# STUDY ON OVARY FECUNDITY OF CLIMBING PERCH (*Anabas testudineus,* BLOCH) IN PUTHIMARI *beel* OF BARPETA DISTRICT, ASSAM, INDIA.

**A Project report**

**Submitted to the**

**B.H. COLLEGE**


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**GAUHATI UNIVERSITY**

THIS WORK IS DEDICATED

TO

ALL THE ENTHUSIASTIC RESEARCHERS

# Declaration Form

This is to certify that Project Report entitled " **Study on Ovary Fecundity of Climbing Perch (*Anabas testudineus,* Bloch) in Puthimari *beel* of Barpeta District, Assam, India"** submitted to the IQAC, Research Cell of B.H. College, Howly for partial fulfillment of the "Student's Minor Research Project" under the "Satya Nath Das Research Fund" is a record of research work carried out by **Jyotishman Nath, Debasish Bayan, Ankita Das and Bipanchi Das** under the supervision and guidance of Project in Charge **Dr. Suruchi Singh**.

All kinds of help received during the study have been duly acknowledged.

No part of this Project Report has been reproduced elsewhere for any degree.

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**Abstract**

*Anabas testudineus* (Bloch, 1792) is a commercially important fish in most of the South Asian countries. Its natural populations are seriously decreasing due to heavy exploitation and other ecological changes in its habitat. This study illuminates the fecundity, GSI and condition factor of *A. testudineus* collected from the Puthimari *beel* in Sorbhog, Assam, India. A total of 12 fish specimens were examined from the month of June to July. The total length, body weight, gonadal length, gonadal weight were analyzed with the help of classical tools. Water quality parameters like DO, pH, temperature were monitored periodically and the values were ranged optimal. The fecundity showed a positive growth which recorded from 5188 to 17834 and the recorded GSI value ranges from 15.2% to 22.3%. The current study might be helpful for maintaining the production of the fish in Barpeta district and overall in the state of Assam and raise the economic status of fisherman cultivating this species.

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# ABBREVIATIONS

Cm - Centimeter

DO – Dissolve Oxygen

GSI – Gonado Somatic Index

Ha – Hector

IQAC – Internal Quality Assessment Cell

K – Condition Factor

L - Litre

Mg – milligram

Ppm- Parts per million

TL – Total Length

F – Fecundity

W - Weight

# CHAPTER I

# INTRODUCTION

The state of Assam is endowed with enormous natural as well as man-made water resources. The large perennial rivers and other water bodies with the rich aquifer speak about vastness of its water resource. The state is drained by the dense networks of two river systems, viz. Brahmaputra and Barak. These rivers have large number of tributaries joining them from both the banks. In India, the Brahmaputra basin lies in the state of Arunachal Pradesh, Assam, Nagaland, Sikkim and West Bengal. The Brahmaputra rolls down the plain of Assam east to west for a distance of 640 km up to Bangladesh border (Bhattacharjya et al., 2017). River Brahmaputra, the mighty river of the North East India is blessed with diverse ecological features having tremendous fishery potential. It has 42 major tributaries and three forerunners namely Siang, Dibang and Lohit (Bhattacharjya et al., 2017). Bhattacharjya et al. (2017) reported 141 fish species from the river belonging to 84 genera and 29 families.

Besides the rivers, another important source of surface and open water is the wetlands of the state. The state of Assam is gifted with innumerable wetlands. Floodplain wetlands in India are unique and dynamic ecosystems that provide a rich habitat for a diverse array of aquatic species. These wetlands are characterized by their seasonally inundated landscapes, and complex hydrological regimes. Floodplain wetlands are rich in nutrients, diversified in life, and ecologically productive (Sugunan and Bhattacharjya, 2000).

Floodplain wetlands in Assam with an area of 100,815 Ha are among the major fisheries resources of the state constitutes 1.29 percent of the total geographical area of the state with a high production potential of 1000–1500 kg ha−1 yr−1(Das et al.,2018). Assam's wetlands support a diverse range of fish species for its subtropical climate, favorable ecological and geo-hydrological condition and auto stocking capacity of the wetlands (Deka, 2001). The district of Barpeta has a total of 97 wetlands, covering an area of 33.01 $km^2$. The Puthimari *beel* is one of them, situated on the North of Barpeta district. The *beel* is fed by Puthimari river, a tributary of the river Brahmaputra. The *beel* is almost 2 km far from the town of Sorbhog and covers a total area of 300 ha. This wetland is a major habitat for the aquatic fauna including varied type of fish species. *Anabas testudineus* is one of the major species found in this *beel.*

*Anabas testudineus***,** (Bloch,1792)commonly known as climbing perch or 'Koi' in local language, is a small sized food fish belonging to the family Anabantidae under the order Anabantiformes. They are commonly around 12.5 cm in length and can attain a maximum length of 25 cm. The body is laterally compressed, mouth is anterior and lower jaw is slightly longer. Their body color varies from dark to pale greenish, fading to pale yellow on belly whereas dorsal and caudal fin are dark grey, anal and pectoral fins are pale yellow, and pelvic fin is pale orange in color (Viswanath,2007)

Scientific classification (IUCN,2015)of *Anabas testudineus* is –

Kingdom: Animalia

Phylum: Chordata

Class: Actinopterygii

Order: Anabantiformes

Family: Anabantidae

Genus: *Anabas*

Species: *A. testudineus*

It inhabits mostly in freshwater and brackish water; mostly in canals, lakes, ponds, ditches, wetlands, floodplains, and swamps. During dry seasons, they remain buried under muddy areas. Studies have confirmed about their omnivore feeding behavior without other feeds (Vikas *et al.* 2022).

