THE FECUNDITY OF THE ROHU, *LABEO ROHITA* (HAMILTON)

BY T. J. VARGHESE

*(Fisheries College, University of Agricultural Sciences, Mangalore)*

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**ABSTRACT**

Fecundity estimations from sixty-five specimens of *L. rohita* ranging in size from 150 g to 5,000 g have been made. The relationships between total length and fecundity, total weight and fecundity, ovary weight and fecundity, total length and ovary weight and total weight and ovary weight have been worked out for the species. Statistically significant relations were found to exist between the above variables. An attempt has been made to estimate the percentage of eggs retained in the ovary of rohu during spawning. Fecundity factors and percentage ovary weights of the species were found not influenced by the size of fish.

**INTRODUCTION**

*Labeo rohita* (Hamilton) is the most esteemed among the extensively cultured major carps of India. Though a good deal of information on various aspects of its biology and culture is available, literature on its fecundity is rather patchy. Khan (1934) has recorded a total number of 19,05,000 eggs from a ripe female rohu of 4·54 kg. The fecundity of the species estimated at Cuttack varied from 1·77 to 4·02 lakhs (Sukumaran, 1969). Absolute fecundity figures of over seventy rohu specimens ranging from 51·0 to 75·2 cm in total length, studied by the staff and trainees of the Central Institute of Fisheries Education, Bombay, ranged from 2,25,600 to 27,94,000 as reported by Sukumaran (1969). But for these records, detailed studies on fecundity and its relation to the size of the fish have not been made so far. A knowledge of the expected number of eggs from a brood fish is of great practical utility in fish culture for proper planning of the hatching and nursery operations. The number and size of the brood stock to be maintained for achieving a certain set target of fish seed production also calls for a knowledge of the fecundity of the species in question. In view of these practical values, detailed studies on the fecundity of *L. rohita* were made and the results thereof are reported in this paper.
MATERIAL AND METHODS

Fifty-three ovaries were collected from mature specimens of *L. rohita* caught from Pawai Lake, Bombay, during June, 1969, while twelve mature ovaries were collected from fish of Balabhadrapuram Fish Farm (Andhra Pradesh) in July, 1969. The total length and total weight of each specimen were recorded before the ovaries were removed. The ovaries removed were accurately weighed and a small portion thereof preserved for fecundity estimation. About 2 g of this were later weighed accurately in a mono-pan electrical balance and the number of ova in the sample counted. From this, the total number of ova in the ovaries of the specimen concerned was calculated.

OBSERVATIONS

*Relation between total length and fecundity.*—The specimens of rohu from which ovaries were collected varied in total length from 26·0-55·8 cm, while their fecundity ranged from 59,650 to 12,27,500. The absolute fecundity figures are plotted against total lengths in the form of a scatter diagram in Fig. 1, which shows that the relationship between length and

![Graph showing the relationship between total length and fecundity of *L. rohita*]
fecundity in rohu is curvilinear. The arithmetic values were, therefore, converted to logarithmic values and a relationship was calculated based on the equation, \( \log F = a + b \log L \), where \( F \) = fecundity, \( L \) = total length and \( a \) and \( b \), two constants. The formula calculated from the data can be expressed as

\[
\log F = -5.0413 + 3.9634 \log L.
\]

Based on this equation, expected fecundity values were calculated for different fish lengths and a curve was fitted to the data as shown in Fig. 1. The correlation coefficient, \( r \), of the above relationship was 0.8494. The \( r \) value was tested for significance when the calculated \( t \) (24.2079) was found greater than the \( t \) value at 5% level (1.96), indicating the high level of significance of length–fecundity relationship.

Relation between weight and fecundity.—The weight of rohu specimens studied ranged from 150 g to 5,000 g. The fecundity data when plotted against the weight of fish indicated a linear relationship between these two variables (Fig. 2). A formula for estimating the fecundity of a fish of known weight was calculated using the equation, \( F = a + bW \) (\( F \) = fecundity,
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W = total weight in g and a and b = constants). This formula can be expressed as

\[ F = -35051 + 268.34 \times W \]

The correlation coefficient, r, (0.98) when tested for significance showed that the relationship between weight and fecundity in rohu was highly significant (t = 220.354 > 1.96 at 5 %).

