# ESTIMATION OF FECUNDITY AND GONADOSOMATIC INDEX (GSI) OF PARADISE THREADFIN, *POLYNEMUS PARADISEUS* (LINNAEUS, 1758) FROM THE MEGHNA RIVER ESTUARY, BANGLADESH

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***Abstract:*** *The present investigation was conducted to assess the fecundity and gonadosomatic index of female Polynemus paradiseus (L.) of the Meghna river estuary during the spawning season. A total of 75 samples were collected from local fish markets Chairmanghat, Sonapur and Maijdee of Noakhali. Mean total length and mean body weight of the collected fish samples were 16.38 ± 0.29 cm and 25.01 ± 1.45g respectively. The mean total fecundity was found 11383.33 ± 343.35.Variation in fecundity, GSI, total length, body weight and gonad weight of the studied species was found across the spawning season (April- June). Gonadosomatic index was found higher in May-June than April. The relationships of fecundity with body length, body weight and gonad weight were found to be linear and correlation coefficient (r) values were 0.6861, 0.7823 and 0.8049 respectively. The linear relationship between body weight and fecundity was found more valid than the relationship between body length and fecundity. The present study revealed that the fecundity of P. paradiseus was comparatively low than other estuarine fish species. Basic information on the size at sexual maturity and fecundity of P. paradiseus will be helpful to evaluate reproductive potential of individual fish species in similar studies.*

***Keywords****: Paradise Threadfin, Fecundity, Gonadosomatic Index, Spawning season, Meghna River Estuary, Bangladesh*

## 1. Introduction

Polynemus paradiseus, of the order Perciformes and family polynemidae, is one of the commercially important fish in Bangladesh. Its English name is 'Paradise threadfin and locally known as taposi, tapsi, muni, rishi, bairagi in Bangladesh. It is an important commercial fish in South Asia and Southeast Asia, especially in India, Thailand, Vietnam, and Bangladesh. It contributes a significant portion to marine fish production in Bangladesh. But the catch of this species has declined in recent years because of over fishing [1].

Fecundity is the number of eggs that is ready for the next spawning by a female. The gonadosomatic index (GSI) is an indicator of the state of gonadal development. Knowledge about fecundity and GSI of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery [2, 3]. Although a considerable number of works on different biological aspects of *P. paradiseus* have been done, but no published work has been found yet on the fecundity and GSI of this fish in Meghna river estuary of Bangladesh. Hence, considering the economic importance of this species, an investigation was conducted during the spawning season to assess the fecundity and GSI of *P. paradiseus.*

## 2. Materials and methods

### 2.1 Sample collection

The experiment was conducted during the spawning season of Paradise Threadfin from April to June, 2010. Twenty five fish samples were collected from the Chairmanghat, Sonapur and Maijdee local fish market, Noakhali in each month. Samples were then brought to the laboratory of Fisheries and

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Marine Science Department of Noakhali Science and Technology University, Noakhali, Bangladesh using the ice box and preserved in refrigerator.

**2.2 Estimation of total length, body weight and gonad weight**

The total length and body weight of each fish were recorded separately to the nearest 0.01 cm and 0.01 g respectively. Then the samples were dissected and the gonads from each specimen were removed out intact. Each lobe of matured ovaries was weighed nearest 0.00001g by a sensitive electric balance (Scout pro SP402, Ohaus Corporation, USA). Three sub-samples taken from the anterior, middle and posterior regions of each ovary were weighed and preserved in 5% formalin solution.

**2.3 Determination of Fecundity**

Gravimetric method was applied in the present study. The numbers of eggs in each of the sub-samples were counted under a magnifying glass after 24 hours and mean value of the eggs was computed. The average numbers in sub-sample were multiplied by the weight of the ovary and calculated the value of fecundity of right and left gonad. Fecundity was calculated by the following formula:

$$F = n \times G/ g$$

Where "F" is fecundity, "n" is the average number of eggs, "G" is weight of the gonads and "g" is the weight of the sub sample.

**2.4 Calculation of GSI**

The gonadosomatic index is an indicator of the state of gonadal development. The GSI value was calculated from the ratio of total body weight and gonad weight.

