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Morphometric-meristic characters of Sumatran featherback (*Chitala hypselonotus*, Bleeker 1852) from Kelekar River, South Sumatra, Indonesia

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Abstract

The Sumatran featherback (*Chitala hypselonotus*, Bleeker 1852) is an endemic freshwater fish species native to the island of Sumatra in Indonesia. The objective of this study was to measure and calculate the morphometric-meristic characters of *C. hypselonotus*. The study utilized a total of ten specimens, collected between July and September 2024, from the Kelekar River in Indonesia. The morphometric and meristic characters of *C. hypselonotus* were measured at the Fisheries Laboratory, Department of Fisheries, Faculty of Agriculture, Universitas Sriwijaya, Indonesia. The results demonstrated that the total length of *C. hypselonotus* samples ranged from 340 to 500 cm, with a standard length ranging from 310 to 470 cm. Additionally, the body weight of the specimens ranged from 276 to 1066 g, with a proportion of standard length to total length of 94.16% and a head length to standard length ratio of 21.28%. The number of rays on the dorsal fin is 9 (D. 9), the pectoral fin has between 12 and 15 rays (P. 12-15), the ventral fin has between 2 and 3 rays (V. 2-3), and the anal fin is fused to the caudal fin, with a range of 118 to 131 rays (A-C. 118-131). The findings of our present study may prove useful to students, fisheries biologists, and taxonomists in the future, facilitating the correct identification and classification of *C. hypselonotus*. It is recommended that further studies be conducted on the morphometric-meristic and other biometric parameters of the threatened and commercially important fish *C. hypselonotus*, to enable the management and conservation of populations in natural water bodies.

Keywords: *Chitala hypselonotus*, condition factor, endemic species, morphometric, meristic character

1. Introduction

The Sumatran featherback (*Chitala hypselonotus*, Bleeker 1852) is one of the freshwater fish species endemics to Sumatra, Indonesia. The species is also known by its scientific name, *Notopterus hypselonotus*. In the local vernacular of South Sumatra, the fish is known as the belido or belida fish. The species is classified within the Notopteridae family ^[1]. The Notopteridae family comprises 10 species, including *Chitala blanci*, *Chitala borneensis*, *Chitala chitala*, *Chitala hypselonotus*, *Chitala lopsis*, *Chitala ornata*, *Notopterus notoapterus*, *Papyrocranus afer*, *Papyrocranus congoensis*, and *Xenomystus nigri* ^[2]. Notopteridae native to Indonesia include *C. borneensis*, *C. hypselonotus*, *C. lopsis*, and *N. notoapterus*. Notopteridae species are found in various aquatic habitats, including rivers, lakes, and flooded swamps ^[3-6]. *C. hypselonotus* is one of Indonesia's endemic freshwater fish species. The distribution of *C. hypselonotus* in Indonesia is limited to the islands of Sumatra and Kalimantan ^[7,8]. In Sumatra, the species is found in the Kampar Kanan River in the Riau Province ^[9], the Way Sekampung in the Lampung Province ^[10], and the Musi River in the South Sumatra Province ^[11,12]. In Borneo, this species is found in the Mahakam River ^[13]. It is also present in the Kelantan River in Malaysia ^[14]. The diet of *C. hypselonotus* is composed of fish and crustaceans ^[7].

Phenotypic variations may encompass alterations in both meristic and morphometric characteristics, which are dynamic traits frequently employed to quantify discrepancies among populations of the same fish species ^[15-17]. The morphometric and meristic study of fish species represents a crucial tool for precise species identification. This is achieved through the measurement of key physical characteristics, including length, weight, the number of fins and

spines, and other pertinent parameters ^[18-20]. Morphometric characters are continuous and quantifiable traits that describe the morphology of the body, including its shape and size ^[21]. Nevertheless, several morphometric characteristics demonstrate ecophenotypic variability and are frequently employed in both biometric research and field studies ^[22]. Additionally, they are utilized in investigations of species health and reproduction within their natural habitats ^[23]. In contrast, meristic characters are defined as several discrete, serially repeated, countable structures that are controlled by a combination of genetic and environmental factors, with the specific proportions of these factors currently unknown ^[24]. Furthermore, these techniques have been employed for the identification of fish stocks ^[25] and the provision of data for subsequent studies on stock improvement ^[26].

The objective of this study was to measure and quantify the morphometric and meristic characteristics of the *C. hypselonotus* from the Kelekar River in the Ogan Ilir

Regency, South Sumatra, Indonesia. The findings of this study are invaluable as a foundation for the management of *C. hypselonotus* resources.

