CHAPTER-IX

Fecundity of *Puntius ornatus*,
*Lepidocephalichthys guntea* and
*Neotropius atherinoides*
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9.1 Introduction

Fecundity of a fish may be defined as the number of eggs that are likely to be laid during a spawning period (Singh *et al.*, 1982). It varies from species to species, depending on age, length and weight. There are various environmental conditions that may influence fecundity of a species such as temperature, salinity, oxygen and food supply (Wootton, 1973; Bagenal and Braum, 1978). Wootton (1973) suggested that food supply and nutrition affect the egg production and thereby the fecundity. He confirmed in his experiments with stickle back, that the low food intake led to fewer eggs, greater weight at maturity and shorter inter-spawning interval. Fecundity is directly related to fish production and fisheries and also it has considerable bearing on the reproductive potential of a population. Studies of the fecundity of fishes are useful for increasing the yield of commercially important fish species. It also helps in stock study, life history study, practical culture and actual management of the fishery. (Lagler, 1956; Doha and Hye, 1970; Das, 1977)

Many workers have worked on the fecundity of different fishes. A number of similar studies are also reported from Northeast India (Kaur, 1981; Sen, 1982; Biswas, 1982; Das, 1989; Das, 1990; Das, 2002;
Bhuyan, 2003; Kar et al. 2006). The present work was planned on the three selected fishes from Northeast India. Some reports of fecundity of species under the same family can be cited here.

Fecundity of different *Puntius* *sp.* has been worked out by different workers viz, Sobhana and Nair 1974, on *P. sarana subnasutus*; Sinha 1975, on *Puntius sarana* Rao et al., 1979 on *Puntius dorsalis*, Singh et al. 1982 on *Puntius chilinoides*, Prem Kumar et al. 1985 on *Puntius amphibious*, Islam and Hossain 1990, for *Puntius stigma*, Bhuiyan and Parveen, 1998 on *Puntius sophore*; Suryawanshi and Wagh 1999, on *Puntius kolus* in India and abroad. There is no report on fecundity of *Puntius ornatus* as it is a newly described species from Northeast India (Viswanath and Laisram. 2004 and Bordoloi and Baishya 2006). In the present study, sufficient mature fish was collected over a period of time covering different seasons from the landing site. Hence this is the first information related to the reproductive biology of the species.

There is little information regarding fecundity of species under Cobitidae family. Some works like Banu et al. (1992) studied fecundity of *Lepidocephalus guntea* in Bangladesh. Hussain et al. (2007) studied fecundity of *Botia Dario* in Bangladesh. Fecundity of *Lepidocephalichthys irrorata* was studied by Devi and Devi (2009) from Manipur. However, report on fecundity of *Lepidocephalichthys guntea* is
scanty. Earlier report shows that species under Cobitidae family are highly fecund fish.

Regarding fecundity of Schilbeidae family some works have been reported from India and abroad. Fecundity of three species of this family was reported by Olatunde (1978) from Nigeria. In India Ramakrishnaiah (1983) mentioned the fecundity of *Pseudeutropius taakree*. Alam *et al.* (1994) reported the fecundity of *Ailia coila* in Bangladesh. Kar *et al.* (2006) worked on fecundity of *Eutropiichthys vacha* from Assam.

There is paucity of literature on similar studies of *Neotropius atherinoides*. As the fish is in the endangered category, a need was arisen to study the reproductive biology of this species. The present study will help to assess the breeding potential of *Neotropius atherinoides*.

### 9.2 Materials and Methods

All the three selected fishes could be collected from the same habitat and also from the same landing site during the study period. Though they are collected from the same habitat, they are not abundant throughout the year. During pre monsoon and monsoon period, *Puntius ornatus* and *Neotropius atherinoides* are found to be available than the post monsoon period. Mature fish of both these species could be collected during this period for fecundity study. Mature
*Lepidocephalichthys guntea* was collected during pre monsoon period for fecundity study.

