

Comparative Morphometric and Meristic Analysis of *Anabas testudineus* (Bloch, 1792) from Golaghat and Jorhat Districts of Assam

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ABSTRACT

Objectives: *Anabas testudineus* (Bloch, 1792) is a freshwater fish. It is very tolerant of bad environmental conditions and can live for several days without water, utilizing its accessory breathing organs. Morphometric and meristic variation within geographic populations of *A. testudineus* has been reported, but no previous study was carried out to compare the two districts (Golaghat and Jorhat) of Assam. This study is the first comparative evaluation of this type. **Materials and Methods:** The morphometric parameters measured were total length, standard length, head length, pre- and post-dorsal length, pre- and post-orbital length, fin lengths (pectoral, pelvic, anal, dorsal, and caudal) and body weight. Meristic characters were the scale counts (above, below and total lateral line), the dorsal and anal fin spines, the dorsal, anal, pectoral and pelvic fin rays and the branchiostegal rays. **Results:** The TL ranges from 11.835±0.37 to 13.148±0.49 and BW ranges from 32.25±3.96 to 35.8±6.18. Whereas, meristic characteristics are as follows: Dorsal spines: 16 - 17; Anal spine: 9 - 10; Pelvic spines - 1; Dorsal fin rays: 8 - 9; Anal fin rays: 10 - 11; Pectoral fin rays: 14 - 15; Pelvic fin rays: 6 - 7; Caudal fin rays: 15 - 16; and total numbers of scales on the lateral line: 27 - 28. Number of branchiostegals: 6. **Conclusion:** This study provides a baseline to understand geographic morphological variation among the two populations of *A. testudineus* for further studies on taxonomy, ecology, fisheries and conservation in Assam.

Keywords: *Anabas testudineus*, Assam, Morphometric measurement, Meristic measurement, Population variation.

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INTRODUCTION

Anabas testudineus, the climbing perch, is a freshwater fish belonging to the family Anabantidae and order Perciformes. It is extensively available in Asia, from Wallace line to India. There are two species of *Anabas* that have been documented in India: *Anabas testudineus* and *Anabas oligolepis* (Khan Manon *et al.*, 2023; Zworykin, 2023).

The native air-breathing climbing perch is a potamodromous fish that is usually found in freshwater and brackish water. They can withstand temperatures between 22 to 30°C. The adults of *A. testudineus* are found in rivers, brooks, flood zones, stagnant water bodies with dense vegetation, but the species is extensively distributed in canals, lakes, ponds, swamps, and estuaries. It is

generally found in turbid and stagnant water bodies, although it can tolerate very adverse water conditions as well. It can survive for several days without water if its extra respiratory organ is kept moist. It is the best-tasting fish, and fish markets sell it alive (Khan Manon *et al.*, 2023; Zworykin, 2023).

SYSTEMATIC POSITION

- Domain: Eukaryota
- Kingdom: Animalia
- Phylum: Chordata
- Family: Anabantidae
- Class: Osteichthyes
- Order: Perciformes

The morphological description of *A. testudineus* given here is derived from the well described studies by Rahman (2005), Talwar and Jhingran (1991), and Yadav (1997) which are summarized below: Morphologically compressed laterally. Lower jaw is shorter than upper and mouth is located anteriorly. On the jaw, there are villiform teeth. There is a long anal and dorsal fin. The dorsal fin is dark grey, anal and pectoral are pale yellow and the pelvic is pale orange. The body colour ranges from black to pale greenish,



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with a pale-yellow belly. The shape of the pectorals and tail is rounded. Changes to anal fin, pelvic fin and dorsal fin to make them spin. It has ctenoid scales/broken lateral line. Swimming is the study of the behaviour of animals in their environment. How they socialize with each other and how an animal could come to grasp its surroundings cognitively (Rahman, 2005; Talwar and Jhingran, 1991; Yadav, 1997). The morphometric and meristic variation of *Anabas testudineus* have been studied in various geographical regions but the morphometric variation between populations of the two districts namely, Golaghat and Jorhat, Assam have been limited. To the best of the author's knowledge, this is the first study that compares both the morphometric and meristic data of the population of *A. testudineus* of these two districts. Considering this, it was decided to do the present work to compare the morphometric and meristic characters of *A. testudineus* from both districts of Assam, namely Golaghat and Jorhat and see how much morphological differences exists between the two populations.

