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Study on Breeding Capacity of Snow Trout *Schizothorax richardsonii* (Gray) From River Yamuna, Uttarakhand, India

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ABSTRACT

This study deals with the assessment of the breeding capacity of snow trout, *Schizothorax richardsonii* (Gray) in the snow-fed River Yamuna from Doon Valley, Uttarakhand, India. During the present study, it was observed that the overall breeding capacity of snow trout *S. richardsonii* varied from a minimum value of 450 to a maximum value of 15940 in the fish measuring nearly 11cm. to 34.7cm. respectively. The breeding capacity was dependent on the ovary weight than any other body parameters.

Keywords: Breeding capacity, *Schizothorax richardsonii (Gray),* River Yamuna, India

INTRODUCTION

Schizothorax richardsonii (Gray) is locally known as "Asaila or Maseen". It is an economically important fish belonging to the order Cypriniformes and family Cyprinidae with great food value (Bahuguna and Rayal, 2006a,b; Rayal, 2020, 2021). The breeding capacity of a fish can be defined as the number of eggs that are probable to be laid during one spawning period or the capacity of the fish in terms of egg production (Bagenal,1978). Studies on the fecundity of fishes are very crucial in understanding their breeding capacity (Bahuguna and Dobriyal, 2019). The measure of fecundity in fishes is a basic determinant of productivity and hence, contributes to fish culture and population dynamics. Numerous ichthyologist they done very good work on breeding biology of fish viz. fecundity or breeding capacity(Sarojini, 1957; Swarup, 1962; Jyoti and Malhotra, 1972;Dobriyal, 1988,2011, 2012; Bhat and Dutt, 1987; Dobriyaland Singh, 1989; Bhutiyan and Islam, 1990; Hossain et.al, 1997; Dobriyal et.al, 2004,2010; Kumar et.al, 2006; Bahuguna et.al, 2007, 2009, 2010, 2011; Joshi et.al, 2010, 2014; Baruah and Borah, 2008; Bahuguna and Kumar, 2011; Krishan et.al, 2011; Bahuguna 2012; Rashid and Dobriyal, 2020; Bahuguna et.al, 2021) and sex ratio or population composition (Bahuguna and Kumar, 2011; Krishan et.al, 2011; Bahuguna et.al, 2011; Bahuguna, 2013; Joshi et.al, 2014; Rayal et.al,2021a, 2021b), primary and secondary sexual dimorphism (Badola et.al,1982; Dobriyal et.al, 2007; Bahuguna et.al, 2010,2013) and maturation biology (Bisht et.al,2005;Joshi et.al, 2007; 2008; 2009; Kumar et.al, 2006; Bahuguna and Kumar, 2011; Bahuguna and Dobriyal, 2013; Bahuguna, 2007;2012; Bahuguna et.al, 2010 and Dobriyal 2021).

Present communication deals with the breeding capacity of *S. richardsonii* (Gray) from Uttarakhand, India. It is found to inhabit the running water column and pebbly bottom of the snow-fed river Yamuna. Families with low economic conditions use this to fulfill their daily protein needs.

MATERIAL AND METHODS

Study Site

River Yamuna is the longest tributary of river Ganga and originates from Yamnotri glacier at a height of 6387meters from Bandarpooch peaks of the lower Himalayas in Uttarakhand. It flows through Uttarakhand, passes Paonta

sahib at Himachal Pradesh then travels through Haryana, UP and Delhi. It finally merges with Ganga at Triveni Sangam in Prayagraj. Its habitat has inundated from riverine to lacustrine due to its impoundment for various reservoirs viz. Aasan Barrage, Dakpathar Barrage and Hathnikund Barrage etc. Aasan Barrage in 2020 was declared as Uttarakhand's first Ramsar site. While many hydropower plants namely Dhalipur Dhakrani powerhouse, Kulhaal hydro powerhouse etc. have been constructed on the river. This obstructs the natural flow pattern as well as affects the fish density and diversity of the river Yamuna and its tributaries (Rayal et.al, 2021).