For studying the fecundity of *Lepidocephalichthys guntea* and *Neotropius atherinoides* same procedure was followed. Ovaries from mature specimens were used to study the fecundity. The specimens of these fishes were collected from different landing sites of beel and their total lengths were measured with dial vernier calliper nearest to 0.05mm and total weights were recorded in an electronic balance nearest to 0.1gm. The ovaries were then dissected out and lengths were recorded. It was preserved in 5% Formaldehyde solution. After allowing the ovaries to attain hardness they were taken out. The external connective tissues were removed from the surface of the ovaries. Moisture of the ovaries was soaked with absorbent paper. Three sub samples each of 100 mg from anterior, middle and posterior region of ovary were weighed separately. Ova from three regions were counted on a slide and average was taken. Then the fecundity (F) was calculated by Gravimetric method using the following formula.

\[
Fecundity (F) = \frac{\text{Total weight of ovary}}{\text{Weight of sub sample}} \times \text{Number of mature ova in the sub sample}
\]

The fecundity (F) thus estimated was studied in relation to several variables viz, the total length, weight of fish and ovary length, ovary weight of the fish.
These relations have been expressed as follows by applying the method of least square.

The straight line, \( Y = a + b X \)

The relative fecundity was calculated according to the following formula

\[
\text{Relative Fecundity} = \frac{\text{Egg numbers}}{\text{Body weight}}
\]

Absolute fecundity = Total number of mature ova in both parts of ovary.

*Puntius ornatus* is a small sized fish. So, to study fecundity, absolute fecundity of *Puntius ornatus* was calculated for this purpose. Mature ovaries of collected fishes dissected out and lengths were recorded nearest to mm and weights nearest to mg and preserved in 5% Formaldehyde solution. After allowing the ovaries to attain hardness they were taken out. The external connective tissues were removed from the surface of the ovaries. Moisture of the ovaries was removed with the help of a blotting paper. Mature ova from both parts of ovary were counted on a slide with the help of needle.

The absolute fecundity thus estimated was studied in relation to several variables viz, the total length, weight of fish, length of ovary, weight of ovary of the fish. These relations have been expressed as follows by applying the method of least square.

The straight line, \( Y = a + b X \).
For the present study 25 numbers of mature *Puntius ornatus*, 30 numbers of mature *Lepidocephalichthys guntea* and 20 numbers of mature *Neotropius atherinoides* were collected from the landing site of beel. Out of these 20 numbers of ovaries of *Puntius ornatus*, 15 numbers of ovaries of *Lepidocephalichthys guntea* and 11 numbers of ovaries of *Neotropius atherinoides* were used for fecundity study. However, the number of fishes examined for fecundity estimation was subject to availability during the spawning season in the habitat.

9.3 Observation

9.3.1 Fecundity relationship with other parameters

To establish the mathematical relationship of fecundity with other parameters in the selected fishes the values of regression coefficient (b), intercepts (a), correlation coefficient (r) were established by using the standard formula, $Y = a + b X$ (Table-29). Linear correlation ships were obtained in all the cases.

9.3.1.1 *Puntius ornatus*

Fecundity and total length of fish (TL)

The relationship between fecundity and total length of fish is shown in Table (28). The number of ova in a mature fish ranged from 450 for a fish length of 38.07 mm to 725 in a fish measuring 43.8 mm.
Table 28: Relationship between Fecundity and various parameters of body and Ovary of *Puntius ornatus*.

<table>
<thead>
<tr>
<th>No. of fish examined</th>
<th>Total length of fish (mm)</th>
<th>Total weight of fish (gm)</th>
<th>Ovary length (mm)</th>
<th>Ovary weight (gm)</th>
<th>No. of eggs(F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>20</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>38.07 - 43.8</td>
<td>41.19</td>
<td>0.5432 - 0.8869</td>
<td>0.6867</td>
<td>8.95 - 13.45</td>
</tr>
</tbody>
</table>

Table 29: Values of Correlation coefficient of different parameters with fecundity of *Puntius ornatus*.