Anabas is widely found across the globe particularly in the tropical and subtropical Asian countries such as India, Sri Lanka, Bangladesh, Burma, Indonesia, Malaysia, Thailand, Cambodia, Philippines and Vietnam. In India, this fish holds a high economic value in the states of Assam, Bihar, Jharkhand, Orissa, Manipur, Tripura, Maharashtra and West Bengal. They also have a high demand in the southern states of the country. The climbing perch is euryhaline i.e. they are able to adapt to a wide range of salinities. (Borah *et al.* 2020) This fish has the adaptive ability to survive in adverse climatic conditions such as low dissolved oxygen, high turbid water, extreme pH, high temperature, etc. It is an air-breathing species using a labyrinth organ to take oxygen directly from the atmosphere. Anabas feeds on

macrophytic vegetation, shrimps and fish larvae. They possess accessory respiratory organs, because of which they can remain buried under muddy areas during dry season. Thus, it has a wide range of geographical distribution. Due to its air breathing ability and tolerance to extreme unfavorable condition, this species is treated as a prominent candidate fish for aquaculture (Sarkar *et al,* 2005), as it is a good fish for climate resilient aquaculture.

The climbing perch has great nutritional importance. They are rich in proteins (16.97g), fats, vitamins (such as Vitamin D, Vitamin E, Vitamin A, Vitamin K and Vitamin $B_{12}$), minerals (such as calcium, sodium, zinc, iron), amino acids and fatty acids. Zinc and iron help in the synthesis of hemoglobin. Omega-3 fatty acids play important role in lowering our triglycerides levels, which makes it the most important nutritional constituent in Anabas. This species is considered as a valuable item of diet for sick and convalescent. It is also popular for their lean meat, which contain easily digestible protein and fat of very low melting point and many essential amino acids making them an ideal food (Hossain *et al.* 2015). So, Anabas has a good market demand. It is an economically important fish and has a high market price in India, especially in North-Eastern states. The climbing perch has been used as a prime ingredient of food for many cultural and authentic dishes for ages due to its delicious taste and flavor. In India, we have two strains of Anabas- the Indian and the Vietnamese strain, which people use as food. However, in the North Eastern region of our country and especially in Assam, the Vietnamese strain is preferred the most.

Fecundity is an important factor in the management of fish stock of a species. It can be defined as the number of ova that are likely to be laid by a fish during the spawning season.

It is an important index of biology of fishes which helps in the evaluation of reproductive potential of a particular fish species that must be understood to explain the variation in the level of fish population and attempt to increase the aquaculture harvest and production. The fecundity varies from species to species depending on various environmental factors, length, age etc. It also depends on the variation of location (Gunderson, 1977; Mann *et al* 1984). Thus, fecundity is a measure of the reproductive capacity of a fish and is an adaptation to various conditions of the environment. Along with the fecundity, Gonado Somatic Index (GSI) is also a crucial factor to compare the reproductive condition of particular species, whereas GSI is the ratio between the gonad weight and the total weight of the individual (Anderson et al., 1985).

**In this backdrop the objectives of the present study were taken:**

1. To study the ovary fecundity of Vietnamese strain of *Anabas testudineus* from the Puthimari *Beel*, Barpeta.
2. To determine the optimum condition for highest fecundity observed during the month of June and July from the Puthimari *Beel*, Barpeta.
3. To find the Gonado Somatic Index of *Anabas testudineus* using appropriate statistical tool.

## CHAPTER II

## REVIEW OF LITERATURE

Marimuthu *et al.* 2009 studied the fecundity of *A. testudineus* and relation between ova diameter, total length and body weight were also established. In the study, the variation of eggs were found with respect to different total length of the fish, simultaneously variation of eggs were also recorded for different fish with same total length. This variation of fecundity in the fishes assumed due to nutritional diet, running water and influence of vitamins. Further, it was revealed from the study that fecundity increases with the total length, total weight and gonad weight. The study also suggested that less number of eggs is related with shorter development of time and reduced the mortality rate of juvenile fish.

A study was conducted in Bangladesh based on the breeding biology of Vietnamese strain of *A. testudineus* (Bloch 1792). Five gross ovarian stages (immature, maturing, mature and ripe) of the fishes were examined. During the study period temperature, pH and dissolved oxygen were ranged from 17.5$^{o}$C to 33.6$^{o}$C, 6.9 to 7.6 and 4.18 mg/l to 5.57 mg/l where the above mention parameters are crucial for better breeding success. Studies on the development of different ovarian maturation stages indicates reproductive periodicity which further inform about the spawning season, breeding period of the species. The highest GSI value of male and female were 8.33 and 14.91in the month of May indicating as the peak breeding season for Vietnamese Koi. The study also arrayed a positive relation between fecundity and total length of the fish, its weight, ova weight and ova diameter of *A. testudineus* ( Hafijunnahar *et al.* 2016).

Study of climbing perch by Ndobe *et al.* 2020 in Central Sulawesi, Indonesia indicated that spawning of climbing perch occur over at least four months (June to September) likely over a lengthy period with a spawning peak in July-August. Also the study revealed that ranges and means were different for male and female climbing perch although they have similar length and weight. Allometric positive growth patterns have

been reported for male climbing perch in this study but most studies have found negative growth patterns. Here specimen's showed high fecundity and GSI were large in size and weight which specify fecundity increases in larger size. The study also revealed that the condition factor *K* for male was generally lower than females and also it was found that GSI of female gonad maturity stage IV was seen high and it is correlated with Fulton's condition factor *K*.