The fish samples were collected by employing traditional fishing gear (Bahuguna et.al, 2010; Bahuguna and Joshi, 2012; Bahuguna 2020, 2021; Rayal et.al, 2021). The samples were immediately preserved with 5-8% formalin solution upon arrival in the laboratory. A total of 14 female fish *S. richardsonii* (Gray) were collected with the help of local boys catch at snow-fed river Yamuna from Doon Valley from March 2020 to Februrary 2021. For the sampling, the Barkot site was selected which is located at 30°48'39.2"N, 78°11'59.3"E.

Laboratory Work

Total length (TL) was measured to the nearest 1mm. Whole fish body weight (BW) was taken on a digital balance with 0.001mg accuracy. The whole ovary was removed from each female fish. Each ovary length (OL) and weight (OW) were measured to the nearest 1mm and to the nearest 0.001mg, respectively. For the estimation of fecundity, the middle and posterior parts of the ovary were taken and the number of ova in each sample was counted with the help of a binocular microscope. The Breeding capacity or fecundity was calculated as follows:

$$B.C. = S \times OW/100$$

Where,

B.C. = Breeding capacity,

S = Average number of ova from samples of 100 mg each,

OW = Total weight of ovary.

The relationship between breeding capacity and other body parameters were obtained by the least square test, using the formula as: Y = a + bx, Where Y = (Breeding capacity, dependent variable), x = Body parameters (independent variables); a = Slope and b = Intercept.

RESULTS

In sequence on the subject of breeding capacity, different body parameters are presented in Table 1. The fish length ranged between 11.0cm. to 34.7cm. while bodyweight varied from 30.0 gm to 240.92 gm. The minimum breeding capacity value was recorded as 450 for fishes measuring 11cm. length and weight 30gm, whereas maximum breeding capacity value was noted as 15,940 in the fishes measuring 34.7cm. length and weighing 240.92gm. The breeding capacity was thus dependent on the ovary weight rather than any other body parameters.

The relationships of breeding capacity with different independent body parameters were observed straight and presented in Fig. 1 to 4. The mathematical equations obtained were as follows: The equation (BC = a +bx)

1. BC = –9713.4 + 631.62 FL, r = 0.8021; r^2 =0. 6434
2. BC = –2392.2 + 55.699 FW, r = 0.7935; r^2 = 0.6297
3. BC = –6947.3 + 1633.8 OL, r = 0.8238; r^2 = 0.6787
4. BC = –1098.8 + 196.34 OW, r = 0.9555; r^2 = 0.913

(Where BC = breeding capacity, FL = Fish length, FW = Fish weight, OL = Ovary length, OW = Ovary weight, and r = Coefficient of correlation).

Table 1: Summarized data of different body parameters and fecundity of *Schizothorax richardsonii* (Gray).

S. No.	Size Groups (cm)	Number of Fish	Fish Length (cm)	Fish Weight (gm)	Ovary Length (cm)	Ovary Weight (gm)	Fecundity
1	10.1-15.0	06	11-15* 13.5±1.5	30.00-46.70 37.82±8.12	3.6-4.9 4.13±0.70	7.02-10.01 8.52±1.49	450-668 543.33±22.96
2	15.1-20.0	04	16.5-19.8 18.03±1.96	55.20-68.42 60.57±7.19	5.2-6.9 6.37±1.24	11.79-15.25 13.50±2.01	1008-1490 1260.00±192.4
3	21.1-25.0	05	22.0-25.0 23.67±1.54	100.00-140.80 123.45±20.81	7.2-7.9 7.33±0.25	18.96-42.78 32.15±8.30	1849-7848 4136.66±312.7
4	25.1-30.0	16	25.1-29.8 27.0±1.94	140.00-225.95 175.56±36.57	6.2-10.8 8.65±1.23	21.32-58.18 41.53±14.74	1950-10246 6898±890.32
5	30.1-35.0	08	30.2-34.7 32.9±1.81	180.76-240.92 210.58±30.8	10.7-11.7 11.23±0.3	59.29-78.19 69.82±7.22	10270-15940 13668±998.39

