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Fecundity of *Coilia dussumieri* Valenciennes*

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Total number of maturing and mature ova were counted from the ovaries of 97 specimens of *Coilia dussumieri* collected from the Hooghly estuarine system. The specimens studied belonged to the IV or V stage of sexual maturity. The fecundity of the species varied from 795 ova in a fish measuring 104 mm (S. L.) and weighing 4.5 g to 6225 ova in fish measuring 142 mm (S.L.) and weighing 23.25 g.

The relationships between length and fecundity as well as weight and fecundity of *C. dussumieri* were of the parabolic form. However, the parabolic curve in case of weight-fecundity relationship was quite flat indicating that it was not very different from linear relationship. The relationship between ovary weight and fecundity indicated a reduction in the rate of egg production with increase in ovary weight. Exponential relationships were found to exist between length and ovary weight as well as between weight and ovary weight, in *C. dussumieri*.

Introduction

Coilia dussumieri Valenciennes is the most widely distributed species of the genus *Coilia*. It is recorded from India, Java, Sumatra, Madura and Singapore (Weber & Beaufort 1922). In India, the species occurs along the coasts of Maharashtra, Orissa and West Bengal and enters the estuaries of these areas. It supports a good fishery along Bombay coast while forms a minor fishery along the coast of West Bengal and in the lower zone of the Hooghly estuary. All the studies made on the biology of *C. dussumieri* are on the fish occurring in Bombay water. A preliminary study of the food and feeding habits of the species was made by Bapat and Bal (1950). Jones and Menon (1952) have described certain larval forms of the species. The maturity and spawning habits were studied by Palekar and Karandikar (1953). Joshi and Bal (1953a, 1953b) have described the skeleton of the species. The food and feeding habits and the length-weight relationship were studied by Bal and Joshi (1956). Some aspects of the biology were studied by Gadgil (1967). A detailed investigation on the biology of the fish inhabiting the Hooghly estuarine system was conducted. An account of the maturation and spawning cycle was already published (Varghese 1974), and the fecundity of the species is described now.

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Material and Methods

The material was collected from trawl catches made in the lower zone of the Hooghly estuarine system during the period from November 1961 to October 1963. The specimens of *C. dussumieri* in the trawl catches were sorted out and random samples preserved in 5% formaldehyde. The standard length and total weight of each specimen used for fecundity studies were recorded accurately in the laboratory. The ovaries from each specimen were removed carefully and preserved in 5% formalin. Later, the ovaries were weighed in a chemical balance and the total number of large, opaque ova was counted. Ninety-seven specimens of *C. dussumieri* in stage IV or V of maturity only were considered for fecundity counts.

Observations

Relation between fish size and fecundity

It is well known that the number of eggs produced increases with an increase in the size of a fish. A formula to estimate the fecundity of a fish of known size or vice versa is of high applied value in fishery investigations. Hence, the relationships between body length/weight and fecundity of *C. dussumieri* were attempted.

The individual fecundity values were plotted against the respective standard lengths of the fish, as a scatter diagram, (figure 1). The number of ova varied from 795 in a fish measuring 104 mm weighing 4.5 g to 6.25 in one measuring 141 mm and weighing 13.25 g. The relation between standard length and fecundity of *C. dussumieri* was of the form :

$$F=aL^n \text{ or } \log F=\log a+n \log L$$

where F is fecundity ; L, standard length; a, a constant and n, an exponent. In order to calculate the values of a and n, the arithmetic values of length and fecundity data were converted to log length and log fecundity and the relationship was as under:

$$\log F=4.8246 \log L-1.8905$$

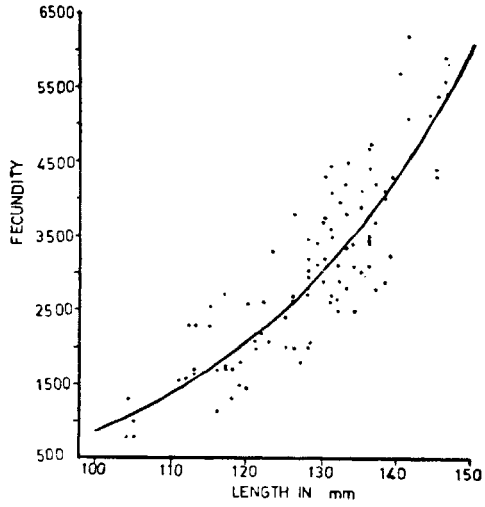

Figure 1 The relation between standard length and fecundity of *C. dussumieri*

Employing this formula, fecundity values were calculated for different fish lengths and a curve was fitted to the data as shown in figure 1. The correlation coefficient, r, for the above relation was 0.8821. The r value was tested for significance and was found to be highly significant.