MATERIALS AND METHODS

Sample collection

A total of 10 mature fish specimens *Anabas testudineus* were collected from the fish markets of each district of Golaghat and Jorhat (Figure 1), and brought to the department laboratory and acclimatized.

Morphometric measurements

These measurements can yield useful data for managing fisheries, identifying species, and evaluating growth. A measuring scale was used to measure various lengths, such as Total Length (TL), Standard Length (SL), Head Length (HL), Pre-dorsal Length (PrDL), Post-dorsal Length (PoDL), Pectoral Length (PcL), Pelvic Length (PvL), Anus Length (AnsL), Pre-anal Length (PrAnL), Post-anal Length (PoAnL), Pre-orbital Length (PrOrL), Post-orbital Length (PoOrL), Pectoral Fin Length, Pelvic Fin Length, Anal fin length, Dorsal fin length and Caudal fin length (Figure 2). Body Weight (BW) was measured with an electronic balance with an accuracy of 0.01g for each individual (Lagler *et al.*, 1977; Ara *et al.*, 2018).

Meristic characters

Countable traits were collected, including the number of spines or rays on each fin, numbers of scales above and below the lateral line, and numbers of scales along the lateral line. In *A. testudineus* Rahman (2005) reported a damaged lateral line. In this study, lateral line was separated and recorded from upper and lower lateral line. The number of scales on the lateral line (Figure 3) was determined by adding the two scales on either line. The three qualitative traits recorded were colour of the base of the pelvic fin, body spot and spot on the base of the caudal fin (Ara *et al.*, 2018).

RESULTS

Morphometric Analysis

The body of *Anabas testudineus* is laterally compressed. Its mouth is anteriorly positioned with longer lower jaw, composed of villiform teeth. There is a long anal and dorsal fin. In adult, dorsal fin extended up to 16 spines whereas, anal spines are about 10. The dorsal and caudal fins are dark grey, the anal and pectoral fins are pale yellow, and the pelvic fin is pale orange in colour. The body colour ranges from black to olive green, with a golden-yellow belly. The pectorals and caudal fin of the species were observed in rounded structure. The anal fin, pelvic, and dorsal rays are altered to spin. Ctenoid scales with a broken lateral line. Scales are present all over the including head and operculum, body, below the lower jaw and on the base of dorsal, anal and caudal fins. The TL ranges from 11.41 cm to 13.51 cm (Mean $\pm$ SD=11.835 $\pm$ 0.37 and 13.148 $\pm$ 0.49), and BW ranges from 24 g to 40 g (Mean $\pm$ SD=32.25 $\pm$ 3.96 and 35.8 $\pm$ 6.18) given in Table 1 and Figure 4.

DISCUSSION

In the case of the morphometric measurement of the experimental fish, *Anabas testudineus*, which was collected from the district of Golaghat, we have found the average mean of BW of 32.25 g, TL of 11.835 cm, SL of 9.585 cm, PrDL of 3.3275 cm, PoDL of 8.735

Meristic Counts

Table 2: Meristic Measurements of *Anabas testudineus* at the district of Golaghat and Jorhat (n=10).

