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FECUNDITY OF THE SNOW FED MINOR CARP *Barilius bendelisis* (HAM.) (PISCES: CYPRINIDAE) FROM RIVER YAMUNA, INDIA

RAJESH RAYAL[1], SARASHTI GOEL[1*], H. K. JOSHI[2], NEHA SHARMA[1] AND PANKAJ BAHUGUNA[3]

[1]Department of Zoology, S.G.R.R. University, Dehradun - 248001, U.K., India.
[2]Department of Zoology, Govt. Degree College Chaubatakhal, Pauri Garhwal – 246162, U.K., India.
[3]Aquatic Biodiversity Lab, Department of Zoology, B. D. Govt. P.G. College, Jaiharikhal-246193, Uttarakhand, India.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Authors RR, HKJ and PB designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors SG and NS collected the fish sample, performed the statistical analysis and managed the literature search. All authors read and approved the final manuscript.

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ABSTRACT

The present study deals with the observation of fecundity of the snow fed minor carp *Barilius bendelisis* from river Yamuna, state Uttarakhand, India. The fecundity of the snow fed water fish varies from a lowest 162 to a highest 4203, the fish measuring to 58mm to 120mm respectively. It is observed that fecundity was maximum depending upon the fish length and ovary weight than any other body parameter.

Keywords: Fecundity; *Barilius bendelisis*; doon valley.

1. INTRODUCTION

Barilius bendelisis (Hamilton) locally known as "Jabula" is an ornamental fish having food value. It is found to inhabit the sandy and pebbly bottom of Snow fed river Yamuna. *B. bendelisis* belonging to the order Cypriniformes and family Cyprinidae is an ornamental fish and in this local region of Uttarakhand is used as food. Family with low economic conditions use this to fulfil their daily Protein needs. The knowledge of fecundity, its mathematical relationship, with the body parameters and sex-ratio is considered very useful in fishery sciences' as it provides prior information regarding number of eggs that are likely to be received for hatching process and further management of nursery

**Corresponding author: Email: sarashtigoel21@gmail.com;*

etc. [1]. Fecundity and its relation with different body parameters of female fish make it possible to estimate the potential of egg output [2] and the potential number of offspring in a season and reproductive capacity of fish stocks [3].

Assessment of reproductive biology (GSI, fecundity, spawning period and sex ratio) in different water bodies of Garhwal Himalayas have been reported by Badola and Singh [4] and Dobriyal and Singh [5]. However, reproductive biology of *B. bendelisis* in breeding capacity has not been attempted from snow fed River. Therefore, the present study is aimed to observe the fecundity of *B. bendelisis* in wild habitat. Till date available literature on the fecundity of *Barilius bendelisis* by Dobriyal and Singh [5], Bahuguna et al. [6] however, they worked on the samples from spring fed water streams but present work is the first-time record on the samples from Snow fed water stream.

Several ichthyologist have worked on the fecundity of different fish viz. Dobriyal and Singh [5], Kumar et al. [7], Bahuguna et al. [1,8,6,9], Joshi et al. [10], Dobriyal et al. [11], Bahuguna and Kumar [12], Krishna et al. [13], Bahuguna [14], Dobriyal [15] and Joshi et.al, [16]. Present study deals with the fecundity in snow fed water Cyprinidae fish *Barilius bendelisis* (Ham-Buch.) from river Yamuna, Doon Valley, state Uttarakhand, India.

2. MATERIALS AND METHODS

The present work was done in Snow fed river Yamuna from Doon Valley, India. The geographical location of the sampling area is 30° 26'02.5" N and 77° 37'23.7" E. The fish was caught by means of the traditional fishing gears (cast net and tarjal) [17]. The samples were immediately preserved with 5% formalin solution upon arrival in the laboratory. A total of 28 female fish *Barilius bendelisis* were collected with the help of local fisherman catch at snow fed river Yamuna from Doon Valley during July 2020 to April 2021(Fig. 1) All specimens were sexed by gonad observation under a binocular microscope to identify the mature females for this study. For each individual, morphometrics were assessed. Total length (TL) and Standard lengths (SL) were measured to the nearest 1mm. Whole body weight (BW) was taken on a digital balance with 0.001 mg accuracy. The whole ovary was removed from each female fish. Each ovary length (OL) and weight (OW) was measured to the nearest 1mm and to the nearest 0.001mg, respectively. 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.

3. OBSERVATION AND RESULTS

Study shows that, *Barilius bendelisis* (Ham.) reaches a maximum total length of 120 mm, and a minimum length of 58 mm. The summarized data about the breeding capacity is given in Table 1. Different type of relationships of the ovary length and weight parameters in *Barilius bendelisis* were calculated with the help of Regression Analysis.