GSI= (Gonad weight / body weight) ×100

**2.5 Statistical analysis**

Data were analyzed using the Microsoft Excel 2003 with the level of significance at $p<0.05$. Correlations and regression between fecundity and other parameters such as total length, body weight, gonad weight, GSI were also determined. Data have been presented as mean ± SEM.

**3. Results and discussion**

**3.1 Description of the ovaries**

Ovary of *Polynemus paradiseus* is bi-lobbed with a short oviduct; the right lobe was always found larger than that of the left one at the ripe stage. The average weight of the right lobe (1.66 ± 0.03g) was significantly higher than the weight (1.49 ± 0.03g) of the left lobe (Table 1). The observed variation in numbers of eggs in different lobes could be due to the variations in environmental conditions and food intake by the individual. The variation in fecundity is very common in fish and has been reported by many workers [4, 5, 6]. Numerous factors like different stock of fish [7], nutritional status [8], racial characteristics [9], time of sampling and maturation stage, changes in environmental parameters [4] etc. have so far been reported to affect the fecundity both within the species and between fish populations. So, variation in fecundity of *P. paradiseus* is not an exception. The right lobe was found larger in most cases than that of the left one at the ripe stage. Similar result was observed in *Glossogobius giuris* [5]. The rate of maturation in the left and right lobes of ovaries was similar for *Odentomblyopus rubicundus* [10]. About 90 per cent of the left ovaries of Salmon held more eggs than the right side [11]. The data for the king Salmon in Japanese waters do not show significant differences in egg numbers between the two ovaries [12].

**3.2 Fecundity**

In gravid female *P. paradiseus*, fecundity was found variable across the spawning season. The average number of eggs was found 11,383.33 ± 343.35 (Table 1). The observed number of eggs of the studied fish indicates that the fish was low fecund for its size than other estuarine species. Higher number of eggs was observed in the same species from the Hooghly estuary and Roopnarayan estuary [8]. The mean fecundity in *Puntius gonionotus* was obtained as 14.321 [4]. The mean fecundity was found 31833.50 ± 10313.42 in *Botia dario* (Hamilton) [13] and 129,964.10 ± 48,733.48 in *Glossogobius giuris* [5].

**Table 1** Mean (± SEM) and Range value of fecundity and other parameters of *Polynemus paradiseus*

| Parameters | Mean ± SEM | Range |
|---|---|---|
| Total length (cm) | 16.38 ± 0.29 | 14.5 − 18.9 |
| Body weight (g) | 25.01 ± 1.45 | 13.04 − 38.05 |
| Gonad weight (g) | 3.11 ± 0.12 | 1.65 − 4.94 |
| Weight of right gonad (g) | 1.66 ± 0.03 | 0.87 − 2.63 |
| Weight of left gonad (g) | 1.49 ± 0.03 | 0.76 − 2.31 |
| Fecundity of right gonad (g) | 6144.67 ± 151.85 | 2631 – 11590 |
| Fecundity of left gonad (g) | 5238.67 ± 173.89 | 2026 – 10683 |
| Fecundity | 11383.33 ± 343.35 | 4985 – 22273 |
| GSI | 12.75 ± 1.06 | 8.91 − 14.52 |

### 3.3 Seasonal variation in different biological parameters of *P. paradiseus*

*3.3.1 Fecundity (no.)*

Variations in fecundity were observed in *P. paradiseus* during the spawning seasons (April - June). The highest level was observed in June (15368.2 ± 1099.93) and the lowest (6700.8 ± 273.6) in April. The mean value of fecundity in May was 12081 ± 792.94 (Fig. 1). There was no significant difference between the fecundity in May and June. This indicates the peak season is May to June and the mature females are available in June.

*3.3.2 Total body length (cm)*

In May and June, the total body length of *P. paradiseus* was found similar (16.86 ± 0.27 cm in May and 16.92 ± 0.33 cm in June). The lowest value was found in April (15.36 ± 0.26 cm) and highest value in June (Fig. 2).