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Equation, $Y = a + bX$.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinate</td>
<td>Abscissa</td>
</tr>
<tr>
<td>Fecundity(F) Total length(TL)</td>
<td>-128.11</td>
</tr>
<tr>
<td>Fecundity(F) Total weight(TW)</td>
<td>98.911</td>
</tr>
<tr>
<td>Fecundity(F) Ovary length(OL)</td>
<td>492.03</td>
</tr>
<tr>
<td>Fecundity(F) Ovary weight(OW)</td>
<td>40.39</td>
</tr>
</tbody>
</table>
The relationship between fecundity and total length (Table-29) of the fish can be expressed as-

\[ F = -128.11 + 16.862 \text{ TL} \]

\[ r = 0.476282 \]

Figure (9.1a) shows a linear relationship between fecundity and total length of the fish

**Fecundity and total weight of fish (TW)**

The relationship between fecundity and total weight of fish is shown in Table (28). Egg production ranged from 450 for a fish of weight 0.5432 gm to 725 in the fish weighing 0.8869 gm.

The relationship between fecundity and total weight (Table-29) of the fish can be expressed as:

\[ F = 98.911 + 688.25 \text{ TW} \]

\[ r = 0.85517 \]

Figure (9.1b) shows a linear relationship between fecundity and total weight of the fish

**Fecundity and ovary length of fish (OL).**

The relationship between fecundity and ovary length of fish is shown in Table (28). The number of ova varied from 450 for a fish having ovary length 8.95 mm to 725 in the fish having ovary length 13.45 mm.
Fig 9.1a: Graphical representation of Total length vs Fecundity of Puntius ornatus

Fig 9.1b: Graphical representation of Total weight vs Fecundity of Puntius ornatus

Fig 9.1c: Graphical representation of Ovary length vs Fecundity of Puntius ornatus

Fig 9.1d: Graphical representation of Ovary weight vs Fecundity of Puntius ornatus
The relationship between fecundity and ovary length (Table-29) of the fish can be expressed as-

\[ F = 492.03 + 6.7646 \times OL \]

\[ r = 0.384683. \]

Figure (9.1c) shows a linear relationship between fecundity and ovary length of the fish.

**Fecundity and ovary weight of fish (OW)**

The relationship between fecundity and ovary weight of fish is shown in Table (28). The number of ova varied from 450 for a fish having ovary weight 0.0598 gm to 725 in the fish having ovary weight 0.0985 gm.

The relationship between fecundity and ovary weight (Table-29) of the fish can be expressed as-

\[ F = 40.39 + 6296.4 \times OW \]

\[ r = 0.923973 \]

Figure (9.1d) shows a linear relationship between fecundity and ovary weight of the fish. The coefficient of correlation (r) shows that relationship is highly significant.
9.3.1.2 *Lepidocephalichthys guntea*

**Fecundity and total length of fish (TL)**

The number of ova produced varied from 2989 for a fish length of 79.1 mm to 4628 in the fish measuring 107.8 mm.

The relationship between fecundity and total length (table-31) of the fish can be expressed as:

\[ F = -2968.2 + 70.174 \text{TL} \]

\[ r = 0.924002 \]

Figure (9.2a) shows a linear relationship between fecundity and total length of the fish. The coefficient of correlation (r) shows that relationship is highly significant.

**Fecundity and total weight of fish (TW)**

Egg production ranged from 2989 for a fish of 3.87 gm weight to 4628 in the fish weighing 13.2 gm.