Muslimin *et al.* 2020 studied the gonadal maturation of *A. testudineus* with supplement like vitamin C, vitamin E and *Spirulina sp.* added to the fish feed. Result from the study revealed that addition of *Spirulina sp.* had a great impact on index of gonadal maturation whereas, vitamin E significantly affected ovary diameter and fecundity. Vitamin C was not effective on all parameters. Average length and weight approx. 1.66cm and 12.28g of fish fed with *Spirulina sp.* Vitamin E fed fish resulted the best gonad weight at 2.44g. Similarly, highest fecundity was found to be 5,719 eggs of the fish treated with vitamin E. The study also concluded that vitamin E was effective for ovary diameter and fecundity of female brood, keeping in mind of other environmental factors and quantity of feed.

Sarma *et al*. 2010, conducted a research on Acclimation of *Anabas testudineus* (Bloch) to three test temperatures influences thermal tolerance and oxygen consumption.Teleost fish have developed their own specific adaptive mechanism, both behavioral and physiological, to maintain homeostasis in response to unfavorable temperatures. Therefore, this study was aimed at assessing the critical thermal maxima ($CT_{Max}$), critical thermal minima ($CT_{Min}$), and oxygen consumption rate of *Anabas testudineus* (17.03 ± 1.2 g) after acclimating to three preset temperatures (25, 30, and 35°C) for 30 days. The $CT_{Max}$ and $CT_{Min}$ were 40.15, 41.40, 41.88°C and 12.43, 13.06, 13.94°C, respectively, and were significantly different ($P < 0.05$). The thermal tolerance polygon for the specified temperatures was 278.30°$C^2$. The oxygen consumption rate (117.03, 125.70, 198.48 mg $O_2$ $kg^{-1}$ $h^{-1}$, respectively) increased significantly ($P < 0.05$) with increasing

acclimation temperatures. The overall results indicate that the thermal tolerance and oxygen consumption of *A. testudineus* are dependent on acclimation.

A investigation was put forwarded by Dubey *et al.*2015 on Response of *Anabas testudineus* (Bloch, 1792) to salinity for assessing their culture potentiality in brackish water inundation prone areas of Indian Sundarban .Their study investigated the effect of salinity on growth and survival of Anabas testudineus for assessing their culture potential in brackish water. The estimated median lethal salinity concentration of 96-hour for *A. testudineus* (11.74 g) was 18.86 g l-1. Based on median lethal salinity concentration, survival and growth performances were assessed at three sub-lethal salinity levels. The results of the present experiment indicated that salinity plays a significant role for the culture of freshwater climbing perch *A. testudineus*. It reflects that the species can adjust or tolerate their adaptability in high saline condition of water.

Jacob (2005) investigated the reproduction, maturation and larval development of *A. testudineus* (Bloch). Also a relation between surface water temperature and GSI was evaluated. The study also revealed that *A. testudineus* neither bred under captivity nor at altered temperature. Hatching was seen at 19 hours post fertilization where temperature ranged between 26-28$^{o}$C. Minor fluctuations were also seen in the monthly values of the condition factor 'K'. Study revealed the fecundity range from 1000 to 59,022 in fish size ranging from 8.9 cm to 18.7 cm.

From the study conducted by Ziauddin *et al.* 2016 on climbing perch the morphometry and relationship between fecundity to length and weight, length and weight of ovary and volume of ovary was established. Testicular morphometry revealed that testis weight, volume and length increase with respect to increase in fish length and weight. Also the GSI was found to be 10.4±2.5 during the breeding season. The relation between fecundity and fish length was turned up to be F=9486 + 1119 TL, where F and TL refers to fecundity and total length. The resulted data between fish weight and fecundity was turned up to be F=25645 + 157 FW.

Dash *et al.,* 2019 studied the effect of different feeding frequencies on growth and feed utilization in *A. testudineus* (Bloch 1792) fry. Fishes were grouped into $T_1$, $T_2$, $T_3$ and $T_4$ according to their times of feeding. The weight gain percentage (%)(WG) is higher in $T_3$ group (112.80±2.25) similar indication for specific growth rate (SGR) was also observed to be high (2.15±0.03). Study concluded that feeding frequency of 4 times a day results better growth and utilization of feed during cultivation of climbing perch.

The study was performed for evaluating the growth and production performance of Indian and Vietnamese strain of Koi (*Anabas testudineus*) in the rectangular cemented tank of size (10 ft X 6 ft) in the experimental farm of Livestock Research Station, Hekera, Mondira, Assam Agricultural University, Assam for the period of four months during, 2018. There were two treatments each with three replications. Three tanks each under treatment-1 (T1)and treatment-2 (T2) were stocked@ 200 number/ tank with Indian strain of climbing perch fry of (0.60±000) g and Vietnamese strain of climbing perch fry bearing weight of (0.59±001) g, respectively. Fish were fed with commercial pellet feed named "Abis" two times in a day @ of 60% (1st month), 25% (2nd month),10% ($3^{rd}$ Month) and 5% ($4^{th}$month) of their body weight in all treatments. The mean FCR value of T1 (Indian Koi) and T2 (Vietnamese Koi) were obtained 1.49±0.01 and 1.29±0.00, respectively. The water quality parameters of tank water monitored monthly were within acceptable range for fish culture. The survival rates were 85.33±0.88 and 90.67±1.45 for T1 and T2, respectively. The results demonstrated that the higher mean growth and production were observed in Vietnamese strain (T2) than Indian strain (T1) of climbing perch.

