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Research Article

Morphometric characteristics and meristic counts of greenback grey mullet (*Liza subviridis*) population from the Khulna district

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A B S T R A C T

A study was conducted in four different regions of Khulna district, to describe the morphometric and meristic characteristics of greenback grey mullet (*Liza subviridis*) populations. The comparison was based on data collected over three months in 2023, from June to August. A total of one hundred specimens with total body weights (TBW) ranging from 10.05 to 16.25 g and total body lengths (TBL) ranging from 13.8 to 14.65 cm were used in the morphometric and meristic analyses. When compared to the other four populations, the Mongla River population exhibited higher averages for total body length, standard length, post-orbital length, eye diameter, length of pre-dorsal fin, and length of anal fin. Every biological trait differed significantly ($p < 0.05$) between the Gajirhat beel and Mongla population. The average meristic features of the anal, pelvic, and dorsal fin spines did not vary among the four populations ($p > 0.05$). However, the number of pectoral fin rays in the Rupsha and Gajirhat beel was significantly ($P<0.05$) higher than in other regions. Additionally, there were more dorsal and caudal fin rays in the Mongla River. Compared to other populations, the Paikgacha population had more scales on its lateral line. Four different body proportions showed significant differences at the 5% level: Head length: pre-orbital, head length: post-orbital, head length: eye diameter, head length: body depth, and head length: standard lengths. Overfishing, pollution, environmental degradation, disease transmission, the introduction of alien species, and inadequate management, all contribute to population loss, according to the research. The investigation also advocated for the protection of the Liza subviridis population in the Khulna division and neighboring areas.

INTRODUCTION

The greenback grey mullet (*Liza subviridis*) (Valenciennes, 1836), is a ray-finned fish belongingto the Mugilidae (mullets) family, referred to locally as "JatiBata" or “Bhangon bata” in Bengali. In Bangladesh, it is typically found in estuaries, shallow coastal waters, and mangrove swamps. It is hardy, euryhaline, and eurythermal fish. This fish does not compete for food, both as adults and juveniles. This species occurs in shallow coastal waters, and they go into estuaries and lagoons to find food. The grey mullet is an international group in the Mugilidae family and is extensively distributed in the coastal waters of tropical and subtropical regions (Nash and Shehadeh, 1980). It provides the essential proteins needed by people living in the Pacific basin, Southest Asia, India, Bangladesh, the Mediterranean region, Eastern Europe, and many regions of Central and South America. Due to their omnivorous nature and ability to be stocked in both freshwater and brackish ponds, grey mulletsis predicted to be a major contributor to future productivity through effective use of available water space (Nesarul, 2014; Rahman *et al*., 2022). Despite being widely consumed locally in Bangladesh, this fish is still underutilized despite its potential to help meet demand. Mugilidae family species are important for harvesting commercially throughout the year, including the offseason,

due to their deliciousness, high nutritional value, and marketability, regardless of stock, size, or maturity. The catch of these fishes has reportedly decreased recently due to overfishing (Lan *et al*., 2017). Preserving the biodiversity of these fish species is essential to meeting demand. Although many techniques are used for identification, morphometric and meristic phenotyping is regarded in fish biology as one of the most reliable and early methods for fish species identification (El-Saidi *et al*., 2017 & Rahman *et al*., 2022). Morphometric and meristic work can be viewed as the initial step of more intricate molecular-level investigation based on the concept of fish morphology, which completes the first protocol in stock assessment (Ainsworth, 1992). To effectively manage this species, one must pinpoint the cause of the decline and possess a thorough understanding of the target species' ecology (Leunda *et al*., 2007). The current study aims to characterize the morphometric and meristic features of *Liza subviridis*, as well as to pinpoint the primary threats to the species and offer recommendations for conservation measures that will safeguard the remaining, isolated populations in the Khulna regions.

MATERIALS AND METHOD

Between June and August of 2023, samples of *Liza subviridis* were taken from the catch of fishermen that was landed at the Mongla River, Paikgacha, Gajirhat Beel, and Ruppsha Landing Center in Khulna, Bangladesh. The traditional fishing nets known as jhaki jal (cast net) and dughair (conical trap) were used to catch this fish (Kibria and Ahmed, 2005). According to Froese and Pauly (2007), the specimens were moved to the Department of Fishery Biology and Genetics Laboratory at Khulna Agricultural University (Bangladesh), which is part of the Faculty of Fisheries and Ocean Sciences. There, all morphometric and meristic characteristics were examined. A standard centimeter scale, divider, and forceps were used to record the morphometric data, which were then recorded to the closest centimeter. The following morphometric characteristics were measured individually: caudal peduncle length, predorsal fin length, pre-pectoral fin length, pre-anal fin length, head length, body depth, pre- and postorbital length, eye diameter, and others. This was the typical length, measuring from the base of the caudal fin to the tip of the snout. Beginning at the tip of the nose and concluding at the longest caudal-fin ray, the total length was measured. Fin ray characteristics, including the tiniest anterior rudiments, were enumerated. After compiling all of the measured data, an analysis of variance (ANOVA) was used to determine the significance level. The required data and information for this study were also gathered through surveys of 120 fishermen, 80 fish farmers, 30 fish traders, representatives of NGOs and the government, knowledgeable individuals in the fisheries industry, and existing literature.

