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Research Paper

Biochemical composition of different loaches in bangladesh

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ABSTRACT

This study was conducted to determine the biochemical composition of Botia dario and Lepidocephalichthys guntea collected from different regions in Bangladesh. Samples were collected from fishermen during the study period. Fishing activities were done either by dewatering process or by using fishing gears. Different types of gear were used to collect fish samples includes lift net, push net, cast net, and other fishing gear. For B. Dario the moisture content was 68.50%, ash content was 2.72%, crude protein content was 15.50 %, lipid content was 12.21%, and carbohydrate content was 1.07% in wet weight basis and 12.50% moisture, 8.68% ash, 63.2% crude protein, 13.07% lipid, and 0.11% carbohydrate was in dry matter basis. The nutritive components of L. guntea fish were 77.89% as moisture, 3.09% as ash, 16.54% as crude protein, 1.53% as lipid, 0.95% as carbohydrates on a moisture basis, and 10.11% as moisture, 13.84% as ash, 64.70% as crude protein, 6.92% as lipid, 4.43% as carbohydrates on a dry matter basis. The overall study revealed that B. dario and L. guntea are very rich in nutrient composition. All of the information will be helpful for researcher and policy makers for proper conservation and management of these fish.

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1. INTRODUCTION

Bangladesh is one of the world's leading producers of fish. According to IUCN (2000) [1] the country has 253 fish species in freshwater habitat. Small indigenous fish species, or SIS, are those fish

species that grow to a maximum length of 25 cm. Fish is an easy digestible food item and rich source of animal protein. SIS dominates the fish consumption market in Bangladesh. As SIS is so rich in vitamin A and D, which are necessary for healthy bones, teeth, skin, and eyes in humans. Additionally, SIS offers adequate amounts of calcium, phosphorus, iron, and iodine [2]. According to [3] in Chalan Beel, Padma River, Tanguar Haor, and Chittagong region contains 121, 119, 123, and 129 species of SIS, respectively. In another study, In Bangladesh, 143 species of SIS were reported by [4]. Botia dario locally known as rani fish and Lepidocephalichthys guntea locally known as gutum are two of them. These two species have been recorded from different parts Bangladesh including [5], [6], [7] Nethai River of Mymensingha district [8], Ghaghat river of Gaibandha district [9], the Dogger beel of Chandpur district [10], the Halda river in Chittagong [11], also the Meghna river estuary of Noakhali district [12]. There are three types of Botia species found in Bangladesh and one of them is B. dario [13]. Loaches has been considered as a table fish due to its admirable flesh quality in some parts of Bangladesh and India [14]. Those fish mainly inhabit in rivers, beels, haor, baor, streams, ponds, lakes, and inundated wetlands, clear mountain streams, and marshes with sandy bottoms [15]. B. dario are the endangered categories in Bangladesh. The main risks to this species include reckless fishing for the ornamental trade, habitat disturbance, climate change, and decreased water flow. Due to intensive harvesting, habitat loss, and ecological changes, the wild population is dwindling. (IUCN, 2010) [16].

L. guntea is small fish found mostly in swift streams but also in rivers, ponds, lakes, and inundated areas throughout Bangladesh. Cobitis guntea was described only from Ganges River by [17]. Later, it was assigned to the genus Lepidocephalus. There was confusion over its generic placement as Lepidocephalus or Lepidocephalichthys. The correct placement of the species is under Lepidocephalichthys [18]. This fish is available in fish markets especially in the rainy season but not abundant. It was listed in IUCN red book of least concern fish of Bangladesh by IUCN Bangladesh (IUCN, 2010) [19]. For the purpose of reporting the nutrient makeup of fish from a public health perspective, it is crucial to understand their biochemical composition. A fresh fish's moisture, protein, fat, and ash content are the key components of its nutritional or biochemical value. According to [20], these components make up between 96 to 98% of the tissue components in fish. Proximate composition of the fish is not only important to know its nutritional value, but also for its better processing and preservation [21]. Despite the high consumption of fish protein, there are only a few studies on the nutritional composition of SIS [22], [23]. [22] discovered that the biochemical composition of some small indigenous fish species namely Mola (Amblypharyngodon mola), Chapila (Gudusia chapra), Punti (Puntius chola), Chanda (Chanda nama), Batashi (Pseudeutropius atherinoides) and Kajuli (Ailia coila) were analyzed. Estimated protein content for A. mola, G. chapra, P. chola, C. nama, P. atherinoides, and A. coila was 18.46, 15.23, 14.08, 18.26, 15.84, and 16.99%, respectively. To the best of our knowledge, there is no report on the biochemical composition of B. dario and L. guntea. Therefore, the purpose of the current study was to ascertain the nutritional value and biochemical composition of B. dario and L. guntea gathered from several water bodies of Noakhali and Sunamgonj district of Bangladesh.

