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Relationship among body weight, body length, ovary weight and the fecundity of *Cyprinus carpio* Var. *communis* in Kashmir Himalaya

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Abstract
The study provides the relationship between body weight, body length, ovary weight, absolute fecundity and relative fecundity *Cyprinus carpio* var. *communis*. The data reveals that fish weight shows the significant positive correlation with fish length, ovary weight absolute fecundity(r=.878, p<0.01; r=.888, p<0.01; r=.907, p<0.01 respectively). Furthermore significant positive correlation was formed between fish length and ovary weight (r=0.981, p<0.01), fish length and absolute fecundity (r=.976, p<0.01), Ovary weight and absolute fecundity (r=.998, p<0.01). Relative fecundity showed a significant negative correlation with weight, length and absolute fecundity(r=-0.747, p<0.01; r=-0.419, p<0.05and r=-0.460, p<0.05 respectively).

Keywords: *Cyprinus carpio* var. *communis***,** absolute fecundity, Relative fecundity

1. Introduction
Several workers reported the linear relationship exists in different freshwater fish species between fecundity and fish length, fish weight, ovary length and ovary weight have been reported by various workers [1, 2, 3, 4, 5] (Singh and Srivastava, 1982; Sharaf *et al*., 1997; Somdutt and Kumar, 2004; Joshi, 2008 and Bahuguna and Khatri 2009). In *L. rohita*, fecundity of was more closely related to the ovary weight [6] (Alam and Pathak, 2010). According to [7] Bhatt *et al.* (1977), two morphometric variables accurately estimates the fish fecundity by taken together with less accuracy for length than weight variables. Moreover, for estimating fish fecundity than the two other variables, gonad weight is more accurate (body length and weight). However [7], Bhatt *et al.* (1977) reported that it is not realistic to use gonad weight to estimate fecundity based on live specimens under field conditions. Fecundity has a linear relationship with weight are reported by several workers [7, 8, 9, 10] (Bhatt *et al*., 1977; Bhargava, 1971; Pantulu, 1963; Qasim & qayyum, 1963). This suggests that with the increase in body and gonad weight of the fish, the number of eggs in the ovaries increases proportionally. Fecundity exhibited a straight line relationship with length and body weight as reported by [11] Shafi *et al.* (2013). Fecundity and ovary weight also exhibited linear relationship [12]. Shinkafi and Ipinjolu (2012) determine the relationship between GSI, fecundity and egg size with total length (TL), total weight (TW), gonad weight (GW) and gonad maturation stages (MS) [13]. Hulata *et al.* (1974) studied the relationship of gonads and eggs size to weight and age in the European and Chinese races of the common carp *Cyprinus carpio* L. and observed that Gonad weight in both sexes was correlated with body weight, but proportional gonad weight, i.e. the ratio gonad weight divided by body weight, was independent of body weight.

2. Materials and methods
2.1 Selection of female brooders
A total of 120 samples of female *Cyprinus carpio* var. *communis* were collected during the breeding season from the wild environment i.e. Dal Lake and was carried to Fishery Biology laboratory of Faculty of fisheries, Rangil, Ganderbal for the reproductive study.

2.2 Fecundity
For the estimation of fecundity, fishes were sacrificed and both the ovaries were taken out carefully. The moisture was thoroughly wiped out from the ovaries with a blotting paper. The length and weight of ovaries was noted down with complete care. The collected ovaries were placed in 10% formaldehyde for at least 24 hours to bring hardness of eggs, so as to make easy and accurate calculation of sticky eggs.

This was followed by drying of eggs on blotting paper for 1-2 hours, three subsamples of one gram each from anterior, middle and posterior region were weighed and then eggs were counted carefully by gravimetric method. The mean numbers of eggs were multiplied by gonad parts of ovary weighed on a sensitive mono-pan weighing balance and the total number of eggs per gonad was obtained, i.e fecundity of fish. The absolute fecundity and relative fecundity was calculated as per the formula given by [14] (Bagenal, 1978):

$$\text{Absolute fecundity} = \frac{\text{No. of ova in the subsample} \times \text{total ovary weight}}{\text{Weight of subsample}}$$

$$\text{Relative fecundity} = \frac{\text{Absolute fecundity}}{\text{Weight of fish}}$$