Priyatha and Chitra (2022) evaluated the reproductive strategy and gonadal development of climbing perch under controlled laboratory condition. During the pre-spawning and spawning stages of reproduction the GSI in males ($p < 2C$) were seen increased significantly during May to August months. Also the relationship between fecundity and ovary weight, fish length were evaluated to be correlated to each other. Also it was reported that the sexual dimorphism during spawning stage (July to August) was well defined by the morphological characters such as bulging abdomen. Proper morphological

analysis of ovary under microscopic examination disclosed different developmental stages throughout the reproductive cycle.

Borah et al.2020 evaluated the performance of Indian and Vietnamese strain of *Anabas testudineus* under captive condition in lower Brahmaputra valley zone of Assam.

# CHAPTER III

# MATERIALS AND METHODS

## 3.1 Collection of fish samples –

The present study was based on a total of 12 fish samples ranging in the size from 12.8 to 18.8 cm total length (T.L) and weight ranging from 44.59 to 66.88g. The samples were collected in May, 2023 from Puthimari *beel* by scoop nets with the help of local fisherman and fish vendors.

## 3.2 Study Area -

The Puthimari *beel* is located on the north of the Barpeta district. The *beel* is fed by Puthimari river, a tributary of the river Brahmaputra. The species was collected from the *beel* and studied in B.H. College, Howly from June 2023 to July 2023. The location of the sampling site is (26.509717$^{o}$ and 90.894482$^{o}$) which is located 18 km from our study area.

## 3.3 Water quality measurement –

We examined the water quality parameters during the study period in biweekly basis. DO range was analyzed with the help of digital DO meter and the temperature was measured by digital thermometer. Similarly, pH was analyzed by litmus paper (Indikrom Papers).

## 3.4 Analytical Instruments and glassware used –

Sl. No. Name

1) Weighing electronic balance precision of 0.01g
2) Dissection Tools
3) Centimeter Scale (30cm)

4) Glass aquarium of size 60cm×38cm×30cm

**3.5 Software used –**

Microsoft Excel 2010.

**3.6 Analytical method** -

The collected fish samples were cleaned and disinfected and then kept in the sophisticated glass aquarium with aerators and gravels. Feeding was done regularly along with regular maintenance like cleaning and siphoning. Water quality parameters were analyzed from the aquarium fortnightly.

**3.6.1 Morphometry -**

The total length of the collected fish was measured using a centimeter scale and the body weight was determined by an electronic balance. The samples were then sacrificed by piercing a pin on the head and ovary dissected out by scissors. Lastly, the size, and appearance of the ovary was recorded.

**3.6.2 GSI (GONADO SOMATIC INDEX) –**

It is the percentage of gonad weight to the total weight of the fish. The gonads were removed from the collected fish and were weighed by digital weighing balance. The GSI was calculated by the following formula Parmeswaram *et al.* (1974) for the sample:

GSI = (weight of gonads x 100)/ weight of fish

**3.6.3 Fecundity –**

Fecundity is the number of eggs present in the ovary of fish in its mature stage. For the estimation of fecundity, the fish samples were studied from June 2023 to July 2023. The gonads were removed and weighed by digital weighing balance. Samples were taken from the anterior part of the ovary. The

numbers of eggs from each sample was then counted by Gravimetric method. The fecundity was calculated using the Le cren (1951) formula :

Fecundity = ( Gonad weight x No. of eggs)/ sample weight

### 3.6.4 Condition Factor –

It helps in estimating the proper condition of fish. Condition factor is an important quantitative parameter because weight of the fish of a given length is directly proportional to the physiological condition of the organism. This factor also helps in determining possible differences between different stocks of same species. It is used to measure various biological and ecological factors and also suitability of the environment regarding the feeding condition of the fish.

The Fulton's Condition factor is determined by the following formula -

$K = W \times 100/L^3$

Where, K = Condition Factor

W = Weight of the fish (gm)

L = Length of the fish (cm)

# CHAPTER IV

# RESULTS

## 4.1 Fecundity and GSI

Fecundity is the number of eggs present in an ovary of a fish. Gonado Somatic Index(GSI) is the percentage of gonad weight to the total weight of the fish.

Table 1: Fecundity and GSI count of *Anabas testudineus* in the month of June.

| Sample | Body weight(gm) | Ovary weight(gm) | Fecundity | GSI % |
|---|---|---|---|---|
| A | 44.59 | 7.15 | 6821.1 | 16 |
| B | 51.22 | 8.02 | 9872.62 | 15.6 |
| C | 66.08 | 7.67 | 10738 | 11.6 |
| D | 46.08 | 7.84 | 9141.44 | 17 |
| E | 55.8 | 8.53 | 11771.4 | 15.2 |
| F | 33.53 | 5.52 | 5188.8 | 16.4 |

For the fecundity count of *Anabas testudineus* Sample E shows the maximum count which is 11771 among the six examined sample . And on the other hand lowest count was shown by the sample F which is 5188. Similarly for the GSI maximum 17% was observed in sample D and minimum 11.6% was observed in sample C among the six samples. To count fecundity of the samples the total body weight and total ovary weight of the species were examined which was found in a range of 33.53gm to 66.08gm and 5.52gm to 8.53gm respectively.

