

## Short Communication

# On the fecundity of *Schizothorax curvifrons* Heckel from River Jhelum, Kashmir

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### Abstract

Fecundity of *Schizothorax curvifrons* weighing 77-736 g (total length, 194-411 mm) ranged from 4,843 to 31,221 eggs ( $\bar{x}$  11,998). Relative fecundity varied from 25 to 70 ( $\bar{x}$  45). Per cent coefficient maturity of fishes (IV-VI stages of maturity) was in the range of 6.9 to 14.0 ( $\bar{x}$  11.3). Absolute fecundity ( $\text{kg}^{-1}$  of the body weight) was estimated to be 44,437. It was found that the fecundity was better related to the weight than the length of the fish. The fecundity in 2<sup>+</sup> year specimens was observed to be 4,483 and the increase was significant with the advancement of age. In 6<sup>+</sup> years of its life, fecundity increased nearly to four folds i.e. 21,461 eggs per spawn.

**Key words:** *Schizothorax*, absolute fecundity, relative fecundity, gonado-somatic index.

## 1. Introduction

*Schizothorax curvifrons* forms an important food fishery amongst the endemic carps (Sub-family Schizothoracinae) inhabiting River Jhelum, a major Himalayan river in Kashmir. Although various aspects of biology of some other schizothoracids have been studied by many workers<sup>1-5</sup>, the biology of *S. curvifrons* has not been studied in detail. Hence, investigations on the fecundity of *S. curvifrons* were undertaken for a period of two years.

## 2. Material and methods

A total of 60 female specimens of *S. curvifrons* measuring 196-411 mm in total length (weight range: 77-736 g) were procured from River Jhelum during July 1980-June 1982. Fecundity estimates were made separately for either lobes of the ovaries in ten specimens. Absolute fecundity was determined by gravimetric method. Mature ovaries alone (stage IV-VI) were considered for fecundity studies. After removing the adhering water, using a blotting paper, the number of ova visible to the naked eye from weighed ovarian samples was counted. On the basis of the total weight of ovaries, fecundity was estimated. To avoid any error,

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fecundity was calculated from pooled counts of mature ova in three random sub-samples of the ovary of a known weight<sup>6</sup>. The relationships between fecundity and fish length, fecundity and fish weight, fecundity and ovary weight and fish weight and ovary weight were determined by the method of least squares. The age of the fish used for fecundity studies was worked out by hard parts viz., vertebrae, otoliths and opercular bones.

### 3. Results and discussion

In 90% cases of *S. curvifrons*, the differences between the fecundities of the two lobes of the ovary were statistically insignificant and the overall pooled chi-square test also did not show any significance between the fecundity of either lobes.

Fecundity details of various specimens of *S. curvifrons* during the period of observations are given in Table I. Fecundity, as calculated, ranged from 4,843 to 31,221 eggs with an

**Table I**  
**Average fecundity counts at various length ranges in *Schizothorax curvifrons* \***

Total length of fish (mm)	Weight of fish (g)	Weight of ovary (g)	Number of ova/g ovary weight	Total number of ova	Relative fecundity (Number of ova/g body weight)	Gonadosomatic Index
190-210 (196)	77	9.350	518	4,843	63	12.1
211-230 (227)	102-134 (118)	11.490-11.530 (11.510)	542-583 (562)	5,903-6,699 (6,301)	44-66 (55)	8.6-11.3 (9.7)
231-250 (239)	105-156 (139)	10.820-17.110 (12.652)	470-537 (507)	510-8,607 (7,035)	42-63 (51)	7.7-11.9 (9.1)
251-270 (259)	137-173 (159)	12.920-18.760 (15.460)	462-531 (502)	6,861-8,667 (7,718)	47-54 (49)	8.2-11.6 (9.7)
271-290 (281)	171-302 (212)	11.940-34.310 (23.194)	307-531 (521)	9,125-11,578 (9,878)	35-70 (47)	7.0-13.2 (10.9)
291-310 (310)	199-348 (280)	13.000-41.520 (30.200)	291-551 (404)	7,163-16,691 (11,345)	37-57 (41)	9.2-13.9 (10.7)
311-330 (317)	227-341 (292)	24.010-46.430 (30.845)	307-517 (442)	8,124-20,960 (13,414)	28-74 (46)	6.9-13.6 (10.6)
331-350 (341)	292-403 (362)	28.270-50.100 (38.615)	292-403 (398)	10,205-21,342 (15,521)	25-58 (43)	7.0-12.7 (10.7)
351-370 (362)	361-477 (428)	24.260-56.190 (39.194)	361-477 (448)	12,639-22,476 (16,830)	35-48 (39)	6.7-11.9 (9.2)
371-390 (375)	502-532 (517)	40.290-58.510 (49.400)	502-532 (463)	20,145-24,984 (22,564)	40-47 (44)	8.0-11.0 (9.6)
411-430 (411)	736	102.030	306	31,221	42	13.8