**Relation between ovary weight and fecundity.**—The number of ova in the ovaries of a fish will obviously be related to the weight of the ovary. In order to study the relationship between ovary weight and fecundity of *L. rohita*, the data on fecundity were plotted against the respective ovary weights on a graph paper (Fig. 3), which indicated a linear relationship between these two variables. Therefore a formula for calculating the number of eggs if only the ovary weight is known, was worked out as in the case of total weight fecundity relationship. This can be expressed as

\[ F = 43533 + 947.553 \times O.W. \]

![Fig. 3. Relationship between ovary weight and fecundity of *L. rohita.*](image-url)
where \( F \) = fecundity and \( O.W. \) = ovary weight. The correlation coefficient, \( r \), was 0·9879. The test of significance of the relationship showed that the calculated \( t \) (326·72) was much greater than the \( t \) value at 5 \% (1·96), indicating that the relationship between ovary weight and fecundity was highly significant.

**Relation between total length and ovary weight.**—The data pertaining to total length and ovary weight of the sixty-five specimens of rohu studied are presented in Fig. 4 as a scatter diagram, which shows a curvilinear relationship between these two variables. Therefore, the values were converted to logarithms and a formula was calculated, following the method adopted for calculating total length–fecundity relationship. This formula can be expressed as

\[
O.W. = -8.6059 + 4.1516 \log L
\]

where \( O.W. \) = ovary weight and \( L \) = total length. The correlation coefficient, \( r \), for this relationship was 0·8392. This value when tested has shown

![Fig. 4. Relationship between total length and ovary weight of *L. rohita*.](image)
that the relationship was statistically significant \(t = 22.510 > 1.96\) at 5\%.

Therefore, a curve was fitted to the scatter diagram using the formula developed, which represents the calculated values of ovary weights at different lengths of \(L.\ rohita\).

Relation between total weight and ovary weight.—The data on total weight and ovary weight of each specimen of rohu studied were plotted on a graph paper, as shown in Fig. 5. The scatter diagram indicated a straight line relationship between total length and ovary weight. A formula for calculating the ovary weight of a mature rohu of known weight was developed and it can be expressed as

\[
O.W. = -73.6512 + 0.2751 W
\]

where, \(O.W.\) = ovary weight and \(W\) = weight of fish. The correlation coefficient, \(r\), for the above relationship was 0.9823. This value when
statistically tested was found highly significant \( t = 222.76 > 1.96 \) at 5\%.

Therefore, a straight line was fitted to the scatter diagram which represents the calculated ovary weights at different weights of rohu.

**Relation between fecundity and number of eggs spawned.**—During induced breeding of Indian major carps by hyphophysation, it is generally observed that the actual number of eggs laid by a female fish is often less than the number of ova expected. This is obviously because some ova are retained by the female fish during spawning. In order to estimate the percentage of such retained ova during spawning, the actual number of eggs released by twelve rohu females, selected at random, were compared with the calculated fecundity on the basis of weight-fecundity formula (Table I). The table shows that in

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Total weight of the fish (g)</th>
<th>Actual number of eggs laid</th>
<th>Calculated fecundity</th>
<th>Percentage difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>250</td>
<td>45,825</td>
<td>32,034</td>
<td>+43.0</td>
</tr>
<tr>
<td>2.</td>
<td>500</td>
<td>42,700</td>
<td>99,119</td>
<td>-56.9</td>
</tr>
<tr>
<td>3.</td>
<td>600</td>
<td>71,500</td>
<td>1,25,953</td>
<td>-43.2</td>
</tr>
<tr>
<td>4.</td>
<td>800</td>
<td>62,660</td>
<td>1,79,621</td>
<td>-65.1</td>
</tr>
<tr>
<td>5.</td>
<td>850</td>
<td>1,05,750</td>
<td>1,93,038</td>
<td>-45.2</td>
</tr>
<tr>
<td>6.</td>
<td>900</td>
<td>1,50,605</td>
<td>2,06,455</td>
<td>-27.0</td>
</tr>
<tr>
<td>7.</td>
<td>1,250</td>
<td>1,31,250</td>
<td>3,00,374</td>
<td>-56.3</td>
</tr>
<tr>
<td>8.</td>
<td>1,800</td>
<td>2,30,000</td>
<td>4,47,961</td>
<td>-48.6</td>
</tr>
<tr>
<td>9.</td>
<td>2,100</td>
<td>5,30,400</td>
<td>5,28,463</td>
<td>+ 0.4</td>
</tr>
<tr>
<td>10.</td>
<td>2,600</td>
<td>3,90,399</td>
<td>6,62633</td>
<td>-41.1</td>
</tr>
<tr>
<td>11.</td>
<td>3,000</td>
<td>6,24,000</td>
<td>7,69,969</td>
<td>-19.0</td>
</tr>
<tr>
<td>12.</td>
<td>4,400</td>
<td>8,52,480</td>
<td>11,45,645</td>
<td>-25.6</td>
</tr>
<tr>
<td>..</td>
<td>..</td>
<td>..</td>
<td>Average</td>
<td>-32.05</td>
</tr>
</tbody>
</table>
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ten out of twelve cases, the actual number of eggs spawned were less than
the calculated fecundity. There was wide variation in the percentage differ-
ence between the calculated fecundity and the number of ova spawned.
Based on the data of twelve specimens of rohu, it was seen that, on an average,
the actual number of eggs spawned by an individual female fish was 32%,
less than the calculated fecundity.