2. METHODOLOGY

2.1. Collection of Fish Sample

For biochemical analysis, B. dario was collected from Dekhar haor, Sunamganj and L. guntea was collected from Noakhali district (Figure 1). Different types of gear were used to collect fish samples includes lift net, push net, cast net, and other fishing gear. Sample collection time was maintained in the early morning of the day. The samples were tightly packed in separate pre-sterile polyethylene bags. After that the polyethylene bags were then loaded into an ice-box with enough ice and sent right away to the fish nutrition laboratory at the Department of Aquaculture, Bangladesh Agricultural University (BAU) where the experiment was conducted.

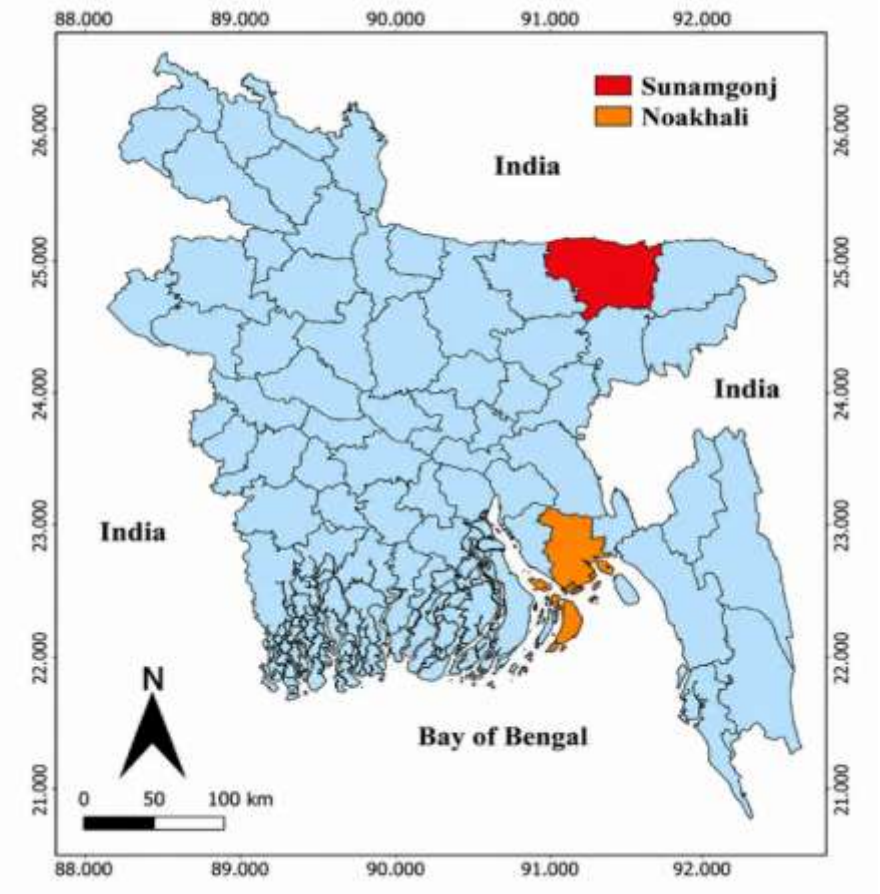

Figure 1. Sample Collection Location of the Study

2.2. Fish Preparation

The fish were gently cleaned with tap water. Fins, gills and viscera were removed and cleaned with tap water once more. Before performing a biochemical study, about 300 g of fresh L. guntea and B. dario fish were crushed in an electric blender.