\* Figures in the parentheses are the averages.

average of 11,998 eggs per fish. The number of eggs  $g^{-1}$  body weight ranged from 291 to 583 ( $\bar{x}$  451 eggs). Absolute fecundity  $kg^{-1}$  body weight was estimated to be 44,437. Relative fecundity (number of ova  $g^{-1}$  body weight) ranged from 25 to 70 ( $\bar{x}$  45).

(i) *Gonado-somatic index*: The gonado-somatic indices (% coefficient of maturity) of mature fishes (IV-VI stages of maturity) ranged from 6.9 to 14.0 with a mean value of 11.3.

(ii) *Fecundity in relation to length of fish*: The relationship between fecundity and fish length was found to be curvilinear (fig. 1) and the mathematical relationship calculated was:

$$\text{Log } F = -3.9563 + 3.2502 \text{ Log } L \quad (r = 0.9312; P < 0.001)$$

(iii) *Fecundity in relation to weight of fish*: The relationship between fecundity and fish weight, when plotted, was found to be linear (fig. 2) and a direct relationship between the two variables arrived at was:

$$F = 37.0007 W + 1923.3450 \quad (r = 0.9632; P < 0.001)$$

(iv) *Fecundity in relation to weight of ovary*: Fecundity was found to hold a straight line relationship with ovary weight (fig. 3) and was expressed as:

$$F = 386.0251 O_w + 1477.5571 \quad (r = 0.9866; P < 0.001)$$

(v) *Weight of ovary in relation to weight of fish*: The relationship between the ovary weight and the fish weight has been found to be linear (fig. 4) and was expressed as:

$$O_w = 0.0919 W - 3.0963 \quad (r = 0.9166; P < 0.001)$$

(vi) *Fecundity in relation to age of fish*: Fish below the age group of 2 years were not found to spawn. Fecundity in 2<sup>+</sup> year specimens was observed to be 4,843 and the increase was significant with the advancement of age. Fecundity at ages 3<sup>+</sup>, 4<sup>+</sup>, 5<sup>+</sup> and 6<sup>+</sup> was calculated to be 7,115, 9,185, 14,279 and 21,461 respectively.

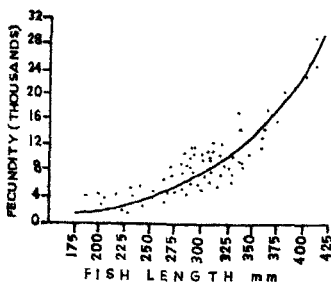


FIG. 1. Fish length and fecundity relationship in *S. curvifrons*.

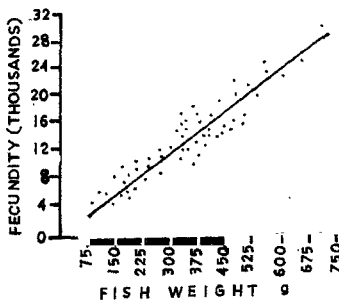


FIG. 2. Fish weight and fecundity relationship in *S. curvifrons*.

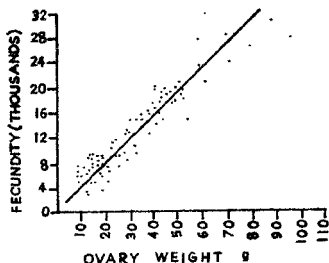


FIG. 3. Ovary weight and fecundity relationship in *S. curvifrons*.

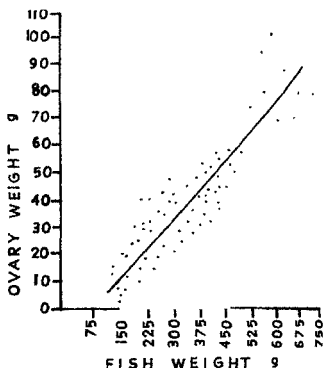


FIG. 4. Fish weight and ovary weight relationship in *S. curvifrons*.