Table 2 : Table showing Mean Standard deviation and Level of significance of morphometric and reproductive biology parameters in the month of June

| | N | Mean | Standard Deviation | Significance (2- tailed) |
|---|---|---|---|---|
| Body weight(gm) | 6 | 49.5500 | 11.03064 | 0.000 |
| Ovary weight(gm) | 6 | 7.4550 | 1.04943 | 0.000 |
| Fecundity | 6 | 8922.2267 | 2478.68237 | 0.000 |
| GSI % | 6 | 15.300 | 1.9173 | 0.000 |

The standard deviation for body weight was found 11.03064, for Ovary weight it was found 1.04943, for fecundity 2478.68237 and for GSI it was found 1.9173 respectively. One sample t-test was conducted for the above reproductive biology parameters where P= 0.000 (<0.05) which is statistically significant.

Table 3: Fecundity and GSI count of *Anabas testudineus* in the month of July

| Sample | Body weight(gm) | Ovary weight(gm) | Fecundity | GSI % |
|---|---|---|---|---|
| A | 48.52 | 8.19 | 8975.18 | 16.8 |
| B | 54.20 | 8.76 | 10967.45 | 16.1 |
| C | 66.88 | 7.98 | 11712.81 | 11.9 |
| D | 52.05 | 9.14 | 13134.79 | 17.5 |
| E | 56.91 | 9.67 | 16789.98 | 16.9 |
| F | 44.57 | 9.97 | 17834.23 | 22.3 |

For the fecundity count of *Anabas testudineus* Sample F shows the maximum count which is 17834.23 among the six examined sample . And on the other hand lowest count was shown by the sample A which is 8975.18. Similarly for the GSI maximum 22.3% was observed in sample F and minimum 11.9% was observed in sample C among the six samples . To count fecundity of the samples the total body weight and total ovary weight of the species were examined which was found in a range 44.57gm to 66.88gm and 7.98gm to 9.97gm respectively.

Table 4 : Table showing Mean Standard deviation and Level of significance of morphometric and reproductive biology parameters in the month of July.

| | N | Mean | Standard Deviation | Significance (2- tailed) |
|---|---|---|---|---|
| Body weight(gm) | 6 | 53.855 | 7.707583 | 0.000 |
| Ovary weight(gm) | 6 | 8.951 | 0.79366 | 0.000 |
| Fecundity | 6 | 13236 | 3446.904 | 0.000 |
| GSI % | 6 | 16.916 | 3.321696 | 0.000 |

The standard deviation for body weight was found 7.707583, for Ovary weight it was found 0.79366, for fecundity 3446.904 and for GSI it was found 3.321696 respectively. One sample t-test was conducted for the above reproductive biology parameters where P= 0.000 (<0.05) which is statistically significant.

**4.2 Condition Factor**

Condition Factor estimates the proper condition of a fish. It is determined by the following formula:

$K = W \times 100/L^3$

Where, K = Condition Factor

W = Weight of the fish(gm) which is measured in weighing balance.

L = Length of the fish(cm) which is measured in centimeter scale.

Table 5: Table showing the Condition Factor of all the samples in the month of June and July

| Condition Factor in June | Condition Factor in July |
|---|---|
| Sample A – 1.62 | Sample A - 1.16 |
| Sample B – 1.43 | Sample B - 0.99 |
| Sample C – 1.47 | Sample C - 1.38 |
| Sample D – 1.51 | Sample D - 0.97 |
| Sample E – 1.55 | Sample E - 0.92 |
| Sample F – 1.59 | Sample F - 0.67 |

Condition factor of the ovary was found highest in the sample A for the month of June, which is 1.62. On the other hand sample B shows the lowest condition factor in the month of June which is 1.43 from the six analyzed sample. Similarly in the month of July highest value of condition factor was observed in sample C which is 1.38, on the other hand minimum value was observed in the sample F which is 0.67 from the six analyzed sample.

Table 6 : Table representing the average values of Condition Factor of all the fish samples in both the month.

| Month | Average value of Condition Factor in both the months |
|---|---|
| June | 1.52 |
| July | 1.01 |

The average value of Condition Factor in June was 1.52 whereas in July it was 1.01 the value indicates that the health and quality of the fish samples decreased from June to July.

Table 7: The table represents the Standard Deviation of Condition Factor in the both the months.

| | | Mean | N | Standard Deviation | Significance (2 tailed) |
|---|---|---|---|---|---|
| Pair 1 | Condition Factor in June | 1.5283 | 6 | 0.07223 | 0.006 |
| | Condition Factor in July | 1.0150 | 6 | 0.23873 | |

The Standard deviation of Condition factor of the samples for the month of June and July was found 0.07223 and 0.23873. The value of significance of Condition factor is P= 0.006 (< 0.05) which is statistically significant.

### 4.3 Water Quality Parameters :

Table 8: The average water quality parameters of two sampling month June and July.

| Sampling month | Temperature($^{o}$C) | Dissolve Oxygen(mg/l) | pH |
|---|---|---|---|
| June($1^{st}$- $15^{th}$) | 27.7 | 5.9 | 7.4 |
| June($15^{th}$-$31^{st}$) | 27.8 | 6.0 | 6.8 |
| July($1^{st}$- $15^{th}$) | 29.8 | 5.7 | 7.0 |
| July($15^{th}$-$31^{st}$) | 27.7 | 6.1 | 7.5 |

Highest temperature was recorded during the month of July, 29.8$^{o}$C from the four analyzed samples from the month May and July. DO was observed 6.1mg/l among the four analyzed samples which is highest in the month of July on the other hand lowest DO range was observed in the same month which is 5.7. Lowest range of pH which is acidic in nature was recorded in the month of July, 6.8 among the four examined sample.