RESULTS AND DISCUSSION

A total of one hundred specimens with total body weights (TBW) ranging from 10.05 to 16.25 g and total lengths (TL) of 13.8 to 14.65 cm were used in the morphometric and meristic characteristics studies. Tables 1 and 2 present the primary morphometric and meristic data, respectively. *Liza subviridis* has a broad head and a robust, dorsoventrally flattened body. The dorsal side of the body is dark greenish and silvery onthe ventral side. The pectoral is nearly as long as the head excluding the snout. The pelvicoriginates below the origin of the dorsal. 28 (Rahman, 1989 and 2005); 27-32 (Talwar and Jhingran, 1991) scales present in lateral line.

Populations collected from four different zones varied in several morphometric and meristic traits. The Mongla river population had the longest total length, measuring 15.46 and 13.47 cm, respectively, while the Gajirhat beel population had the shortest. Standard lengths were longer in the Mongla river and Rupsa landing center samples compared to the other populations, and there was no statistically significant difference ($p<0.05$) observed between them. The populations that displayed this trend next were Paikgacha and Gajirhat Beel. The head length of the Mongla river population was noticeably longer than that of other regions. However, the population of the landing centers of Paikgacha and Rupsa showed very little variation in head length measurements. The body depths of 1.57 and 1.48 cm, respectively, were higher in the Mongla River and Paikgacha populations. However, the Gajirhat beel and Rupsha Landing Center populations showed very little difference in body depth. The pre-orbital length (0.53 cm) of Mongla river populations was greater than that of other populations in three regions. The post-orbital length was longer in the Mongla river and Rupsha landing center population than in the other two regions, with values of 1.63 and 1.5 cm, respectively. Near the Mongla river and the Rupsha landing center were population with larger eye diameters than others. Longer caudal peduncles (2.8 and 2.7 cm, respectively) were found in the populationfrom the Mongla River and Rupsha Landing Center, but there was no statistically significant difference ($p<0.05$). Populationfrom the Rupsha landing center, Mongla river, and Gajirhat beel had longer pre- dorsal fin bases than Paikgacha. Compared to other population, the pre-pectoral fin base length was longer in Mongla river population. Longer pre-anal fins (9.24 and 9 cm) were found in two regions: the Mongla river and the Rupsha landing center. These were followed by Paikgacha and Gajirhat Beel. Tables 1 and 2 display the average morphometric and meristic traits of the *Liza subviridis* populations in each of the four regions.

Table 1. Morphometric measurements of the *Liza subviridis* (Valenciennes, 1836) specimens (n= 100) were captured from the four regions of Khulna district.

Region	Total body length (cm)	Standard length (cm)	Head length (cm)	Depth of body (cm)	Pre-orbital length (cm)	Post-orbital length (cm)	Eye diameter (cm)	Length of caudal peduncle (cm)	Length of pre-dorsal fin (cm)	Length of pre-pectoral fin (cm)	Length of pre-anal fin (cm)
Paikgacha	13.8±0.53*	11.43±0.52*	2.59±0.27**	1.48±0.12**	0.4±0.1*	1.39±0.15*	0.51±0.09*	1.92±0.32*	5.63±0.29*	3.02±0.19*	8.28±0.31*
Mongla	15.46±0.47***	12.83±0.36**	2.78±0.19**	1.57±0.11**	0.53±0.04**	1.63±0.11**	0.67±0.08**	2.7±0.33**	6.45±0.26**	3.21±0.14*	9.24±0.39**
Rupsha	14.65±0.21**	12.4±0.14**	2.45±0.35**	1.3±0.14*	0.45±0.07*	1.5±0.14**	0.6±0**	2.8±0.14**	6.15±0.07*	3.4±0**	9±0.14**
Gajirhat	13.47±0.65*	11.12±0.6*	1.9±0.4*	1.27±0.16*	0.47±0.08*	1.47±0.08*	0.57±0.08*	2.55±0.43**	6.62±0.24**	3.18±0.09*	8.82±0.46*

Table 2. Meristic counts of the *Liza subviridis* (Valenciennes, 1836) specimens (n= 100) were captured from the four regions of Khulna district.

