Fecundity of a hillstream minor carp *Puntius chilinoides* (McClelland) from Garhwal Himalaya

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Abstract. One hundred mature specimens of *P. chilinoides* collected from the Badiyar gaad, a tributary of the river Alaknanda were examined for fecundity. The fish weight, ovary weight, and fecundity ranged from 25–115 g, 2·1–14·35 g, and 2135–7974 respectively. The ovary weight was found from 8·4 to 16·34% of the body weight. The relationships between fecundity and total length and weight of fish, fecundity and length, weight and volume of ovary, fish length–ovary weight, and fish weight–ovary weight were found to be of linear form.

Keywords. Fecundity ; *Puntius chilinoides* ; fish weight ; ovary weight.

1. Introduction

Fecundity of a fish may be defined as the number of eggs that are likely to be laid during a spawning period. Studies on the fecundity of fishes are useful for increasing the yield of consumable fish species. However, so far no studies have been made on the fecundity of coldwater fishes of Garhwal Himalaya. Hence it was considered desirable to study the fecundity of *P. chilinoides*, an important food-fish found in the tributaries of the Alaknanda.

2. Materials and methods

Hundred specimens of mature *P. chilinoides* were collected from Badiyar gaad, a tributary of the river Alaknanda of Garhwal Himalaya during March-April 1980 and 1981. The total length and weight of each fish and ovary in fresh condition were noted. The ovary of each fish was dissected out and preserved in 5% formalin solution for 24 hrs. The fecundity of the fish was recorded by gravimetric method (Simpson 1959) and studied in relation to its weight and total length, and length, weight and volume of ovary. These relations have been expressed as follows by applying the method of least square.

(i) The straight line $Y = a + bX$ (ii) $Y = ax^b$ or in logarithmic form as

$$\log Y = \log a + b \log X$$

3. Observations

3.1. Fecundity and fish length

The relationship between fecundity and total length of fish is shown in table 1. According to mean values the number of ova varied from 2097 for a fish of 130 mm to 7978 in the fish measuring 220 mm, while the minimum fecundity was 2080 in a fish of 135 mm. The largest specimen of 217 mm had a fecundity of 8020. The relationship between fecundity and total length in the logarithmic form can be expressed as :

$$\log F = 3{\cdot}56 + 1{\cdot}825\,L$$

where F = fecundity in thousands and L = total length in mm. The fecundity–length relationship in *P. chilinoides* can be expressed as :

$$F = -0{\cdot}15 + 100\,L\ (r = 0{\cdot}9112).$$

3.2. Fecundity and fish weight

The relationship between fecundity and fish weight is shown in table 2. Egg production ranged from 2115 in a fish of $2{\cdot}1$ g to 8020 in a fish of $14{\cdot}6$ g. The fecundity-body weight relationship in *P. chilinoides* can be expressed as :

$$F = -2150 + 100\,WF$$

where WF is the total weight of the fish in g. The relationship between fecundity and body weight in logarithmic form can be expressed as :

$$\log F = 3{\cdot}16 + 2{\cdot}227\ \log\ WF\ (r = 0{\cdot}8767)$$

3.3. Fecundity and ovary weight

The relationship between ovary weight and fecundity was found to be close and linear in nature. The correlation coefficient, r, is $0{\cdot}9493$, which indicates that

Table 1. Relationship between fish length, ovary weight and fecundity in *P. chilinoides*.

Total length (mm) of fish range	Mean (mm)	No. of fish examined	Ovary weight (g)		Number of eggs	
			Range	Average	Range	Average
125–135	130	2	2·00 – 2·100	2·050	2080–2115	2097
135–145	140	15	2·100– 4·200	2·733	2122–3035	2543
145–155	150	21	4·00 – 6·500	5·128	3837–5747	4963
155–165	160	14	6·400– 7·450	6·975	5680–6380	5956
165–175	170	20	6·700–10·600	8·327	6485–7090	6851
175–185	180	17	10·300–12·300	11·108	7081–7750	7398
185–195	190	6	11·900–13·200	12·400	7680–7788	7719
195–205	200	1	13·400	13·400	7820	7820
205–215	210	2	13·800–14·00	13·900	7845–7935	7890
215–225	220	2	14·100–14·600	14·350	7929–8020	7978

Table 2. Relationship between fish weight, fecundity and ovary weight in *P. chilinoides*.