Features	Golaghat	Jorhat
	Fish Measurements	
Dorsal spine	15-17 (16)	15-17 (17)
Anal spine	9-10 (9)	9-10 (10)
Pelvic spine	1	1
Dorsal fin ray	7-9 (8)	7-9 (9)
Anal fin ray	10	11
Pectoral fin ray	10-16 (14)	10-16 (15)
Pelvic fin ray	4-7 (6)	4-7 (7)
Caudal fin ray	13-16 (15)	13-16 (16)
Scale on upper lateral line	20	21
Scale on lower lateral line	7	7
Total scale on lateral line	27	28
Scale above lateral line	4	4
Scale below lateral line	9	9
Branchiostegal ray	6	6

cm, PcL of 3.235 cm, PrAnL of 5.615 cm, PoAnL of 9.235 cm, HL of 3.0075 cm, PvL of 3.805 cm, AnsL of 5.135 cm, PoOrL of 2.09 cm, PrOrL of 0.546 cm, pectoral fin length of 1.968 cm, pelvic fin length of 1.686 cm, anal fin length of 3.606 cm, dorsal fin length of 5.422 cm, and caudal fin length of 2.66 cm, while from the district of Jorhat, it bears a slightly larger one, which has an average mean of BW of 35.8 g, TL of 13.148 cm, SL of 9.96 cm, PrDL of 3.9 cm, PoDL of 9.584 cm, PcL of 3.584 cm, PrAnL of 6.41 cm, PoAnL of 9.178 cm, HL of 3.3 cm, PvL of 5.998 cm, AnsL of 3.998 cm, PoOrL of 2.58 cm, PrOrL of 0.746 cm, pectoral fin length of 2.242 cm, pelvic fin length of 1.924 cm, anal fin length of 4.096 cm, dorsal fin length of 5.932 cm, and caudal fin length of 2.946 cm (Table 1 and Figure 4), which is similar to the findings of Ara *et al.* (2018) worked on local *Anabas* species and recorded mean of as Total Length (TL), Standard Length

(SL), Head Length (HL), Pre-dorsal Length (PrDL), Post-dorsal Length (PoDL), Pectoral Length (PcL), Pelvic Length (PvL), Anus Length (AnsL), Pre-anal Length (PrAnL), Post-anal Length (PoAnL) and Body Weight (BW) in Savar, Bangladesh. Similarly, Hassan *et al.* (2005) had studied morphometric measures like the average total length, standard length, postorbital length, and length of the base of the dorsal and anal fin in *Anabas* species from five regions of Bangladesh, viz., Chittagong, Dhaka, Khulna, Rajshahi, and Sylhet.

Additionally, we have collected the fish species *Anabas testudineus* from the district of Golaghat, whose meristic characteristics are as follows: Dorsal spines - 16; Anal spine - 9; Pelvic spines - 1; Dorsal fin rays - 8; Anal fin rays - 10; Pectoral fin rays - 14; Pelvic fin rays - 6; Caudal fin rays - 15; and total numbers of scales on the lateral line - 27 of which 20 scales are present in the upper



Figure 1: (A) Golaghat Variety of *Anabas testudineus* (B) Jorhat Variety of *Anabas testudineus*.

Table 1: Morphometric Measurements of *Anabas testudineus* at the district of Golaghat and Jorhat (n=10).

Features	Golaghat		Jorhat	
	Fish Measurements (in g and cm)			
	Mean	SD	Mean	SD
BW (Body Weight)	32.25	±3.96	35.8	±6.18
TL (Total Length)	11.835	±0.37	13.148	±0.49
SL (Standard Length)	9.585	±0.44	9.96	±0.2
PrDL (Pr-dorsal Length)	3.3275	±0.17	3.9	±0.24
PoDL (Post-dorsal Length)	8.735	±0.32	9.512	±0.29
PcL (Pre-pectoral Length)	3.235	±0.14	3.584	±0.25
PrAnL (Pre-anal Length)	5.615	±0.32	6.41	±0.36
PoAnL (Post-anal Length)	9.235	±0.44	9.178	±0.54
HL (Head Length)	3.0075	±0.07	3.308	±0.21
PvL (Pelvic length)	3.805	±0.21	5.998	±0.27
AnsL (Anus Length)	5.135	±0.26	3.998	±0.16
PoOrL (Post-orbital Length)	2.09	±3.96	2.58	±0.32
PrOrL (Pre-orbital Length)	0.546	±0.37	0.746	±0.04
Pectoral fin length	1.968	±0.44	2.242	±0.15
Pelvic fin length	1.686	±0.17	1.924	±0.23
Anal fin length	3.606	±0.32	4.096	±0.46
Dorsal fin length	5.422	±0.14	5.932	±0.37
Caudal fin length	2.66	±0.32	2.946	±0.21