The relationship between fecundity and total weight (Table-31) of the fish can be expressed as-

\[ F = 2150.4 + 191.44 \text{TW} \]

\[ r = 0.819916 \]

Figure (9.2b) shows a linear relationship between fecundity and total weight of the fish.
Table 30: Relative fecundity and different parameters of *Lepidocephalichthys guntea*

<table>
<thead>
<tr>
<th>No. of fish examined</th>
<th>Total length of fish (mm)</th>
<th>Total weight of fish (gm)</th>
<th>Ovary length (mm)</th>
<th>Ovary weight (gm)</th>
<th>No. of eggs/gm weight of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>79.1 – 107.8</td>
<td>94.71</td>
<td>3.87 – 13.2</td>
<td>7.98</td>
</tr>
</tbody>
</table>

Table 31: Values of Correlation coefficient of different parameters with fecundity of *Lepidocephalichthys guntea*

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Equation, Y = a + bX</th>
<th>Ordinate</th>
<th>Abscissa</th>
<th>Value of “a”</th>
<th>Value of “b”</th>
<th>Correlation coefficient “r”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecundity(F)</td>
<td>Total length(TL)</td>
<td>-2968.2</td>
<td></td>
<td>70.174</td>
<td></td>
<td>0.924002</td>
</tr>
<tr>
<td>Fecundity(F)</td>
<td>Total weight(TW)</td>
<td>2150.4</td>
<td></td>
<td>191.44</td>
<td></td>
<td>0.819916</td>
</tr>
<tr>
<td>Fecundity(F)</td>
<td>Ovary length(OL)</td>
<td>964.82</td>
<td></td>
<td>69.652</td>
<td></td>
<td>0.790565</td>
</tr>
<tr>
<td>Fecundity(F)</td>
<td>Ovary weight(OW)</td>
<td>3014.4</td>
<td></td>
<td>595.61</td>
<td></td>
<td>0.733811</td>
</tr>
</tbody>
</table>
Fig 9.2a: Graphical representation of Total length vs Fecundity of Lepidocephalichthys guntea

Fig 9.2b: Graphical representation of Total weight vs Fecundity of Lepidocephalichthys guntea

Fig 9.2c: Graphical representation of ovary length vs Fecundity of Lepidocephalichthys guntea

Fig 9.2d: Graphical representation of ovary weight vs Fecundity of Lepidocephalichthys guntea
**Fecundity and ovary length of fish (OL)**

The number of ova varied from 2989 for a fish having ovary length 21.5 mm to 4628 in the fish having ovary length 46.6 mm.

The relationship between fecundity and ovary length (table-31) of the fish can be expressed as-

\[ F = 964.82 + 69.652 \text{ OL} \]

\[ r = 0.790565 \]

Figure (9.2c) shows a linear relationship between fecundity and ovary length of the fish.

**Fecundity and ovary weight of fish (OW)**

The number of ova varied from 2989 for a fish having ovary weight 0.019 gm to 4628 in the fish having ovary weight 3.11 gm.

The relationship between fecundity and ovary weight (Table-31) of the fish can be expressed as

\[ F = 3014.4 + 595.61 \text{ OW} \]

\[ r = 0.733811 \]

Figure (9.2d) shows a linear relationship between fecundity and ovary weight of the fish.
9.3.1.3 *Neotropius atherinoides*

**Fecundity and total length of fish (TL)**

The number of ova varied from 2290 for a fish length of 76.3 mm to 3438 in the fish measuring 89.15 mm.

The relationship between fecundity and total length (Table-33) of the fish can be expressed as-

\[ F = -220.3 + 37.762 \text{TL}. \]

\[ r = 0.474861. \]

Figure (9.3a) shows a linear relationship between fecundity and total length of the fish.

**Fecundity and total weight of fish (TW)**

Egg production ranged from 2290 for a fish of 3.27 gm weight to 3438 in the fish weighing 5.82 gm.