*3.3.3 Body weight (g)*

The highest body weight was observed in May (27.14 ± 1.52 g) and the lowest was found in April (20.87 ± 1.28 g). The body weight in June (27.03 ± 1.55 g) was near to the value of May (Fig. 3).

*3.3.4 Gonad weight (g)*

An increasing trend in gonad weight of *P. paradiseus* was found during the spawning season. The highest value was found (3.77 ± 0.14 g) in June and the lowest value was (2.19 ± 0.1 g) in April. The value measured in May (3.36 ± 0.11 g) was near to the value recorded in June (Fig. 4).

*3.3.5 Gonadosomatic index (%)*

The gonadosomatic index (GSI) is an indicator of the state of gonadal development. The highest average value of GSI was found 14.5 ± 0.66% in June and lowest average value was 10.84 ± 0.31% in April. Significant difference of GSI was in April than other two months.

The GSI value was found 13.03 ± 0.5% in May (Fig. 5). Increasing trends in GSI value during the spawning season indicates the development of the gonads from April to June and also indicates that peak spawning season of *P. paradiseus* is June. It is familiar that the gonadosomatic index increases with the maturation of fish, being maximized during the period of peak maturity and declining abruptly thereafter [14]. In *P. paradiseus*, the gonadosomatic index was observed highest during June when majority of fishes were found mature. The GSI value in May was near the value found in June. The highest GSI value of *Mystus gulio* was observed in July which was the peak spawning season of the fish [15].