Min-Max, Average±SD*

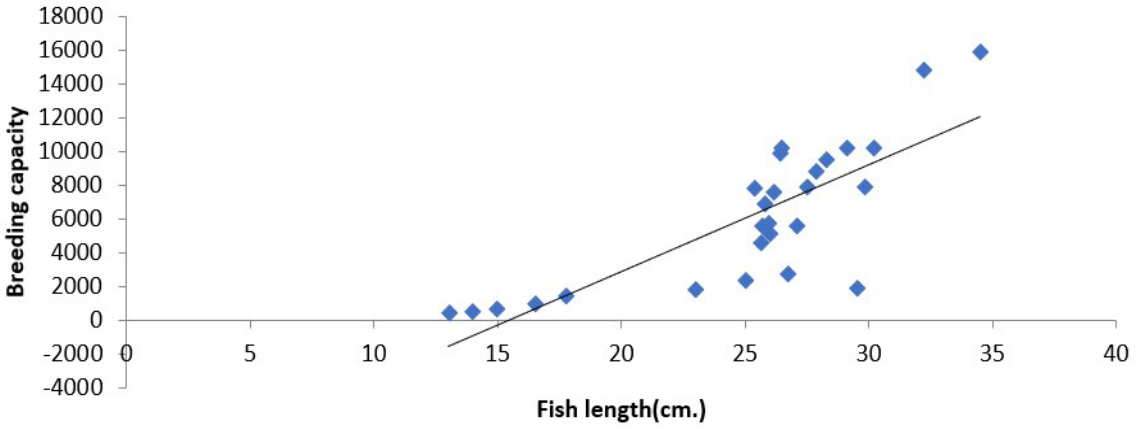

Fig.1: Relationship between fish length and breeding capacity.

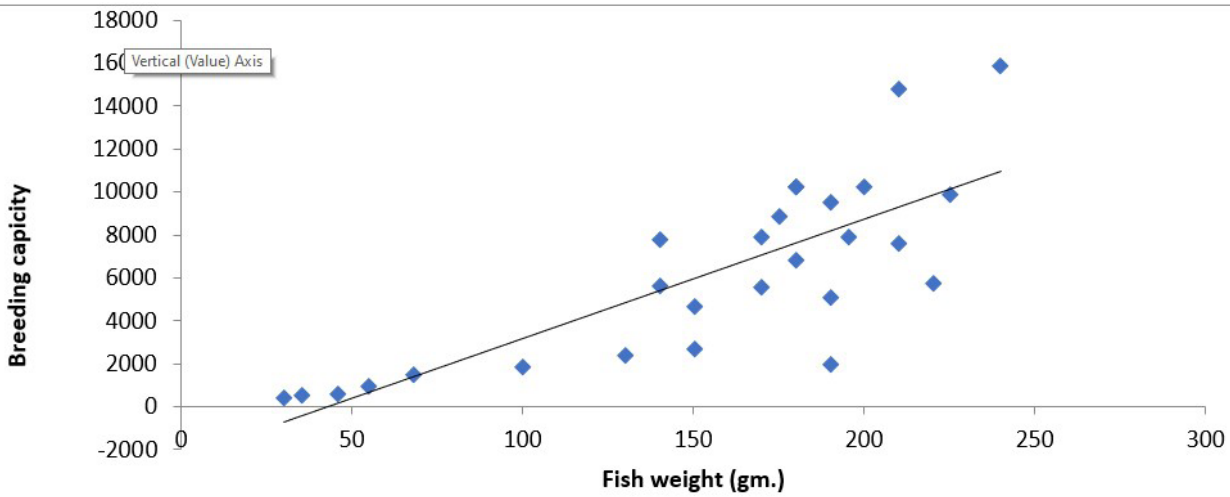

Fig.2: Relationship between fish weight and breeding capacity.