Weight of fish (g) Range	Mean (g)	No. of fish examined	Fecundity		Ovary weight (g)		% of ovary weight in total weight of fish
			Range	Mean	Range	Mean	
20– 30	25	5	2080–2186	2135	2·00 – 2·200	2·100	8·40
30– 40	35	24	2285–4950	3618	2·400– 5·200	3·714	10·61
40– 50	45	18	5050–5992	5652	5·250– 7·200	6·363	14·14
50– 60	55	22	5921–6990	6661	6·900–10·600	7·468	13·57
60– 70	65	11	7020–7392	7201	9·900–11·400	10·622	16·34
70– 80	75	15	7420–7788	7602	10·300–13·200	11·793	15·72
80– 90	85	1	7820	7820	13·400	13·400	15·76
90–100	95	1	7845	7845	14·00	14·00	14·73
100–110	105	1	7935	7935	13·800	13·800	13·14
110–120	115	2	7929–8020	7974	14·100–14·600	14·350	12·47

the fecundity is more directly related to the weight of the ovary. Egg production ranged from 2115 in an ovary of 2·1 g to 8020 in an ovary of 14·6 g. The fecundity-ovary weight relationship may be expressed as :

$$F = 3350 + 354·1 \ WO ; \quad \text{where } WO = \text{weight of ovary}$$

$$\log F = 3·065 + 0·555 \quad (r = 0·9493)$$

3.4. *Fecundity and ovary length*

The fecundity increased with length of ovaries. This relationship can be expressed as :

$$F = -0·09 + 250 \ LO$$

$$\log F = 2·09 + 2·794 \ \log LO ; \quad (r = 0·9629)$$

where *LO* is the length of ovary.

3.5. *Fecundity and ovary volume*

Fecundity increased with the volume of ovaries. The data on the volume of ovary and fecundity can be expressed as :

$$F = 3100 + 423 \ VO ;$$

$$\log F = 3·538 + 0·475 \ \log VO ; \quad r = 0·9384$$

where *VO* = the volume of ovary.

3.6. *Ovary weight and fish weight*

The relationship between the fish weight and ovary weight can be expressed as :

$$WO = -2·8 + 2 FW$$

The same relationship in logarithmic form may be expressed as :

$$\log WO = 0·21 + 2·5 \ \log WF ; \quad r = 0·9597$$

where WF = weight of fish

3.7. Ovary weight and fish length

The relationship between total length of fish and ovary weight was found to be fairly close and linear in nature, the ' r ' being 0·9862 appears to be the highest amongst all relationships. It indicates that fish length is more directly related to ovary weight. The relationship between length and ovary weight may be expressed as :

$$OW = 0·3 + 1·6\ FL$$

$$\log\ OW = -0·854 + 0·202\ \log\ FL;\ r = 0·9862.$$

where OW = weight of ovary and FL = length of fish.

4. Discussion

Various investigators like Clark (1934), Khan (1945), Smith (1947), Lehman (1953), Alikunhi (1956), Mathur (1964), Saigal (1964), Bhatnagar (1964), Alikunhi *et al* (1965), Rangarajan (1971), Devraj (1973), Varghese (1973, 1976), Chondar (1977), and Joshi (1980), have studied the fecundity of several fish species. The relationships have been found to exist between the length and fecundity of different species of fish. Clark (1934) suggested that the fecundity of a fish increased in proportion to the square of its length. Simpson (1951) concluded that the fecundity of plaice was related to the cube of its length. Relationship between fish length and fecundity has been reported by Sarojini (1957), Pantula (1963), Gupta (1968), Varghese (1973), and Joshi (1980). However, in *P. chilinoides*, the fecundity increases with increase in fish length.

A straight line relationship between the fish weight and fecundity has been reported by several workers including Begenal (1957), Sarojini (1957), and Varghese (1961, 1973). A curvilinear relationship was found in *Coilia ramcarati* (Varghese 1976), but in *P. chilinoides* a straight line relationship has been found between the fish weight and fecundity. In *Salvelinus fontinalis* the fecundity is related more to the weight than the length of fish (Smith 1947). A direct proportional increase in the fecundity with the increase in the fish weight has been noted by Simpson (1951) and Lehman (1953). In *P. chilinoides* also there is an increase in the number of eggs with the increase in the body weight.

This paper shows that the fecundity and fish length relationship $(r = 0·9112)$ is more closely related than the fish weight and fecundity $(r = 0·8767)$. The linear relationship between the volume of ovary and fecundity indicates an increase in the number of ova produced with the volume of ovaries. Therefore, it appears' that the fecundity increases at a smaller rate in respect to the volume of ovary.

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