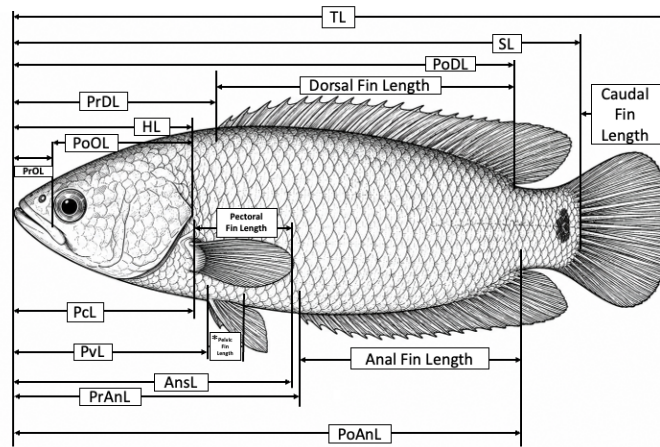


Figure 2: Diagrammatic representation of morphometric measurements of *Anabas testudineus* (* Pelvic fin length).

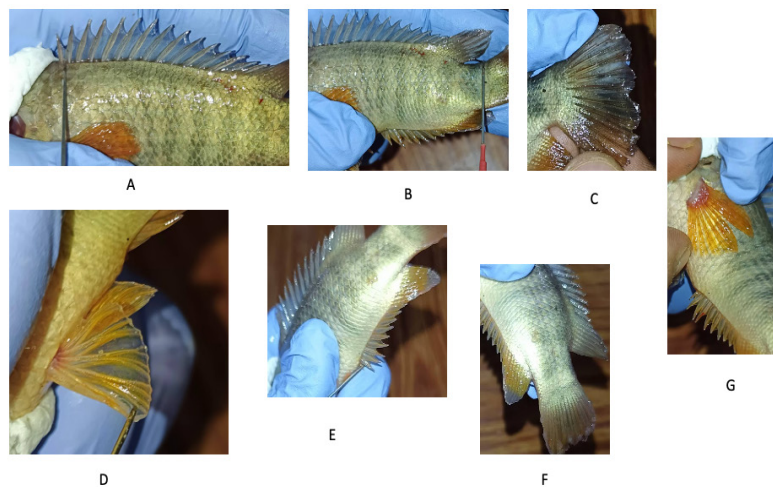


Figure 3: Some meristic features of *Anabas testudineus* (A) Dorsal spine (B) Dorsal fin ray (C) Caudal fin ray (D) Pelvic fin ray (E) Anal spine (F) Anal fin ray (G) Pectoral fin ray.