Table 9: Table showing Standard deviation of the water quality parameters examined during the study.

| Parameters | Standard deviation mean | Significance (2-tailed) |
|---|---|---|
| Temperature | 1.0344 | 0.000 |
| Dissolve Oxygen | 0.1708 | 0.000 |
| pH | 0.3304 | 0.000 |

The Standard deviation of Temperature, Dissolve oxygen and pH are 1.0344; 0.1708; 0.3304 respectively. The value of significance of the water quality parameters are P = 0.000 (< 0.05) which is statistically significant.

# CHAPTER V

# DISCUSSION

As per the study pertained by (Bernal et al. 2015) in Canada wetland , Philippines about the seasonal reproduction of the climbing perch, where they have found that in the month of May GSI percentage of the female species peaked by 10.9% then declined in the month of June with 3.3% and again increases in the month of July by 8.5% .

Which is not corresponds with our present study as we have got an increasing order of GSI percentage 15.3% - 16.91% from June to July in our study.

Hasan et al., 2007 conducted a study on biological aspects of Thai Koi from the January to May in Bangladesh ,where they have studies the fecundity ,GSI percentage and condition factor in relation to the total body weight and total ovary weight and they have found that GSI value was maximum in the month of April with 19.50% from the species which have ovary weight with 20.5gm . Similarly in the same month they have observed rise in fecundity range with 5,53708± 41041/kg . In their study they have found the highest condition factor with 1.005 ± 0.12 in the same month which indicate good health condition of fish in that month.

This study go similar with our study as we have got the highest fecundity and GSI percentage from the sample with highest ovary weight in the month of July which is 17834.23 and 22.3% respectively. But in our study we have got decreasing value of condition factor from the prior month where fecundity and GSI value was low. In our study we have got K = 1.01 condition factor with average GSI percentage of 16.91 %, which indicates the average health condition of the species from the particular month.

According to the observation of Marimuthu et al.,2009 in Malaysia which was continued from October 2007 to may 2008 ,the fecundity of native Climbing Perch was recorded 3120 to 84690 for the fishes with total body weight of 33.22 - 137.19gm. Similarly co relation of GSI with ovary weight was recorded 0.808 from the study. Which indicates that those species have maximum ovary weight result in the highest rate of GSI percentage along with fecundity value.

This study go accordance with our present study that in our experiment as we have recorded the highest GSI percentage for the sample with maximum ovary weight and total body weight which is 9.97gm.

As per the study conducted by Ziauddin et al., 2016 in India, that in the laboratory treatment condition the *Anabas testudineus* species showed the fecundity is directly depend on the variables like body weight ovary weight and ovary length. They have found that GSI varies from 0.271 -0.880 for the ovary length of species with11.0 -16.2mm. Which is going in accordance with our present experiment where we have found that species with ovary length with 9.67 cm shows optimum GSI 22.3% and fecundity value which is 17834.23 .

From the study conducted by Priyatha et al.,2022 in India ,and they have studied the fecundity and GSI percentage of anabas testudineus. Based on its various spawning season. They have observed that in the spawning season mainly July-August month the fecundity was ranged between 6500-11000.The GSI exhibit a significant increase in the spawning stage from pre spawning stage. They also have found positive correlation of fecundity with length ,weight and ovary weight.

In our study also we have observed that in the month of July the fecundity range along with the GSI value was in increasing trend from the month of June, which signifies that in the spawning season fecundity increases along with the GSI percentage. In our study too we have got a positive correlation of fecundity with body length, ovary weight and body weight.

As per the study conducted by Tolba et al.1981 on effect of water quality parameters on the fecundity and sizes of egg of a crustacean species in England. They have found that species collected and treated with bad quality of water from poor site showed low body weight and fecundity as well. Which indicated that quality of water effects the growth and fecundity of crustacean's species.

As our study was on finfish species and the Anabas species is euryhaline in nature, so no distinct effect of water quality on fecundity and condition factors of the species was observed. In our observation, temperature, DO and pH level was normal in both the surveyed months which are 28.2$^{o}$C; 5.9mg/l; 7.1 as average value respectively. Concluding that the water quality parameters don't affect the fecundity and other reproductive biology of *Anabas testudineus*.

As our research period was of only three month duration so all the variables couldn't be correlated with parameters. A longer research period could have get some better results which may help in increasing the productivity.

# CHAPTER VI

# CONCLUSION

The fecundity study of *Anabas testudineus* in the North Eastern India is very rare. During the study period the Fecundity, GSI, Condition Factor and water quality parameters were examined in June and July.

The present study of ovary fecundity of *A. testudineus* showed a positive relationship with the body length and ovary weight. The fecundity of the fish sample increased with the increase in body weight and ovary weight. The average fecundity was estimated to be 11,078.98 .

*A.testudineus* showed comparatively good Gonado Somatic Index (GSI) value. The GSI value increased from June to July (15.3 % -16.9%). It indicated that the gonad began maturing in the month of July and can be considered as spawning season for this species.

