to 85mm length and 2601 to 5500 mg in body weight. The maximum fecundity was 3729 calculated for a fish measuring 83mm and weighing 5500mg whereas the minimum fecundity was 300 in the fish measuring 63mm and weighing 2601mg. The relationships of fecundity with different body parameters were observed straight and the equations obtained were as follows :

F =   62.4529 + 0.0083 FL, r = 0.9903
F =   2175.7694 + 1.2295 FW, r = 0.8624
F =   11.7721 + 0.0097 OL, r = 0.9371
F =   423.6214 + 0.2503 OW, r = 0.7187

Where F = Fecundity, FL = Fish length, FW = Fish Weight, OL = Ovary length, OW = Ovary weight and r = Coefficient of correlation.

Sex ratio : The sex ratio of *Noemacheilus denisoni* noted from river Mandal during May 2007 to April 2008 is presented in the Table II. A total number of fish collected were 149 out of which the numbers of female fishes were 83(55.71) and male fishes were 66 (44.29), the average ratio was 1 : 1.25(female: male).

DISCUSSION

The estimation of fecundity is an important aspect of applied fishery sciences. It provides prior information regarding numbers of eggs that are likely to receive for hatching process and further management of nursery stated by Dobriyal (1983). Various workers reported the reproductive capacity or fecundity term of relative fecundity, which is the number of eggs per unit weight of the fish considered by Joshi & Khanna (1980) and Dobriyal & Singh (1989). In the present study 35 specimens were collected and observed for the estimation of fecundity in *Noemacheilus denisoni Day*. The fecundity varied from a minimum of 300 in fish measuring 63mm and maximum 3729 in the fish 85mm. The mature ovaries of *N. denisoni* were dark yellowish in colour, which occupied maximum space in abdominal cavity during breeding. The full mature ovary of the fish generally had two equal lobes which is found in the present work too. These studies were conducted on the four linear relationships between fecundity and body parameters for *N. denisoni Day*. It was observed that the fecundity highly dependent on fish length than any other body parameters.

Bhatnager (1964) reported the fecundity range of *Labeo dero* from 67,288 to 7, 10,934 in the fish length 33 to 53cm. The biology of *C. mrigala* was studied by Hanumantha Rao (1974) who reported its fecundity 75.900 to 11, 23,200 in the range of 39 to 81 cm. According to Sunder (1984), the fecundity of *S. longipinnis* was to less or

more equally related to the length and weight of the fish. Agarwal *et.al.* (1988) in *Noemacheilus montanus* observed fecundity consistently increased with an increase in the body parameters and straight line relationship has been observed in all the cases. The fecundity of *Barilius bendelisis* was reported from Garhwal region in a range of 900 to 5,048 in the fish measuring 7.5 to 11.5 cm and ovary weighing from 700mg to 2.42gm by Dobriyal *et.al.* (2000). Kumar *et.al.* (2006) reported low fecundity of *Botia dayi* Hora in a range of 2225 to 8840 for the fish measuring 10.1 to 14.5 cm and weighing 11.72gm to 38.6gm. Bahuguna *et.al.* (2007) observed a high fecundity of 360 to 1727 for an ornamental hill stream minor carp *Puntius conchonius* (Ham. - Buch.)

The study of sex ratio of a population has been considered of immense importance in the fisheries. Mostly all the hill stream fishes the annual average sex ratio is nearly 1male: 1 female with slight variation. In the present study sex ratio of 1 : 1.25 (Male : Female) was observed in *Noemacheilus denisoni* Day (X^2 = 1.94 Non Significant). Rautela (1999) studied sex ratio in *Glyptothorax telchitta* and *Garra lamta* 1 : 1.052 and 1 : 1.18 (male : female) respectively. Kumar *et al.* (2006) stated that the sex ratio in rare hill stream fish *Botia dayi hora* was noticed 1:1.04(male : Female). Bahuguna *et.al.* (2007) reported that the sex ratio was quite natural one in *Puntius conchonius* (1 Male : 1.17 Female).

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