2.3. Gonadosomatic index

Gonadosomatic index (GSI) of the fish was calculated as per the formula given by [15] (Desai, 1970):

$$\text{GSI} = \frac{\text{Weight of gonads (g)}}{\text{Total weight of fish (g)}} \times 100$$

3. Result

3.1 Relationship between fish body weight, body length, ovary weight, absolute fecundity and relative fecundity

Table 1 shows the Statistical estimates of reproductive biology of female Scale carp Table 2 shows the relationship between body weight, body length, ovary weight, absolute fecundity and relative fecundity. The data reveals that significant positive correlation was found between fish weight and fish length (r=.878, $p<0.01$), fish weight and ovary weight (r=.888, $p<0.01$), fish weight and absolute fecundity. (r=.907, $p<0.01$. Furthermore significant positive correlation was formed between fish length and ovary weight (r=0.981, $p<0.01$), fish length and absolute fecundity (r=.976, $p<0.01$), Ovary weight and absolute fecundity (r=.998, $p<0.01$). Relative fecundity showed a significant negative correlation with weight, length and absolute fecundity(r=-0.747, $p<0.01$; r=-0.419, $p<0.05$and r=-0.460, $p<0.05$ respectively).

Table 1: Statistical estimates of reproductive biology of female Scale carp in farmed and wild condition

Parameters	Type	Range	Mean	Standard error
Weight	Wild	120-1300	435.1	66.61
Length	Wild	180-430	301.43	13.93
Ovary weight	Wild	15-86	48.96	4.15
No. of ova	Wild	1110-1545	1362.5	19.38
Absolute fecundity	Wild	16650-129000	68864.07	6563.59
Relative Fecundity	Wild	99.2-240.8	185.96	8.34
GSI	Wild	6.6-18.42	13.77	.658

Table 2: Pearson correlation between fish body weight, body length, ovary weight, absolute fecundity and relative fecundity in wild Scale carp

Parameter	Weight	Length	Ovary weight	Absolute fecundity	Relative fecundity
Weight	1	.878**	.888**	.907**	-.747**
Length		1	.981**	.976**	-.419*
Ovary weight			1	.998**	-.419*
Absolute fecundity				1	-.460*
Relative fecundity					1

**correlation is significant at 0.01 level (2 –tailed).
*correlation is significant at 0.01 level (2 –tailed)

4. Discussion

In different species of fishes, a relationship has been found to exist between fish length and fecundity. Over other factors, Length has an advantage as fish does not shrink significantly although it can lose weight during the spawning season [16]. Fecundity of a fish increases in proportion to the square of its length was suggested by [17]. Fecundity of plaice was related to the cube of its length was pointed out by [18]. During the present study an increase in the number of ova was found with the increase in body weight in fish. Absolute fecundity of *Cyprinus carpio* var. *communis* had a strong correlation with ovary weight than body weight and Total length. These results are in conformity with the results obtained by [19] for *Glossogobius giuris.* According to [20] the fecundity has been more related to the fish weight than to the length in *Salvelinus fontinalis.* Same has been reported for *Liza parsia* by [21, 22]. has found a reduction in the rate of egg production with the increase in ovary weight in *Coilia ramcarati*. But in present study a corresponding increase in the number of eggs with the increase in the weight of ovary has been found, as in *Tilapia nilotica* [23], *Labeo gonius* [24], *Esox lucius* [25] and Chinese silver carp [26]. A direct proportional increase in the fecundity with the increase in fish weight has been reported by [26] and [27]. Fish or gonad length and weight has been usually related to absolute fecundity (Bagenal, 1966) [28]. The close relationship between absolute fecundity and fish length demonstrated here is supported by the works of [25, 24, 26] and many others. Fecundity generally increased with total length in several fishes. A positive correlation has been observed between total length of females with their fecundity of *Mugil parsia* [29] *Osteogenesis militaria* [9] *Polynemus paradiscus* [30], and *Labeo rohita* [31]. In the mosquito fish *Gambusia affinis*, the maximum average monthly fecundity has reached when the length of the mother was at its highest [32].

5. Conclusion

It is concluded that ovary weight, fecundity increases with the size of fish in terms of length and weight.

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