2.3. Determination of Biochemical Composition of B. Dario and L. Guntea Fish

For the purpose of determining the biochemical composition, the Association of official analytical chemicals standard procedure was used (AOAC, 1995).

2.4. Estimation of Moisture

Moisture content was evaluated by oven (Model FD 23, Binder, Germany) drying at 105°C for 24 h by using the following formula: Weight of the crucible = w_0, weight of the crucible + wet sample = w_1, weight of the crucible + dry sample = w_2, moisture factor = (100-moisture)/100, moisture content of the sample (%) = $(\{(w1 - w2) - (w2 - w0)\})/((w1 - w0)) \times 100$

2.5. Estimation of Ash Content

The ash content was evaluated by using a muffle furnace (Carbolite RHF 17/6S, Carbolite Ltd., England) at 550°C for 4 h by using the formula: Weight of clean dry crucible=w_0, Weight of clean dry crucible + dry sample = w_1, Weight of clean dry crucible + ash =w_2, Ash content of the fresh sample (%) = $(w2 - w0)/(w1 - w0) \times 100) \times$ moisture factor.

2.6. Estimation of Protein Content

To determine the crude protein content by the Auto Kjeldahl System (Model UDK159, VELP, Italy) the following equation was used:

S = Titration reading for sample, B = Titration reading for blank
A = Strength of HCL (0.02) and C = Nitrogen factor (0.014)
% crude protein (fresh sample) = $N_2 \times 6.25 \times$ moisture factor
% of nitriogen = $((S - B) \times A \times C \times 100)/(\text{Weight of sample})$

2.7. Lipid Extraction

The ether-extraction method was used to determine the crude lipid content in a Soxhlet Extractor (Model 6XL, Soxhlet Extraction Apparatus, Bakhshi Co., Tehran, Iran) by using the following equation: W_2 =final weight of the conical flask, W_1 =Initial weight of the empty conical flask, S = Weight of the sample taken, % of fat (fresh sample) = $((W2 - W1)/S \times 100) \times$ moisture factor

2.8. Estimation of Carbohydrate Content

The total carbohydrate content (%) in the samples was estimated by subtracting the sum of the total moisture, ash, protein, and fat contents (%) from 100.

3. RESULTS AND DISCUSSION

3.1. Biochemical Composition of B. Dario in Wet and Dry Weight Basis

In this study, the biochemical composition of B. dario fish we analyzed as wet and dry matter basis. From the analysis, it was observed that moisture and carbohydrate were high in wet weight basis compare to dry matter basis. On the other hand, lipid, protein and ash were higher in dry matter basis compare to wet weight basis. B. dario has a wet weight base moisture, ash, protein, fat, and carbohydrate content of 68.50%, 2.72%, 15.50%, 12.21%, and 1.07%, respectively. Figure 2.