1. **Fish length and Fecundity:** The fecundity of the fish varied from a minimum 162 to a maximum of 4203, the fish length goes from 58 to 120 mm respectively. The obtained regression equation for fish length and Fecundity is as follows: F = -4807.5 +72.96x, r = 0.95026 (Fig. 2)
   Where, F is fecundity, r is correlation coefficient.
2. **Fish weight and Fecundity:** The maximum fish weight was noticed 4920 mg during the study period while the minimum was 1525 mg. The regression equation expressed for fish weight was as follows: FW = -1813.2+1.1318, r = 0.8752 (Fig. 3).
3. **Ovary length and Fecundity:** The minimum Fecundity was obtained in a ovary length of 10 mm and maximum in a ovary length of 50 mm. This shows the regression equation for ovary length and fecundity relationship as follows: F = -1113 + 73.677, r = 0.76615 (Fig. 4).
4. **Ovary weight and Fecundity:** The lowest fecundity of 162 is observed in the ovary weight 142 mg and the highest Fecundity of 4203 is shown in ovary weight of 2112 mg. The regression equation obtained from the above data is: F = -248.41 + 1.6774, r = 0.9328 (Fig. 5).

Fig. 1. Female fish, *B.bendelisis*

Table 1. Summarised data on the fecundity of *B. bendelisis* from River Yamuna

Class interval	Fish length (mm.)	Fish weight (mg.)	Ovary length (mm.)	Ovary weight (mg.)	Fecundity
51-60	58-60*	1525-1561	10-11	142-150	162-172
	59 ± 1.414	1543 ± 25.456	10.5 ± 0.707	146 ± 5.657	167 ± 7.071
61-70	64-70	1592-1670	12-12	155-347	180-299
	67 ± 4.243	1631 ± 55.154	12 ± 0	251 ± 135.765	239.5 ± 84.146
71-80	72-80	1780-1957	16-38	370-679	328-780
	76.23 ± 3.193	2414.45 ± 532.321	29 ± 7.746	545.33 ± 129.562	635.778 ± 135.347
81-90	82-89	2510-2982	39-41	502-1212	820-1817
	85.5 ± 2.739	2684.67 ± 165.978	38.833 ± 1.602	860 ± 259.058	1171.333 ± 373.593
91-100	93-100	3316-3960	42-45	1549-2012	1278-2681
	97.25 ± 3.096	3528.5 ± 302.727	43.5 ± 1.291	1806.75 ± 233.151	2182.5 ± 619.318
101-110	108	4314	48	2040	3842
111-120	116-120	4472-4920	48-50	2088-2112	4012-4203
	118 ± 2.828	4696 ± 316.784	49 ± 1.414	2100 ± 16.971	4107.5 ± 135.057