It was observed that the fecundity values arrived at for *S. curvifrons* were well in accordance with the investigations made by earlier workers on the allied species of other schizothoracids from Kashmir waters<sup>2,4,5,7</sup>. Relative fecundity in *S. curvifrons* was found to be 45. Earlier, Malhotra<sup>7</sup> and Qadri *et al*<sup>5</sup> have reported values of 34 and 29.56 for *S. niger* and *S. richardsonii* respectively. The high value observed in the present case could be on account of the observations made on large fish stock in wide range of age and size groups.

Fecundity in *S. curvifrons* was better related to weight of the fish than to its length. This was confirmed statistically (Table II) by deriving the values of mean square deviation, mean deviation (in %) and  $\chi^2$  (mean square deviation divided by calculated values) for testing the goodness of the fit and the validity of different formulae used to calculate the relationship between fecundity and fish length and fecundity and fish weight. The greater the value, the lesser is the validity of the formula<sup>8,9</sup>. The validity proved best relationship between fecundity and fish weight ( $F = a + bW$ ). The validity of curvilinear relationship between fecundity and fish length ( $F = aL^b$ ) was better than linear relationship ( $F = a + bL$ ) (Table II). Identical relationships have been reported in various other fishes<sup>10-13</sup>.

Most of the workers have recorded the exponent values between fecundity and fish length to range around 3<sup>14-16</sup>. In the present case, the exponent value was found to be 3.2505, which is in agreement with the results obtained by Qadri *et al*<sup>5</sup> for *S. richardsonii* ( $b = 3.4001$ ).

In the case of *S. curvifrons*, fecundity and fish length and fecundity and fish weight exhibited a high degree of positive correlation with values as high as 0.9312 and 0.9632 respectively. Raina<sup>3</sup> found low correlation value (0.893) between fecundity and fish length in *S. esocinus*. However, Qadri *et al*<sup>5</sup> recorded higher values of 'r' 0.9852 and 0.9905 for *S. richardsonii*.

**Table II**  
**Relationship of fecundity (in thousands) with length and weight of fish in**  
*Schizothorax curvifrons*

Frequency	Length range (mm)	Average length (mm)	Average weight (g)	Average number of eggs in thousands	Calculated no. of eggs differences (Obs. - Cal.)					
					F(L)	Diff.	F(L) <sup>0</sup>	Diff.	F(w)	Diff.
1	191-210	196	77	4.8	1.9	2.9	4.3	0.5	4.8	—
2	221-230	227	118	6.9	5.3	1.6	6.2	0.7	6.4	0.5
8	231-250	239	139	7.0	6.6	0.4	7.0	—	7.2	0.2
5	251-270	258	159	7.7	8.7	1.0	8.4	0.7	7.9	0.2
8	271-290	281	212	9.9	11.3	1.4	10.4	0.5	9.9	—
10	291-310	301	280	11.3	13.5	2.2	12.3	1.0	12.5	1.2
12	311-330	317	292	13.4	12.5	0.9	13.9	0.5	13.0	0.4
6	331-350	341	362	15.5	17.9	2.4	16.4	1.2	15.6	0.1
5	351-370	363	428	16.5	20.3	3.3	19.4	2.6	18.1	1.3
2	371-390	375	517	22.5	21.7	0.8	21.0	1.5	21.5	1.0
1	411-413	411	736	31.2	24.8	6.4	25.1	6.1	29.7	1.5
			1. Mean square deviation			11.14		9.84		0.98
			2. Mean deviation (%)			5.57		5.55		5.56
			3. $x^2$			0.54		0.48		0.05

The relationship between the number of ova produced and the ovary weight was seen closely related to each other with a high correlation factor (0.9866) in *S. curvifrons* which is in agreement with the observations of Hickling<sup>17</sup> who stated that the production of eggs is the dominant function of the ovary and a close correlation should be expected between the weight of ovary and the number of ova produced. Qadri *et al*<sup>5</sup> have also observed a high degree of correlation (0.9675) between the two variables in *S. richardsonii*.

The relationship between the weight of the ovary and the weight of the fish has been reported to be linear<sup>13,18</sup>. In the case of *S. curvifrons*, similar condition has been found with a high degree of correlation.

In the present observation, fecundity was found to be increasing with the advancement of the fish age which is quite in accordance with the investigations carried out on *S. niger* from Dal Lake<sup>2</sup>.

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