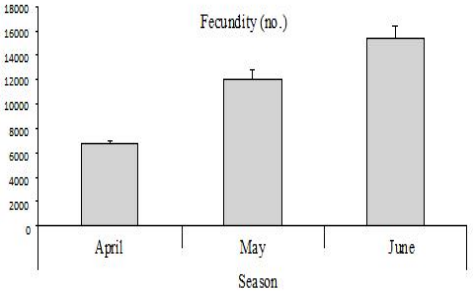


**Figure 1:** Fecundity of *P. paradiseus* observed during the spawning seasons (April-June)

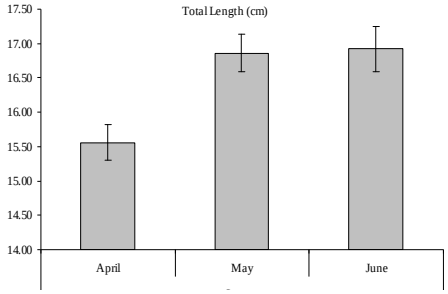


**Figure 2:** Total body length of *P. paradiseus* observed during the spawning seasons (April-June)

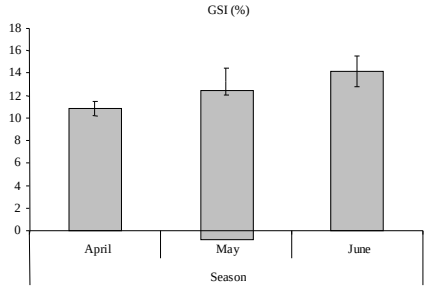


**Figure 5:** GSI (%) of *P. paradiseus* observed during the spawning seasons (April-June)

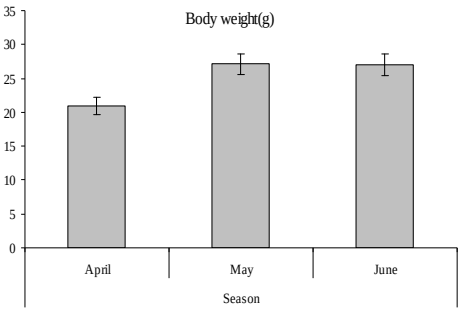


**Figure 3:** Body weight of *P. paradiseus* observed during the spawning seasons (April-June)

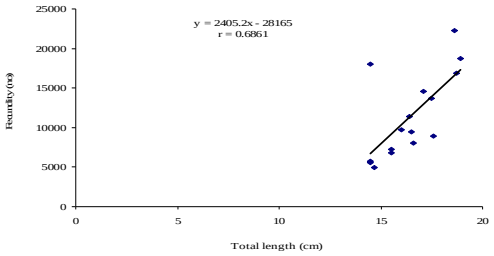


**Figure 6:** Relationship between fecundity and total body length

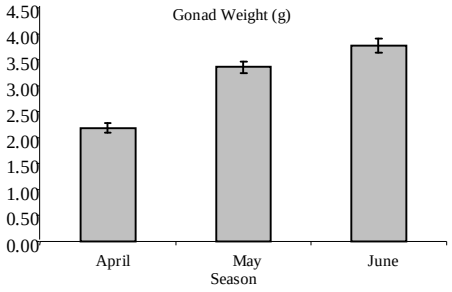


**Figure 4:** Gonad weight of *P. paradiseus* observed during the spawning seasons (April-June)

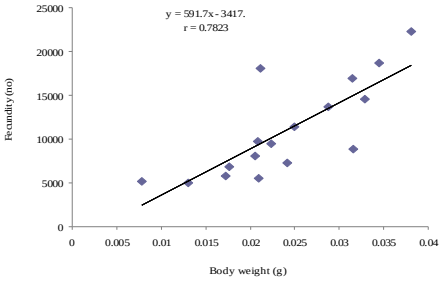


**Figure 7:** Relationship between fecundity and body weight

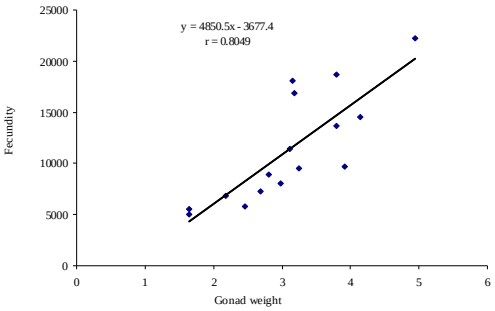


**Figure 8:** Relationship between fecundity and gonad weight

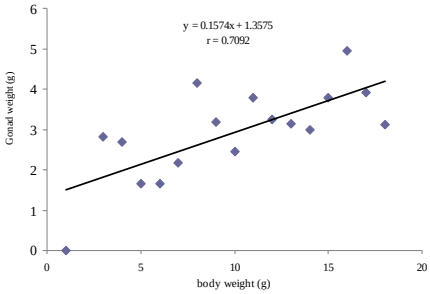


**Figure 9:** Relationship between gonad weight and body weight

### 3.4 Co-relationship between fecundity and other parameters of *P. paradiseus*

The co-relationship of fecundity with total body length, body weight and gonad weight was found to be linear and the correlation coefficient (r) values were 0.6861, 0.7823 and 0.8049, respectively. The relationship between fecundity and body weight (y = 591.7x - 3417; r = 0.7823) was found stronger than fecundity and total length (y = 24050.2x - 28165; r = 0.6861) (Fig. 6 & 7) where as strongest correlation was observed between fecundity and gonad weight (Y= 4850.5X - 3677.4; r = 0.8049) (Fig. 8). Similar finding was observed in catfish *Thachysurus thalassinus* [6] and in *Mystus tengra* [16]. It was observed that number of eggs increased linearly with the increase in body length, body weight and gonad weight (Fig. 6-7). Similar findings were confirmed in various species [17, 9, 10, 18, 19, 20, 14, 21, 22]. Variation in fecundity of the same class length fish was found in the study which indicates the fecundity of a fish is not solely dependent on its length. Similar result was confirmed in *H. ilisha* and in *Lepturacanthus savala* [23, 24]. Positive relationships between fecundity and body weight have also been reported in a number of fishes and this support to the present findings [8, 24].

## 4. Conclusion

This study provides some basic information on the body size at sexual maturity and fecundity for *P. paradiseus* that will be helpful to evaluate reproductive potential of individual fish species in similar studies. Further, it would be useful for fishery biologist/manager to impose adequate regulation for sustainable fishery management for the control of exploitation of young individuals and other information aids in evaluation and prediction of fish stock in the different water bodies of Bangladesh.

## 5. Acknowledgements

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