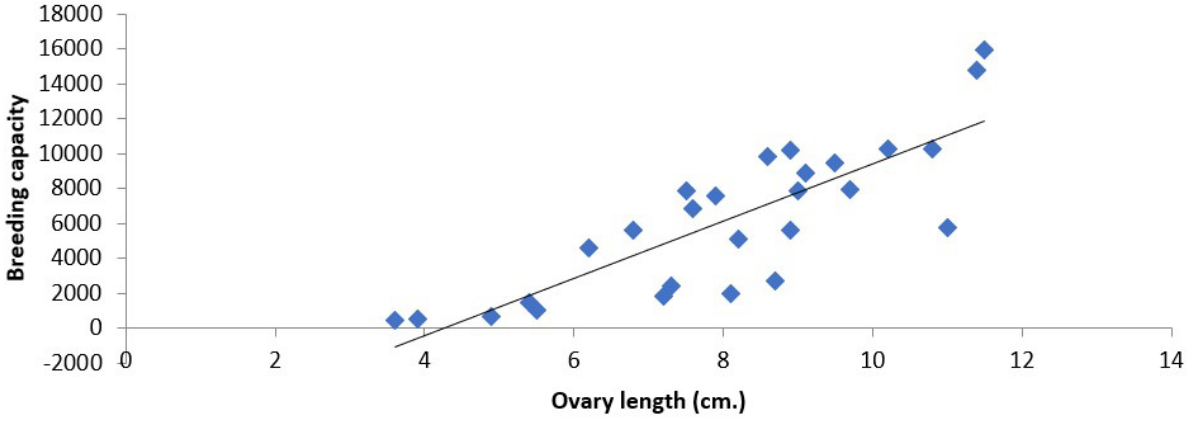

Fig.3: Relationship between ovary length and breeding capacity.

DISCUSSION

S. richardsonii (Gray) is an important nutritional edible fish with a good breeding capacity considering its body size. The snow-fed river fishes show great variation in their breeding potential. It is mostly dependent on the habitat ecology of the river. The value of breeding capacity in *S. richardsonii* (Gray) oscillated from 450 (fish length-11cm.) to 15,940 (fish length-34.7cm.). A straight line relationship was noted between the fish parameters (like Fish length, Fish weight, Ovary length, and Ovary weight) and breeding capacity. The breeding capacity was more dependent on ovary weight (r= 0.9555) and ovary length (r=0.8238), than the fish body length (0.8021) and fish body weight (0.7935). A similar observation was noticed by Bahuguna (2012) in wild major carp *Labeo dyocheilus* from Kumaun Himalaya, India and Rayal et.al.(2021) in snow-fed minor carp *Barilius bendelisis* from river Yamuna, Doon valley.

According to Das and Koul (1965), the fecundity of *Schizothorax richardsonii* varied from a minimum value of 2600 to a maximum value of 16605 for the length groups ranging from 21.6 to 33.1 cm from Kashmir. Mir (1979) from Sindh Nallah in Kashmir reported it to fluctuate from 25,98 to 27,312 for the length groups oscillating from 24.1 to 33.1 cm. Mishra (1982) calculated that the breeding capacity value of *Schizothorax richardsonii* as 3832 to 5310 in the length groups ranging from 35.5 to 53.1 cm. from river Alaknanda of Garhwal Himalayas. Qadri *et al*., (1983) in their study from Sindh and Telbal Nallahs, reported the fecundity of *Schizothorax richardsonii* varying from 2598 to 27846 in the length groups of 22.0 to 47.5 cm. Similarly, Shekhar (1990) reported that the number of total eggs (fecundity) varied from 970 to 6035 from Neeru Nallah in Bhadarwah.

Differences in breeding capacity in several studies have been associated with population density, temperature, food supply, stress and other environmental factors (Bagenal, 1978). According to Chondar (1977), the number of egg production depends upon the ovary weight more closely. El-sarafy (1981) and Thorpe *et al*. (1984) have suggested that egg production varies among individuals and the population of fish species due to differences in age and size. Nikolsky (1963) reported that the food consumed by the fish plays an important role not only in the fecundity but also in the quality of the egg and its fertilization.

The statistical examination of the present work showed a correlation between breeding capacity and various body parameters. However, the correlation between ovary weight and breeding capacity came out to be the maximum (r=0.9555) indicating the dependence of breeding capacity more on ovary weight than any other body parameter. These results are in agreement with the findings of Bhatnagar (1964), Sinha (1972), Singh *et al*., (1982); Dobriyal and Singh (1987); Shekhar (1990) and Bahuguna et.al. (2021).

CONCLUSIONS

The present research work is an account of the *Schizothorax richardsonii* (Gray) inhabiting the lotic system of river Yamuna from Doon valley. The Genus is a medium breeding capacity snow trout which shows the direct dependence of breeding capacity on the ovary weight.

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