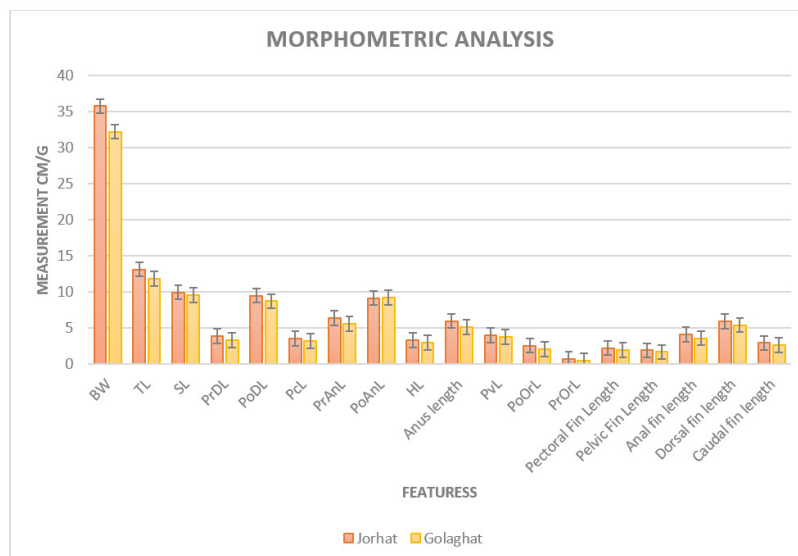


Figure 4: Bar diagram representing morphometric measurements of *Anabas testudineus* at the district of Golaghat and Jorhat ($n=10$).

lateral line and 7 in the lower lateral line. On the other scale, there will be 4 above the lateral line, and -9 below the lateral line. The number of branchiostegal rays-6. However, fish from the district of Jorhat have few differences in the number of dorsal spines (17), anal spines (10), dorsal fin rays (9), anal fin rays (11), pectoral fin rays (15), caudal fin rays (16), pelvic spine (1) and pelvic fin rays (7), and scales on upper lateral line (21) and lower lateral line (7), and total number of scales on the lateral line (28). On the other scale, above the lateral line is 4, and the scale below the lateral line is 9. And the number of branchiostegal rays was similar to that of the Golaghat district. It has a pectoral fin that extends to 9 dorsal spines (Table 2). The broken lateral line that is present is of fish in both the districts. Scales are found on the base of the dorsal and anal fins, the head and the body. The morphological formula of the present fish specimen, *Anabas testudineus* obtained from this study was similar to that of Hassan *et al.* (2005) and Ara *et al.* (2018) who have investigated meristic characters of *Anabas* species and reported number of dorsal fin rays, pelvic fin rays, anal fin rays, and scales below and above the lateral line respectively.

The present study also reveals that both the specimens appearance is different from each other collected from districts of Golaghat and Jorhat at the time of breeding season. The collected specimen of Golaghat district appears golden yellow which become more distinct from below of the lateral line up to belly portion. Above lateral line i.e., dorsal side is olive green colour additionally it makes a stripes like pattern. And fins are orange in colour. While the collected specimen of Jorhat appears dark green to black in colour which runs all over the body as well as fins.

CONCLUSION

The present investigation attempts to make a comparative evaluation of the morphometric and meristic features of *Anabas testudineus* populations from Golaghat and Jorhat district of Assam. Analysis showed differences between the two populations in terms of their morphology, representing population level differences. These may be linked with environmental conditions, habitat, food availability and other ecological differences, but more genetic and ecological studies are needed to identify the causes. There is insufficient information available on the comparative morphology of *A. testudineus* from these two districts to justify a detailed study of geographical variation within the species, however the present study was valuable baseline data in understanding geographical variation within the species. The results of the present study can also be utilized for the

future taxonomic, population biology, fisheries management and conservation studies on *A. testudineus*, in Assam. Additionally, more extensive samples, sampling sites, seasonal samples and molecular markers would help to understand the magnitude and cause of population differentiation.

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ABBREVIATIONS

TL: Total Length; **SL:** Standard Length; **HL:** Head Length; **PrDL:** Pre-dorsal Length; **PoDL:** Post-dorsal Length; **PcL:** Pectoral Length; **PvL:** Pelvic Length; **AnsL:** Anus Length; **PrAnL:** Pre-anal Length; **PoAnL:** Post-anal Length; **PrOrL:** Pre-orbital Length; **PoOrL:** Post-orbital Length; **BW:** Body Weight.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS CONTRIBUTION

Soujit Kumar, Pavitra Chutia, Somim Nasreen, Bhabana Das, Priyambada Chutia: Writing -original draft, formal curation, conceptualization, methodology. **Pavitra Chutia, Somim Nasreen, Bhabana Das, Priyambada Chutia:** Reviews and editing and Supervision.

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