The relationship between fecundity and total weight (Table-33) of the fish can be expressed as-

\[ F = 2206.7 + 172.77 \text{TW}. \]

\[ r = 0.642354. \]

Figure (9.3b) shows a linear relationship between fecundity and total weight of the fish.
Table 32: Relative fecundity and different parameters of *Neotropius atherinoides*

<table>
<thead>
<tr>
<th>No. of fish examined</th>
<th>Total length of fish (mm)</th>
<th>Total weight of fish (gm)</th>
<th>Ovary length (mm)</th>
<th>Ovary weight (gm)</th>
<th>No. of eggs/ gm weight of fish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>11</td>
<td>76.3 – 89.15</td>
<td>83.03</td>
<td>3.27 – 5.82</td>
<td>4.10</td>
<td>14.6 – 19.8</td>
</tr>
</tbody>
</table>

Table 33: Values of Correlation coefficient of different parameters with fecundity of *Neotropius atherinoides*

<table>
<thead>
<tr>
<th>Ordinate</th>
<th>Abscissa</th>
<th>Value of “a”</th>
<th>Value of “b”</th>
<th>Correlation coefficient “r”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecundity(F)</td>
<td>Total length(TL)</td>
<td>-220.3</td>
<td>37.762</td>
<td>0.474861</td>
</tr>
<tr>
<td>Fecundity(F)</td>
<td>Total weight(TW)</td>
<td>2206.7</td>
<td>172.77</td>
<td>0.642354</td>
</tr>
<tr>
<td>Fecundity(F)</td>
<td>Ovary length(OL)</td>
<td>1957</td>
<td>55.545</td>
<td>0.428036</td>
</tr>
<tr>
<td>Fecundity(F)</td>
<td>Ovary weight(OW)</td>
<td>679.6</td>
<td>2129.8</td>
<td>0.952574</td>
</tr>
</tbody>
</table>
Fig 9.3a: Graphical representation of Total length vs Fecundity of Neotroplus atherinoides

Fig 9.3b: Graphical representation of Total weight vs Fecundity of Neotroplus atherinoides

Fig 9.3c: Graphical representation of Fecundity vs Fecundity of Neotroplus atherinoides

Fig 9.3d: Graphical representation of ovary weight vs Fecundity of Neotroplus atherinoides
Fecundity and ovary length of fish (OL)

The number of ova varied from 2290 for a fish having ovary length 14.6 mm to 3438 in the fish having ovary length 19.8 mm.

The relationship between fecundity and ovary length (table-33) of the fish can be expressed as:

\[ F = 1957 + 55.545 \text{ OL} \]

\[ r = 0.428036. \]

Figure (9.3c) shows a linear relationship between fecundity and ovary length of the fish.

Fecundity and ovary weight of fish (OW)

The number of ova varied from 2290 for a fish having ovary weight 0.699 gm to 3438 in the fish having ovary weight 1.25 gm.

The relationship between fecundity and ovary weight (Table-33) of the fish can be expressed as:

\[ F = 679.6 + 2129.8 \text{ OW} \]

\[ r = 0.952574 \]

Figure (9.3d) shows a linear relationship between fecundity and ovary weight of the fish. The coefficient of correlation (r) shows that relationship is highly significant.
9.3.2 Absolute fecundity

*Puntius ornatus*

The total number of ova produced by *Puntius ornatus* was estimated as 450-725 for the fish length measuring 38.07mm to 43.8mm. The average fecundity is found to be 572.8 against average length of 41.19mm fish size and 0.6867gm mean weight of the fish (Table-28)

*Lepidocephalichthys guntea*

In case of *Lepidocephalichthys guntea* the range of total number of ova was estimated to be 2989 to 4628 for fish length measuring 79.1 mm to 107.8 mm. The average fecundity is found to be 3678 against average length of 94.71 mm fish size and 7.98 gm of mean fish weight.

*Neotropius atherinoides*

In case of *Neotropius atherinoides* the range of total number of ova was estimated to be 2290 to 3438 for fish length measuring 76.3 mm to 89.15 mm. The average fecundity is found to be 2798.27 against average length of 83.03 mm fish size and 4.10 gm of mean fish weight.

9.3.3 Relative fecundity

Relative fecundity is the number of eggs per unit weight of fish. It can be used to compare reproductive strategies in fish. So, to compare the fecundity of *Lepidocephalichthys guntea* and *Neotropius atherinoides* with other species relative fecundity was calculated.
*Lepidocephalichthys guntea*

The relative fecundity of *Lepidocephalichthys guntea* ranges from 328.33 to 772.52, average being 490.43 ova per gram body weight of fish (Table-30).