**Lower limit - upper limit*
Average ± Standard Deviation

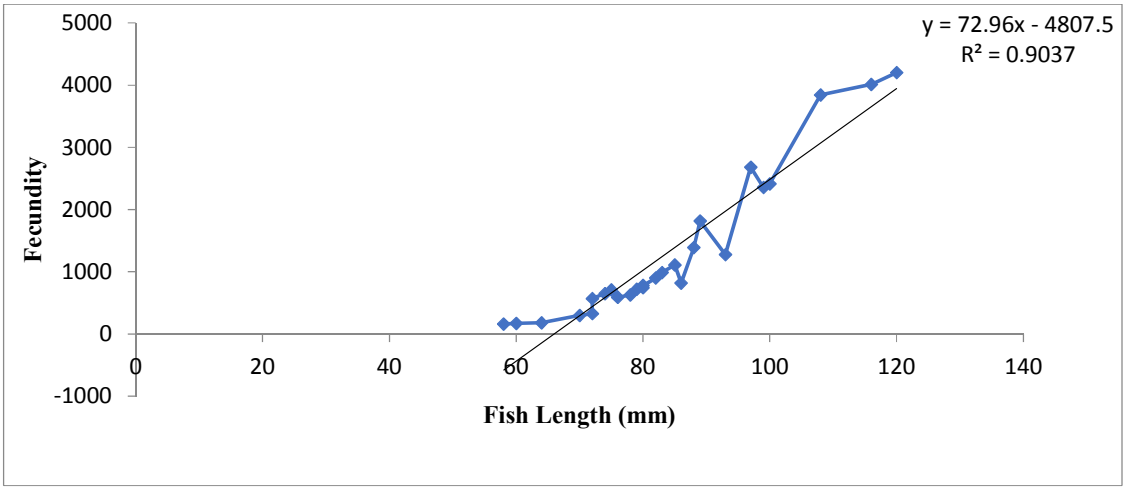

Fig. 2. Relationship between fish length and fecundity

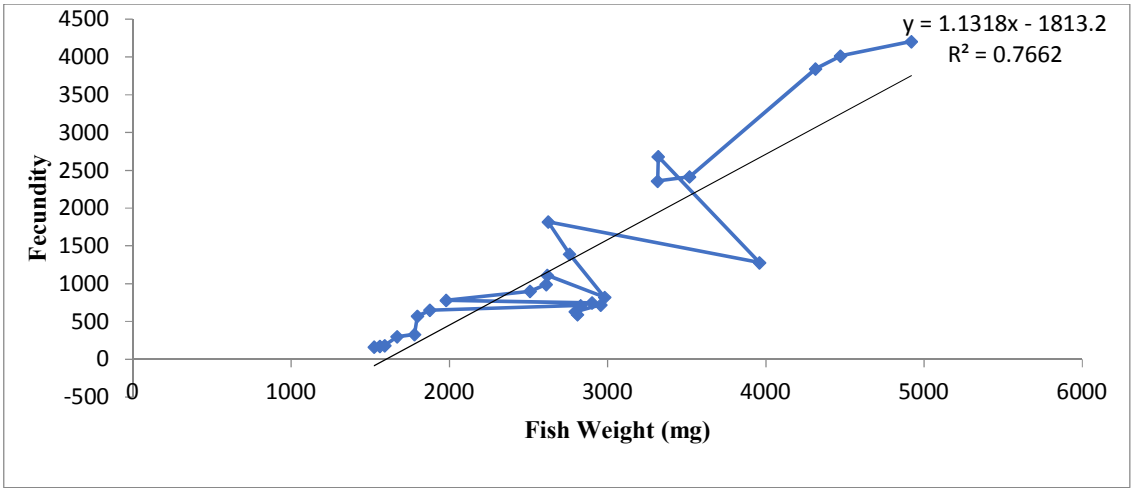

Fig. 3. Relationship between fish weight and fecundity

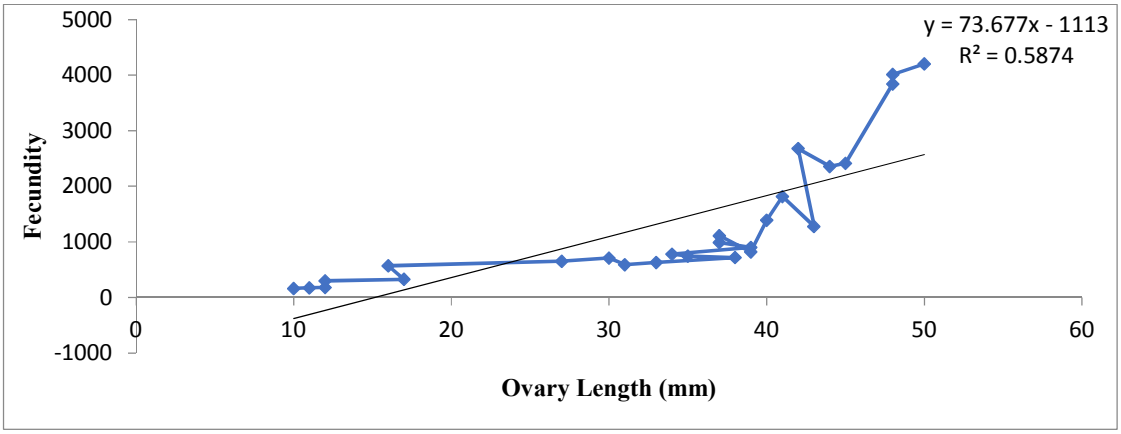

Fig. 4. Relationship between ovary length and fecundity

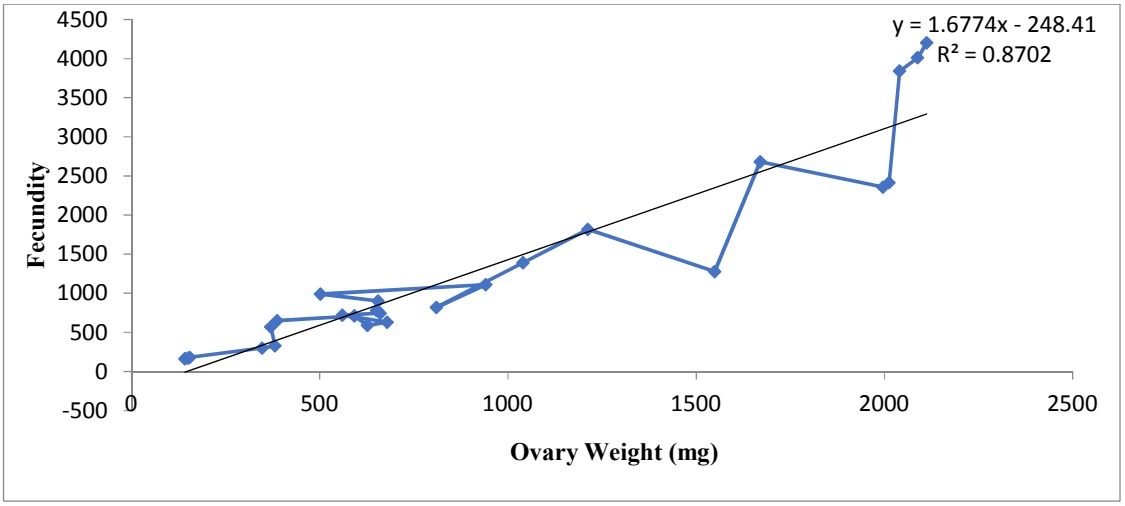

Fig. 5. Relationship between ovary weight and fecundity

4. DISCUSSION

Barilius bendelisis (Ham.-Buch.) is an ornamental fish with a good breeding capacity considering its body size. The hill stream fishes show great variation in their breeding potential. It is mostly dependent on the habitat ecology of the river. In *Barilius bendelisis* the breeding capacity is observed from 162 to 4203 and is directly proportional to the body parameters. A straight line relationship is observed between the fish parameters (like Fish length, Fish weight, Ovary length and Ovary weight) and fecundity.

Dobriyal and Singh [5] reported comparatively higher fecundity (900–5048 eggs) in *B.bendelisis* from Garhwal Himalayan region. Bahuguna et al. [6] noticed in *Barilius bendelisis,* the breeding capacity was observed from 192 to 4317 and increases with an increase in all the body parameters. The straight-line relationship has been observed between the fish length and breeding capacity, fish weight and breeding capacity, ovary length and breeding capacity, ovary weight and breeding capacity. The breeding capacity was more dependent on ovary weight (r= 0.9395) and fish body weight (0.8936) than the fish body length (0.7999) and ovary length (r=0.7601). Saxena et al. [18], reported that the number of total eggs (absolute fecundity) varied from 320 to 4000 in *B.bendelisis* from Gaula River. The breeding potential of *Barilius vagra* was estimated by Bahuguna et al. [8] from Garhwal region ranging from 510 to 7214 eggs in the fish measuring 55 mm to 89 mm in total length and 407 mg to 4260 mg ovarian weight. Kumar et al. [7] noticed low fecundity of *Botia dayi Hora* in a range of 2,225 to 8,840 for the fish measuring 10.1 to 14.5 cm. and weighing 17.72 gm. to 38.6 gm.