The data relating to body weight and fecundity of *C. dussumieri* were plotted as in figure 2, which shows existence of an exponential relation. The relation between body-weight and fecundity was found to be

$$\log F=1.3292 \log W+2.1910$$

where F is fecundity and W, the body weight of the fish. The correlation coefficient, $r=0.8934$ indicated a high degree of significance.

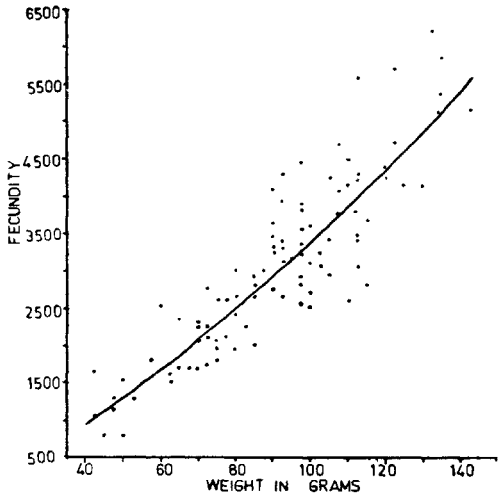

Figure 2 The relation between weight and fecundity of *C. duussmieri*

Relation between ovary weight and fecundity

The weight of lovaries of a fish is mainly influenced by the number of ova contained in them. In order to study the relation between ovary weight and fecundity, the fecundity values were plotted against the respective weights of ovaries as in figure 3. On a casual examination it appeared that the number of ova in relation to the ovary weight increased linearly. However, a close scrutiny of the data revealed that in case of ovaries weighing more than 0.75 g there was a reduction in the rate of egg production. Therefore, a relation that showed a reduction in the rate of egg production with increase in ovary weight could be expected to fit the data more closely. Such a relation, calculated by converting the arithmetic values of ovary weight and fecundity to log values, could be expressed as:

$$\log F = 0.5559 \log Ow + 3.7631$$

where F is fecundity and Ow the ovary weight. The correlation coefficient, $r = 0.8387$ was statistically significant.

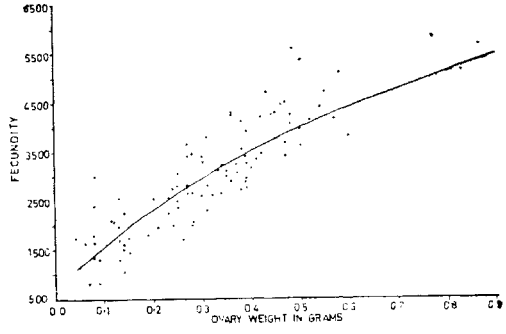

Figure 3 The relation between ovary weight and fecundity of *C. dussumieri*

The relation between fish size and ovary weight

The weight of ovaries in a fish is influenced by its size. In order to study the relations between standard length and ovary

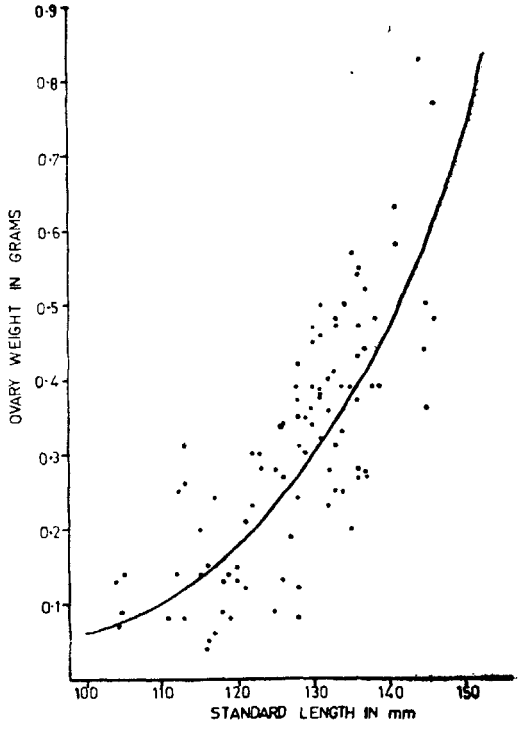

Figure 4 The relation between standard length and ovary weight of *C. dussumieri*

weight and fish weight and ovary weight of the species, the weight of ovaries of each individual fish was plotted against its length as well as body weight in figures 4 and 5, respectively. In both cases, exponential relationships were found to exist. The standard length-ovary weight relation calculated could be expressed as:

$$log\ Ow = 6.1550\ log\ L - 7.3778$$

where Ow=ovary weight and L=standard length. (r =0.7459).