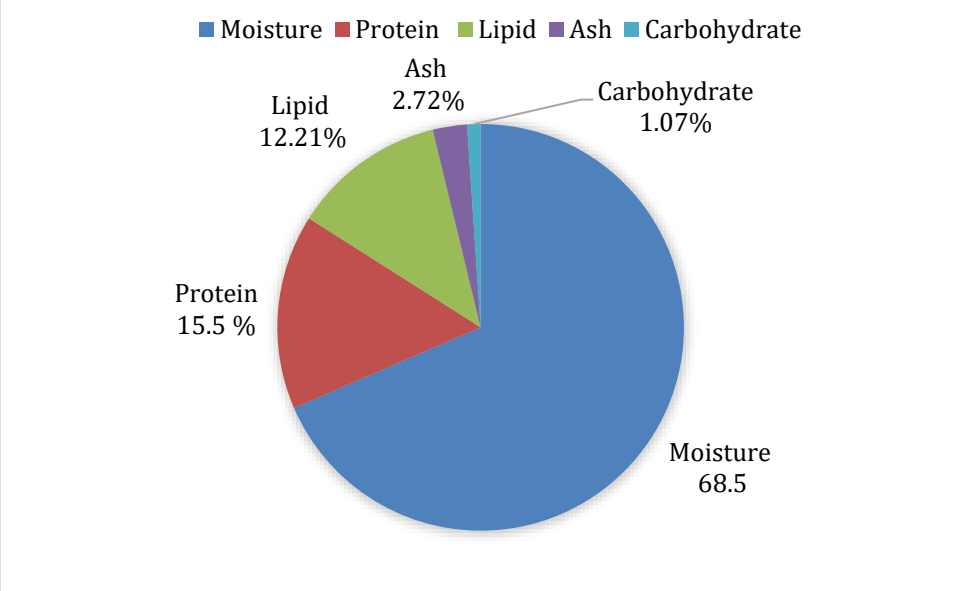

Figure 2. The Biochemical Composition of Rani Fish in Wet Weight Basis

In dry matter basis moisture, ash, protein, lipid, and carbohydrate content were 12.5%, 8.68%, 63.2%, 13.7%, and 1.92%, respectively. Biochemical composition of B. dario in dry matter basis is shown.