Region	No. of dorsal fin rays	No. of dorsal fin spines	No. of pectoral fin rays	No. of pelvic fin rays	No. of pelvic fin spines	No. of anal fin rays	No. of anal fin spine	No. of caudal fin rays	No. of lateral line-scale
Paikgacha	7±0.8*	4±0*	11.3±1.5	5.33±0.5*	1±0*	7.56±0.53	1.44±0.53*	14.4±0.53*	34.4±1.13***
Mongla	7.42±0.53**	4±0*	11.43±0.53*	5.71±0.95**	1±0*	8±0.81*	1±0*	15.28±1.8**	30.14±3.67*
Rupsha	6.5±0.71	4±0*	11.5±0.72**	5.5±0.73**	1±0*	8±0*	2±0**	13.5±0.71*	30.5±2.12*
Gajirhat	7.4±0.51**	4±0*	11.5±0.53**	6±1.09***	1±0*	8.8±0.41**	1.5±0.54*	15.16±1.32**	32±2.53**

All the population under study had the same number of dorsal fin and pelvic spines. However, the dorsal, pectoral, pelvic, anal, and caudal fin rays varied according to location. Dorsal fin ray counts were higher in the Mongla River and Gajirhat Beel populations (7.42 and 7.4 cm, respectively) than in the other populations. Between the populations in the four regions, there was no appreciable difference in the quantity of pectoral fin rays. The Gajirhat beel (6cm) populations had more pelvic fin rays than the other populations did. The number of anal fin rays varied significantly ($p<0.05$) amongst the Mongla River, Rupsha, and Gajirhat beel populations. When compared to other populations, Rupsha populations had a higher number of anal fin spines. When compared to Paikgacha and Rupsha, the populations of Mongla and Gajirhat beel showed more caudal fin rays, and there was no significant difference ($p<0.05$) between them. The Paikgacha and Gajirhat beel populations had larger lateral line scale numbers (34 and 32 cm, respectively) than the Mongla and Rupsha populations ($p<0.05$).

The different proportions of morphometric traits are listed in Table 3. A substantial difference was found between the head length proportion and standard length of the Gajirhat beel populations and those of four other distinct populations. It was discovered that Paikgacha populations differed significantly ($P<0.05$) from other populations in the proportions of head length and eye diameter. The populations of Gajirhat beel varied from those of Mongla or Rupsha in the same morphometric character. There were notable variations ($P<0.05$) in the head length and pre-orbital length proportions among the Paikgacha populations, except Mongla and Rupsha. The percentage of standard length and body depth in the Rupsha region differed from other populations in a significant way ($P<0.05$).

Table 3. Different morphometric proportions of *Liza subviridis* (Valenciennes, 1836) specimens (n= 100) were captured from the four regions of Khulna district.

Region	Proportion of SL: HL	Proportion of HL: ED	Proportion of HL: Preorbital	Proportion of HL: Postorbital	Proportion of SL: BD
Paikgacha	4.41^{a}	5.08^{b}	6.48^{c}	1.86^{a}	7.72^{a}
Mongla	4.62^{a}	4.15^{a}	5.23^{a}	1.71^{a}	8.17^{a}
Rupsha	5.06^{b}	4.08^{a}	5.44^{a}	1.63^{a}	9.54^{c}
Gajirhat	5.85^{c}	3.33^{c}	4.04^{b}	1.29^{b}	8.76^{b}

(Differences in superscript letters denote significant variation ($p<0.05$) it means)

Fish are extremely sensitive to changes in their environment, they can quickly adapt by changing the necessary morphometrics. According to the survey, the variation may be explained by the following: environmental effects, overexploitation, natural disasters, water pollution, diseases, introduction of exotic fish, destruction of breeding grounds, siltation, degradation of natural habits, and inadequate management. The maximum length (total body length) of the species, was recorded as 13.8 cm in Paikgacha, 15.46 cm in Mongla, 14.8 cm in Rupsha landing center, and 13.47 cm in Gajirhat beel region (Mijkherjee *et al*., 2002; and Chakraborty *et al*., 2006). Welcomme (1998), however, noted that a major threat to aquatic biodiversity is the careless introduction of aquatic organisms from one habitat into another. Recently, large-scale artificial reproduction, the release of genetically degraded fingerlings from farms into floodplains, the escape of cultured stocks because of flooding, and large-scale induced breeding operations have all been named as threats to wild endemic fish populations (Rajits *et al*., 2002). It is widely acknowledged that morphological features are highly adaptive to changes in environmental conditions, such as temperature and the availability of food (Allendorf and Phelps, 1988; Swain *et al*., 1991; Wimberger, 1992). Fish growth variance may be influenced by factors such as food source, culture area, and species fecundity. The reduced growth of Parse in the Gajirhat beel region could be ascribed to soil characteristics and water chemistry. The variance in growth in that particular area could have been influenced by salt. Morphometric variability can be caused by changes in the salinity and pH of the water. In-depth research into the species' ecology and biology is required, as well as the development of conservation plans to protect these unique populations in the Khulna region during the spawning season. Several research and educational institutions in Bangladesh have also focused on establishing artificial breeding and raising of the species (Mijkherjee *et al*., 2002; Chakraborty *et al*., 2006).

CONCLUSION

Stock evaluations and population surveys are urgently needed to identify the current status of wild stocks in terms of quantity and distribution, as well as the ecological conditions for effective species propagation. It is advised to create appropriate sanctuaries in specific streams, estuaries, and lakes in addition to determining the true causes of the species' decline and taking the required steps to preserve the habitats that the species prefers. Destructive fishing methods should be completely prohibited, and during the fishing season, law enforcement should be strengthened.

Establishing hatcheries and brood stock management centers is necessary for the preservation of the species.

Conflict of interest

The author claims no conflict of interest.

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