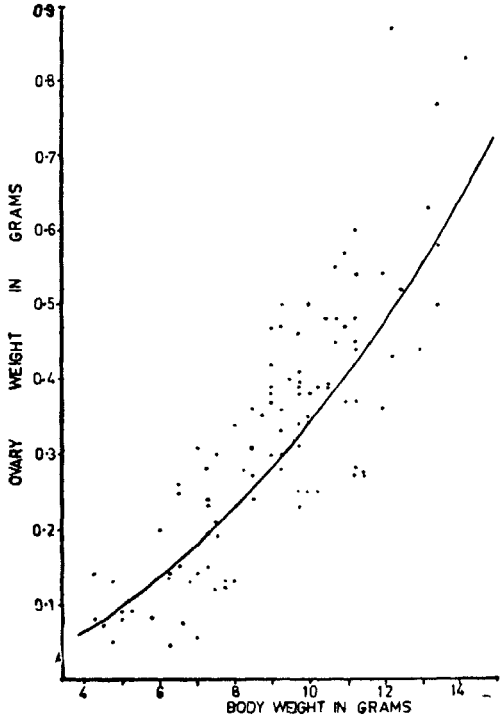

Figure 5 The relation between body weight and ovary weight of *C. dussumieri*

The relation between body weight and ovary weight calculated in the same manner could be expressed as:

$$log\ Ow = 1.8325\ log\ W - 2.3004$$

where Ow is the ovary weight and W the weight of fish (r=0.8117).

Discussion

Different relationships have been found to exist between length and fecundity in different species of fishes. Some of the earlier workers, like Clark (1934), have observed that the fecundity of the species increased in proportion to the square of fish length. Simpson (1951) demonstrated that the fecundity in plaice was related to the cube of its length. Many recent studies have borne out Simpson's contention as they showed that fecundity was related to the length of fish by a factor closer to the cube (Bagenal 1957, Sarojini 1957, Pillay 1958, Varghese 1961, 1973, 1976, Pantulu 1963). Our findings show that the fecundity of *C. dussumieri* increased at a rate of 4.82 times the length increase. A similar high exponential value of 4.32 was recorded in the length-fecundity relation of *C. ramcarati* also (Varghese 1976). Since in both *C. dussumieri* and *C. ramcarati* the exponential values in the length-fecundity relation were found higher than those in the length-weight relation (Varghese 1966), it could be concluded that the fecundity in these species increased at a rate greater than the rate of increase of body weight, in relation to length.

A linear relation between fish weight and fecundity has been reported by several workers (Bagenal 1957, Sarojini 1957, Varghese 1961, 1973, Gupta 1968). However, in *C. dussumieri* this relation was observed to be parabolic. Nevertheless, from figure 2 it could be noted that the curvature of the line of fit was rather flat and was very close to a linear relationship. It is of interest that in *C. ramcarati* also the weight-fecundity relation was very similar, the regression coefficient being 1.37 (Varghese 1976).

The relation between ovary weight and fecundity of *C. dussumieri* suggested a

reduction in the rate of egg production with increase in ovary weight. Such a phenomenon was found in Long Rough Dab (Bagenal 1957) as well as in *C. ramcarati* (Varghese 1976). The accumulating weight of permanent ovarine tissue appeared to be responsible for this. The regression coefficient of 0.56 and the value of constant of 3.76 in the ovary weight-fecundity relation of *C. dussumieri* are very similar to the corresponding values of *C. ramcarati* (Varghese 1976).

The relationship between length and ovary weight and fish weight and ovary weight of *C. dussumieri* revealed that the ovary weight was related to both length and weight curvilinearly, as was noticed in case of *C. ramcarati* also (Varghese 1976). The regression coefficient values of these relationships indicated that the rate of increase of ovary weight in relation to length was greater than the rate of increase of ovary weight in relation to weight. The exponential value of 6.15 in the length-ovary weight relation of *C. dussumieri* was greater than the corresponding values for *C. ramcarati* (Varghese 1976), *Osteogeneiosus militaris* (Pantulu 1963) and *Labeo rohita* (Varghese 1973).

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