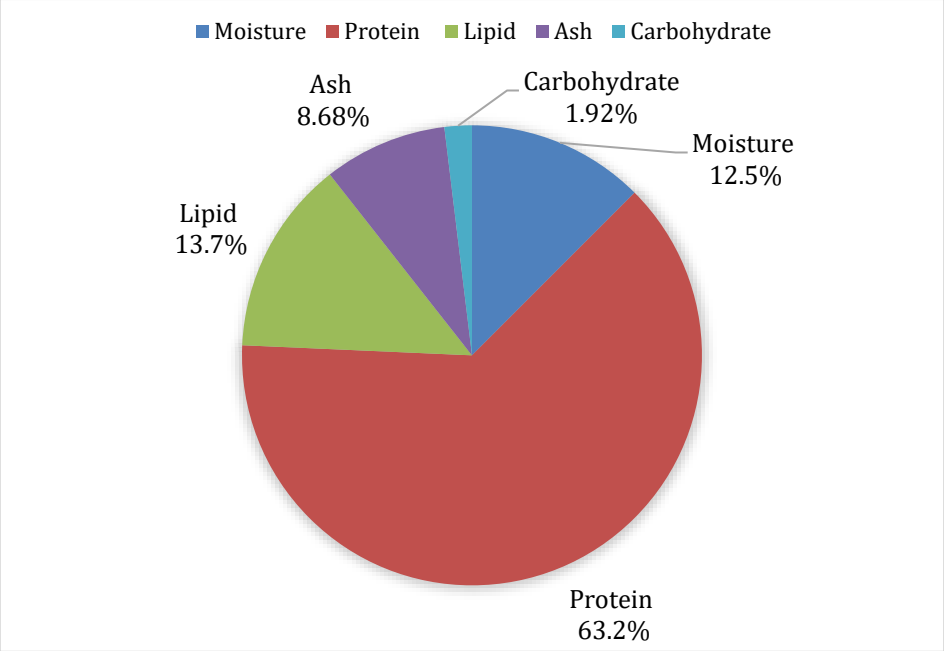

Figure 3. The Biochemical Composition of Rani Fish in Dry Matter Basis

Moisture is the principal constituent of fish. Many fish range in moisture content from 60 to 80%. The moisture content of B. dario in wet weight basis and dry matter basis were 68.50% and 31.50%, respectively. The percentage moisture was recorded 76.38% in A. mola by [22], 79% by [23] in Ompok pabda, 77.87% in Mystus bleekeri by [24], 75.75% in M. nemurus by [25], 76.71% in Clarias gariepinus by [26], and 78.79% in C. gariepinus by [27]. Therefore, compared to other fish species, B. dario had a lower moisture value. The lipid content of B. dario in the present study in wet weight basis and dry matter basis were 12.21% and 13.7%, respectively. Lipid provides the body with energy during starvation and hunger. According to [24], the lipid content of M. bleekeri was 3.26%. The protein content of B. dario in the present study in wet weight basis and dry matter basis were 15.50% and 49.20%, respectively. The structure of cells, the efficiency of antibodies in fighting infections, the control of hormones and enzymes, and the development and repair of body tissues depend on proteins. The protein content was found 15.01% in M. bleekeri [24], 14.87% in C. batrachus, 16.24% in C. gariepinus [27] in wet mater basis and 73.25% in C. gariepinus in dry weight basis [28]. Ash is a mineral content of food item. It also helps in the body's development and growth. The Ash content of B. dario in the present study in wet weight basis and dry matter basis were 2.72% and 8.68%, respectively. According to [29], the ash content of catfishes was 1.32% in C. batrachus, 1.23% in C. gariepinus, 0.59% in M. tengara, 3.95% in O. pabda, and 2.72% in P. pangasius. Numerous variables including habitat, age, size, nutrition, and species have been linked to variations in the body tissue composition of fish [30]. In the present study, the amount of carbohydrates in B. dario was 0.17% in wet weight basis and 0.11% in dry matter basis. [29] reported that the carbohydrate content of selected catfishes were recorded as 0.97% in C. batrachus, 0.95% in C. gariepinus, 0.72% in M. tengara, 0.64% in O. pabda, and 0.66% in P. pangasius.

3.2. The Biochemical Composition of L. Guntea in Dry and Wet Matter Basis

The nutritive analysis of L. guntea displayed in dry matter basis and moisture basis are presented in Figure 4 and Figure 5. Through the dry matter basis, the crude protein content of L. guntea was 64.7%. The ash content was 13.84%, lipid content was 6.92%, and carbohydrate content was 4.43 %. The findings of this investigation indicated that crude protein was the main constituent of the fish under consideration.

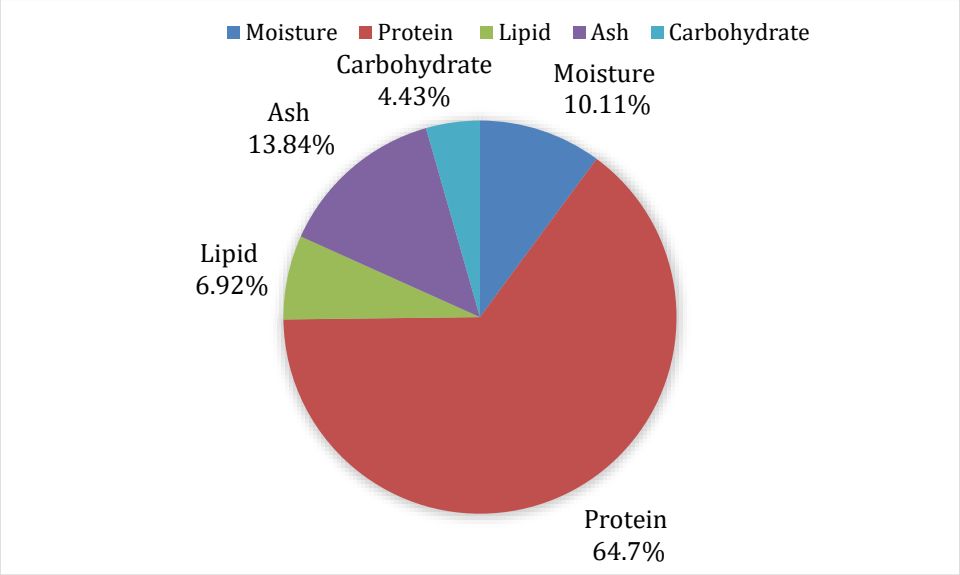

Figure 4. The Biochemical Composition of L. Guntea in Dry Matter Basis

The composition of the tested sample's moisture content was 77.89% in wet weight basis. As moisture basis, ash content of L. guntea fish was 3.09% and crude protein content was 16.54% and the lipid content was 1.53% and the carbohydrate content was 0.95%. According to the findings of this investigation, moisture makes up the majority of fish.