The condition Factor (K) of *A.testudinues* ranged from (1.52 – 1.01) from June to July. And the water quality parameters like Temperature, pH and Dissolve Oxygen was optimal during the study.

A comprehensive account of the reproductive periodicity and the health status of the species with respect to the water quality parameters can be evaluated. Data on GSI and condition factor will provide information on the growth and condition of fish species and will be helpful in conservation of the natural population of the fish in this region. However, there is an imperative need to study other biological aspects of this potentially important species.

## CHAPTER V

## REFERENCE

Sugunan, V.V.; Bhattacharjya, B.K. Ecology and Fisheries of Beels in Assam; ICAR-Central Inland Fisheries Research Institute: Barrackpore, India, 2000; p. 65.

Das, P.; Borah, S.; Yadav, A.K.; Bhattacharjya, B.K.; Das, B.K. Open water fisheries of Assam and strategies for its development. Fish. Chimes 2018, 38, 17–28.

Anderson, S. L., Clark Jr, W. H., & Chang, E. S. (1985). Multiple spawning and molt synchrony in a free spawning shrimp (Sicyoniaingentis: Penaeoidea). *The Biological Bulletin*, *168*(3), 377-394.

Vikas, P. A., and Subramannian, S. (2022). Evaluation of Anabas testudineus Farming in Natural Ponds and Impact on Subsequent Crop. *Indian Journal of Ecology*, 49(6), 2160-2162.

Hossain, Y., Hossen, A., Pramanik, N.U., Ahmed, Z. F., Yahya, K., Rahman, M., Ohotomi, J., (2015). Threatened fishes of the world : *Anabas testudineus* (Bloch,1972) (Perciformes; Anabantidae). *Croatian Journal of Fisheries.*73,125-131.

Borah, A. K., Thakuria, J., Debnath, D., Nath, D. 2020. Performance of Indian and Vietnamese strain of *Anabas testudineus* under captive condition in the lower Brahmaputra valley zone of Assam. *Journal of KrishiVigyan .* pp 236-243.

IUCN Bangladesh. 2015. Red List of Bangladesh Volume 5: Freshwater Fishes. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, xvi+360 p.

Bhattacharjya, B.K., Bhaumik, U., and Sharma, A.P. (2017).Fish habitat and fisheries of Brahmaputra River in Assam, India.*Aquat.Ecosyst.Health Manag.*20 (1-2), 102–115.

Vishwanath, W., & Linthoingambi, I. (2007). Fishes of the genus Glyptothorax Blyth (Teleostei: Sisoridae) from Manipur, India, with description of three new species. *Zoos' Print Journal*, *22*(3), 2617-2626. Vishwanath, W., & Linthoingambi, I. (2007). Fishes of the genus Glyptothorax Blyth (Teleostei: Sisoridae) from Manipur, India, with description of three new species. *Zoos' Print Journal*, *22*(3), 2617-2626.

Borah, A. K., Thakuria, J., Debnath, D., Nath, D. 2020. Performance of Indian and Vietnamese strain of *Anabas testudineus* under captive condition in the lower Brahmaputra valley zone of Assam. *Journal of Krishi Vigyan* . pp 236-243.

Dash, L., Kumar, R., Mohanta, N. K., Mohanty, U. L., Pillai, R. B. and Sundaray, K. J., (2019). Effect of feeding frequency on growth, feed utilization and cannibalism in climbing perch *Anabas testudineus* (Bloch 1792) fry. ICAR- Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar, *Indian Journal of Fisheries*., ***66***(1), 106-111.

Deka, T. K., Kakati, M., and Goswami, M. M. (2001). Diversity of wetland fish and its impact on the fishermen community of Assam.

Hafijunnahar, Rahman, A. M and Hossain, M. M. M. (2016). An investigation on breeding biology of Vietnam strain of Climbing perch, *Anabas testudineus* (Bloch) reared in a commercial hatchery. *International Journal of Fisheries and Aquatic Studies, **4***(1), 08-12.

Healey, M. C., and Heard, W. R. (1984). Inter-and intra-population variation in the fecundity of Chinook salmon (*Oncorhynchus tshawytscha*) and its relevance to life history theory. *Canadian journal of fisheries and aquatic sciences*, ***41***(3), 476-483.

Hossain, Y., Hossen, A., Pramanik, N.U., Ahmed, Z. F., Yahya, K., Rahman, M., Ohotomi, J., (2015). Threatened fishes of the world : *Anabas testudineus* (Bloch,1972) (Perciformes; Anabantidae). *Croatian Journal of Fisheries. **73***,125-131.

Jacob, P.K., 2005 . Studies of some aspects of reproduction of female *Anabas testudineus* (Bloch 1792). *Doctor of Philosophy. Cochin University of Science and Technology India*.

Le Cren, E. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in perch (*Perca fluviatillis*). *The Journal of Animal Ecology,* 201-219.

Mann, K. H. (1984). Fish production in open ocean ecosystem. Flows of energy and materials in Marine Ecosystems: *Theory and Practice,* 435-458.

Marimuthu, K., Arumugam, J., Sandrasagan, D., and Jegathambigai, R. (2009). Studies on the Fecundity of Native Fish Climbing Perch (*Anabas testudineus*, Bloch) in Malaysia. *American-Eurasian Journal of Sustainable Agriculture*, ***3***(3).

Muslimin, B., siti Aminah, R. I., and Khotimah, K. (2020). The gonadal maturation of climbing perch, Anabas testudineus (Bloch, 1792) with dietary supplement add on feed. *Aquaculture, Aquarium, Conservation & Legislation*, ***13***(2), 885-892.