Fecundity factors.—The number of ova per gram body weight and per
gram ovary weight were calculated for each rohu specimen studied. It was
observed that the number of ova/g body weight varied from 121 to 545
while the number of ova/g ovary weight ranged from 895 to 2,312. In order
to examine whether these fecundity factors are influenced by the fish size,
the data was grouped for every 50 mm total length and the average values
of each length group were calculated, as shown in Table II. The table shows
that the fecundity factors are not influenced by the size of the fish. Therefore,
the data were pooled and the average number of ova per g body weight and
per g ovary weight were calculated and found to be 256 and 1,156 respec-
tively.

<table>
<thead>
<tr>
<th>Size group (mm)</th>
<th>Average number of eggs/g wt. of body</th>
<th>Average number of eggs/g wt. of ovary</th>
</tr>
</thead>
<tbody>
<tr>
<td>251–300</td>
<td>239</td>
<td>1193</td>
</tr>
<tr>
<td>301–350</td>
<td>307</td>
<td>1008</td>
</tr>
<tr>
<td>351–400</td>
<td>252</td>
<td>1191</td>
</tr>
<tr>
<td>401–450</td>
<td>222</td>
<td>1262</td>
</tr>
<tr>
<td>451–500</td>
<td>245</td>
<td>1262</td>
</tr>
<tr>
<td>501–550</td>
<td>269</td>
<td>1013</td>
</tr>
<tr>
<td>Average</td>
<td>256</td>
<td>1156</td>
</tr>
</tbody>
</table>
Various relationships have been found to exist between length and fecundity of different species of fishes. Franz [1910 (a) (b)], Kisselewitch (1923) and Clark (1934) have observed that fecundity in the fishes they studied, increased in proportion to the square of length. Simpson (1951) has demonstrated that the fecundity in plaice is related to the cube of length. Many recent studies have borne out Simpson’s contention, as they showed that the number of ova produced is related to the length of fish by a factor closer to the cube (Bagena, 1957; Sarojini, 1957; Pillay, 1958; Varghese, 1961 and 1966; Pantulu, 1963). In the present investigations it is observed that the fecundity of rohu increases at a rate of 3.96 times the length increase of the species.

The existence of a straight-line relation between fecundity and weight of fish has been reported by several earlier workers (Sarojini, 1957; Pillay, 1958; Varghese, 1961). In the present investigations also it is seen that the fecundity of rohu is related to its weight in a linear form.

The average number of eggs per gram body weight and per gram ovary weight in rohu were reported to be 271 and 1,258 respectively for the specimens studied by the students and staff of Central Institute of Fisheries Education at Bombay, while the mean number of eggs per gram body weight was 301 for specimens studied at Cuttack (Sukumaran, 1969). In the present investigations the above fecundity factors were 256 and 1,156 respectively. On the basis of the present study, the number of eggs per kg body weight of rohu is estimated at 2.56 lakhs.

The percentage weight of ovary in the total body weight of rohu ranged from 11.6 to 29.6 as reported by Sukumaran (1969). In the present studies, this factor varied from 10.3 per cent for a specimen weighting 1,020 g, to 33.3 per cent for one weighing 150 g. In order to see if the percentage ovary weight in total body weight of rohu is influenced by the size of fish, the data were grouped into convenient weight classes and the average percentage ovary weight for each group calculated. From this, it was observed that the percentage ovary weight was not significantly influenced by the size of fish. Therefore, the data were pooled and the average percentage ovary weight in the total body weight of rohu was calculated and found to be 25.1.
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REFERENCES