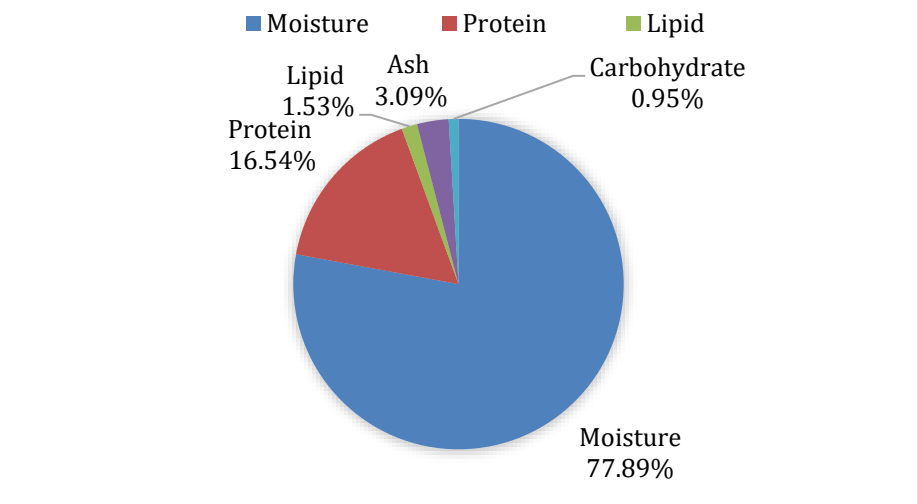

Figure 5. The Biochemical Composition of L. Guntea in Wet Weight Basis

The small indigenous species (SIS) have a very wide range of protein, fat, ash, and mineral concentrations. In the present study moisture content of L. guntea was 77.89 % in wet weight basis, 22.11 % in dry matter basis. Fresh M. tengara contained 76.06% moisture, 13.45% protein, 7.46% fat, and 2.80% ash, according to [31]. In the present observation ash content was 3.09% in moisture basis and 13.84% in dry matter basis, which is supported by the findings founded by [32]. Protein content of L. guntea was found 16.54% in moisture basis and 74.81% in dry matter basis. On a dry matter basis, crude protein levels in fish continue to be higher than all other nutritional components. [33] reported 16.6-19.59% protein content in Indian carp which was similar of our observation. The lipid content was found to be 1.53% on a moisture basis and 6.92% on a dry matter basis in the current analysis. According to [32], the crude fat content of several Bangladeshi zeol fish ranged from 2.18 to 9.38%. [34] conducted an analysis of the biochemical content of the SIS and discovered a 3-4% range for the lipid content.

4. CONCLUSION

The moisture, ash, protein, lipid, carbohydrate content of B. dario were 31.5%, 8.68%, 49.2%, 38.7% and 0.11% in dry matter basis, respectively. The nutritive contents of L. guntea fish were 10.11% as moisture, 13.84% ash, 74.81% crude protein, 6.92% lipid, 4.43% carbohydrate as dry matter basis. The result of the study indicates that the studied fish are very rich in nutrient composition. All of the information will be helpful for consumer health issue, protein requirement of human being, fishermen, researcher and policy makers for proper conservation and management of the B. dario and L. guntea fish.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Shyamal Kumar Paul	✓	✓	✓	✓		✓		✓	✓	✓	✓			
Md. Taufiq Hasan			✓	✓	✓	✓		✓		✓	✓	✓	✓	
Md. Al-Mamun	✓	✓	✓	✓		✓		✓	✓	✓	✓			
Shayla Sultana Mely				✓	✓	✓	✓		✓		✓	✓	✓	✓
Bhakta Supratim Sarker	✓	✓	✓	✓		✓		✓	✓	✓	✓			