Ndobe, S., Masyahoro, A., Serdiati, N., and Moore, A. M. (2020). Reproductive and morphometric characteristics of climbing perch Anabas testudineus in Sigi, Central Sulawesi, Indonesia. *Aquaculture, Aquarium, Conservation and Legislation*, ***13***(1), 167-182.

Parmeswaram, S.C., Selvaraj and Radhakrishnan, S. (1974). Observation on biology of *Labeo gonius* (Hamilton). *Indian Journal of Fisheries.**21***, 54-57.

Paul, B. N., Sridhar, N., Chandan, N., Saha, G. S., and Giri, S. S. (2015). *Anabas E-Phamplet. ICAR- CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE.* Pp-2.

Priyatha, C. V., and Chitra, K. C. (2022). Evaluation of the reproductive cycle and gonadal development in the climbing perch, *Anabas testudineus* (Bloch, 1792) in captivity. *Journal of Fisheries*, ***10***(1), 101206-101206.

Sarkar U.K., Deepak P.K., Kapoor D., Negi R.S., Paul S. K. and Singh S. (2005). Captive breeding of climbing perch *Anabas testudineus* (Bloch 1792) with Wova-FH for conservation and aquaculture. *Aquaculture Research. **36***, 941-945.

Vikas, P. A., and Subramannian, S. (2022). Evaluation of Anabas testudineus Farming in Natural Ponds and Impact on Subsequent Crop. *Indian Journal of Ecology*, ***49***(6), 2160-2162.

Ziauddin, G., Behera, S., Kumar, S., Gogoi, R., Jomang, O., and Baksi, S. (2016). Morphometrical and gonadal studies of a threatened fish, Anabas testudineus with respect to seasonal cycle. *International journal of Fisheries Aquaculture Scientific*, ***6,*** 7-14.

Tolba, M. R., & Holdich, D. M. (1981). The effect of water quality on the size and fecundity of Asellus aquaticus (Crustacea: Isopoda). *Aquatic Toxicology*, *1*(2), 101-112.

Hasan, M., Khan, M. M. R., & Rahman, M. A. (2007). Some biological aspects of Thai koi Anabas testudineus (Bloch). *Journal of the Bangladesh Agricultural University*, *5*(452-2018-3996), 385-392.

Bernal, R. A. D., Aya, F. A., De Jesus-Ayson, E. G. T., & Garcia, L. M. B. (2015). Seasonal gonad cycle of the climbing perch Anabas testudineus (Teleostei: Anabantidae) in a tropical wetland. *Ichthyological Research*, *62*, 389-395.

Dubey, S. K., Trivedi, R. K., Chand, B. K., Rout, S. K., & Mandal, B. A. S. U. D. E. V. (2015). Response of Anabas testudineus (Bloch, 1792) to salinity for assessing their culture potentiality in brackish water inundation prone areas of Indian Sundarban. *Journal of the Inland Fisheries Society of India*, *47*(2), 59-69.

Sarma, K., Pal, A. K., Ayyappan, S., Das, T., Manush, S. M., Debnath, D., & Baruah, K. (2010). Acclimation of Anabas testudineus (Bloch) to three test temperatures influences thermal tolerance and oxygen consumption. *Fish physiology and biochemistry*, *36*, 85-90.

Gunderson, D. R., & Sample, T. M. (1980). *Distribution and abundance of rockfish off Washington, Oregon and California during 1977*. Northwest and Alaska Fisheries Center, National Marine Fisheries Service.

**PHOTO PLATES**


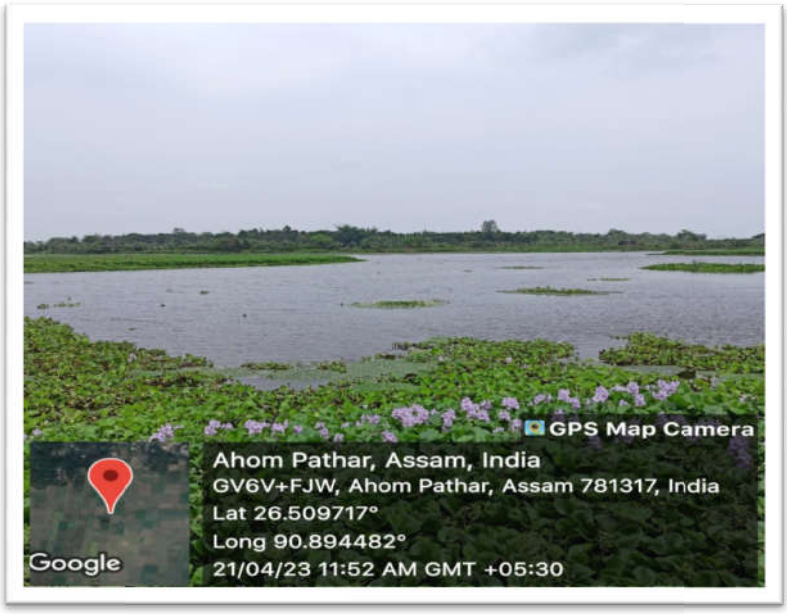


**Fig: STUDY AREA**

**Fig: Ovary of *A. testudineus* dissected out**


**Fig: Weight measurement of *A. testudineus***


**Fig: Length measurement of *A. testudineus***

**Fig: Dissection of *A. testudineus.***