*Neotropius atherinoides*

The relative fecundity of *Neotropius atherinoides* ranges from 508.55 to 911.50, average being 704.83 ova per gram body weight of fish (Table-32).

**9.4 Discussion**

**9.4.1 Fecundity relationship**

*Puntius ornatus*

From the above observation it is clear that fecundity of *Puntius ornatus* has linear growth with total length, total body weight, ovary weight and ovary length. But fecundity is found to increase at a higher rate against ovary weight than the rest of the parameters. The coefficient of correlation between fecundity and ovary weight was found to be highest (r = 0.923973) than total length (r = 0.476282), total body weight (r = 0.85517) and ovary length (r = 0.384683). Hickling (1940) was also of the opinion that close relationship could be expected between weight of ovary and ova produced. The close relationship between fecundity and ovary weight was also reported by Rao *et al.*, (1979) for *Puntius dorsalis*, Suryawanshi and Wagh (1999) for *Puntius kolus* and Islam and Hossain (1990) for *Puntius stigma.*

*Lepidocephalichthys guntea*

In the present study it was found that the number of eggs increase linearly with the increase of total length, total body weight, ovary length and ovary weight of *Lepidocephalichthys guntea*. All the relationships were found to be linear. Comparison of correlation coefficient reveals that the variation of fecundity with total length is highly correlated (*r* = 0.924002) than that of total body weight (*r* = 0.819916), ovary length (*r* = 0.790565) and ovary weight (*r* = 0.733811) of *Lepidocephalichthys guntea*.


In contrary to this a direct relationship between fecundity and total length of fish was observed by Musa and Bhuyan (2007) in *Mystus bleekeri*.
However. Banu et al. (1992) reported a close relationship between fecundity and ovary weight than any other relationship in *Lepidocephalus guntea*. According to Suryawanshi and Wagh (1999), fecundity is known to vary not only in different species but also within the same species depending upon the length, weight, volume of the fish, weight of the gonads, size of the ova and certain other factors. Even the geographical distribution is known to have influence on fecundity. So, it can be concluded that there must be some mentioned reason that may occur in *Lepidocephalus guntea*.

*Neotropius atherinoides*

During the study fecundity with ovary weight was found to increase almost proportionately following a linear relationship for *Neotropius atherinoides*. The number of ova produced is closely related to the ovary weight ($r = 0.952574$). The correlation between fecundity and ovary weight was found to be highest among all the relationship like fecundity and total length ($r = 0.474861$), fecundity and total weight ($r = 0.642354$) and fecundity and ovary length ($r = 0.428036$).

In most fishes this type of relationship was reported by Parameswaran et al. (1972), Siddiqui et al. (1976), Somvanshi (1985), Das (1990) during their observation respectively.

9.4.2 Relative fecundity

*Lepidocephalichthys guntea* and *Neotropius atherinoides*

In the present study relative fecundity was found to be quite high in *Lepidocephalichthys guntea* (490.43) and in *Neotropius atherinoides* (704.83)

However, different workers also recorded high relative fecundity from Indian region which can be cited here, Piska and Waghray (1986) recorded 967 in *Amblypharyngodon mola*; Khan et al. (2001) recorded 828 in *Hilsa ilisha*; Vinci et al. (2005) recorded 894 in *Gudusia chapra*.

From the above discussion it is clear that the fishes under consideration are very much fecund and their relative fecundity can be compared to other Indian fishes.

Fecundity of all the three species have linear relationship with total length, total body weight, ovary length and ovary weight. However, fecundity is found to be more closely related to ovary weight in *Puntius ornatus* and *Neotropius atherinoides* than any other relationship. Likewise fecundity is found to be more closely related to ovary length than any other relationship in case of *Lepidocephalichthys guntea.*