In the present study, low fecundity was observed in fishes found in snow fed water as compared to fishes in spring fed water conditions. This can be ascribed due to environmental factors like temperature and availability of food. The temperature of Snow fed water is low in contrast to spring fed water streams. Doha and Hye [19] reported that the change in fecundity among two populations is common and also concluded that the fecundity of fish by an individual female is depended upon various factors like age, size, food availability, space, climate condition, season, environmental factors, habitat, nutritional status and genetic potential.

According to Nikolsky [20], the food consumed by fish determines not only the fecundity but also the quality of eggs and percentage of their fertilization. Dobriyal and Singh [5] reported the fecundity in a range of 900 to 5048 for *B. bendelisis*. A considerable variation in the fecundity between fish of equal length is common and it may be due to environmental factors, such as temperature, food availability and generic differences (Blaxter, [21]; Gibson and Ezzi, [22]; Hoda and Akhtar, [23]. In the present work, fecundity was more dependent on fish length (0.9506) and ovary weight (r= 0.9328) than the fish weight (0.8753) and ovary length (r=0.7664). Fecundity was increase with fish length and ovary weight of fish high correlation. Fecundity can change with age, and this seems a possible factor. Differences in fecundity between areas have in several studies been associated with population density, temperature, food supply, stress and other environmental factors (Bagenal, [24]. According to Chondar [2], the number of egg production depends upon the ovary weight more closely.

5. CONCLUSION

Barilius bendelisis is a beautiful ornamental fish found in the snow fed Yamuna River of Uttarakhand. In *Barilius bendelisis* the breeding capacity is observed from 162 to 4203. Low fecundity was observed in fishes found in snow fed water as compared to fishes in spring fed water conditions. This can be ascribed due to environmental factors like temperature and availability of food. The temperature of Snow fed water is low in comparison to spring fed water streams.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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