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and approved by the relevant institutional authorities.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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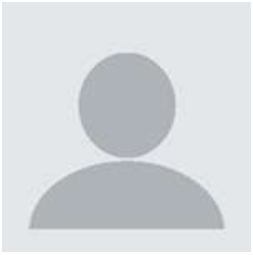
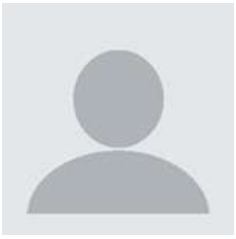
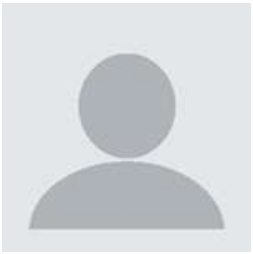
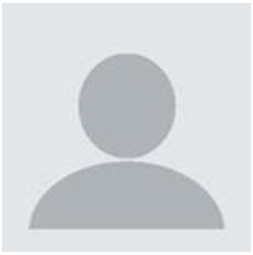
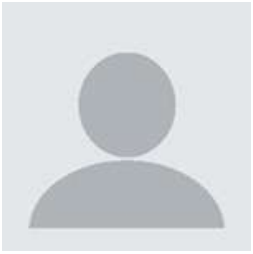
BIOGRAPHIES OF AUTHORS

	**Shyamal Kumar Paul,** is an Assistant Professor in the Department of Fisheries and Marine Science at Noakhali Science and Technology University, Bangladesh. He earned his Ph.D. in Biotic Environment from the United Graduate School of Agricultural Sciences, Iwate University, Japan, his MS in Aquaculture from Bangladesh Agricultural University, Mymensingh, and his BSc (Hons) in Fisheries from Khulna University. He has been involved in teaching and research at the department since October 2015. His research interests include aquaculture, fisheries biology, limnology, and aquatic nutrition, with over 42 publications and 120 citations to his credit.
	**Md. Taufiq Hasan,** is affiliated with the Department of Fisheries and Marine Science at Noakhali Science and Technology University (NSTU), Sonapur, Bangladesh. He has contributed as a co-author on fisheries research, including studies on the biochemical composition of fish species such as Botia dario and Lepidocephalichthys guntea collected from different regions in Bangladesh. His research interests appear to lie in fish biology and aquatic sciences within the NSTU department.
	**Md. Al-Mamun,** is an Associate Professor in the Department of Fisheries and Marine Science at Noakhali Science and Technology University (NSTU), Bangladesh. He completed his PhD at the University of Stirling, UK, under the Commonwealth Scholarship Programme (2012–2016), with research focused on seafood farming systems in Bangladesh and their links to local food security and global trade. With over 12 years of research experience, his expertise spans brackishwater aquaculture, nutrition-sensitive aquaculture, aquatic food systems, and the nexus between aqua-food and public health. He has over 73 publications and actively supervises postgraduate research students.
	**Shayla Sultana Mely,** is a researcher affiliated with the Bangladesh Fisheries Research Institute (BFRI), Headquarters, Mymensingh, Bangladesh. Her work is associated with fisheries and aquatic resource research, contributing to the advancement of sustainable fish production and aquatic ecosystem management. Through her involvement in scientific studies and research activities, she supports efforts to improve fisheries development and promote evidence-based practices that benefit both the environment and local communities in Bangladesh. Email: mely.bfri@gmail.com
	**Bhakta Supratim Sarker,** is affiliated with the Department of Fisheries and Marine Science, Noakhali Science and Technology University, Sonapur, Bangladesh. His academic and research interests focus on fisheries science, marine resource management, aquatic biodiversity, and sustainable aquaculture practices. Through teaching, research, and scholarly activities, he contributes to the advancement of knowledge in fisheries and marine sciences. His work supports the sustainable utilization of aquatic resources and helps address challenges related to fisheries development, environmental conservation, and food security in Bangladesh.