2. Materials and Methods

2.1 Ethical statement

This study has been approved by the Ministry of Education and Culture of the Republic of Indonesia and LPPM Universitas Sriwijaya based on Decree Number 090/E5/PG.00.02.PL/2024, and 0015/UN9/SB1.LP2M.PT/2024.

2.2 Study area

This study was conducted in Kelekar River, Ogan Ilir Regency, South Sumatra. The samples were collected from three stations: Station 1 (3°14'32.0" S 104°38'58.3" E); Station 2 (3°14'41.0" S 104°39'28.4" E); and Station 3 (3°23'89.8" S 104°64'94.8" E) (Figure 1).

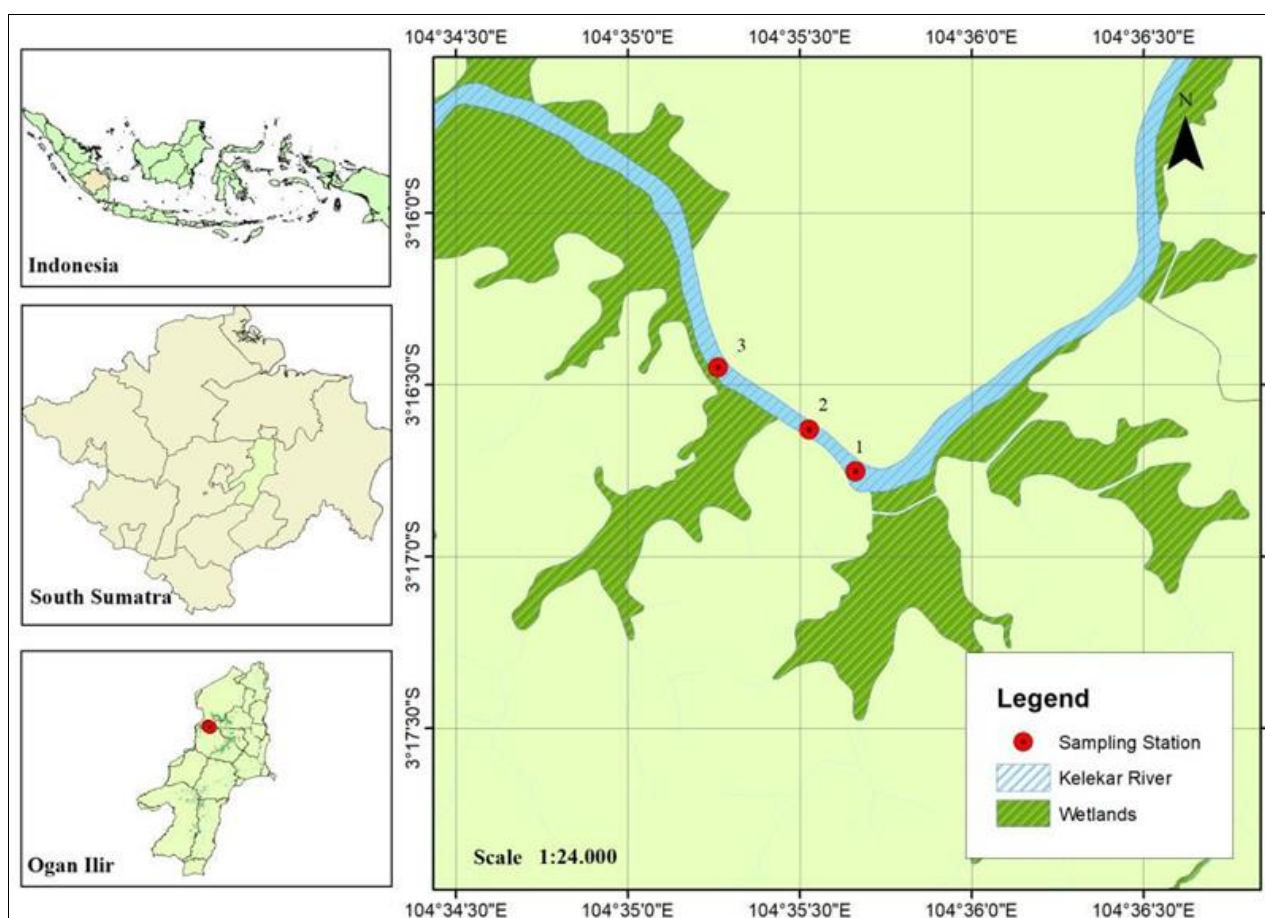


Fig 1: The collection site of Sumatran featherback (*Chitala hypselonotus*, Bleeker 1852) in the Kelekar River, Ogan Ilir District, South Sumatra, Indonesia.

2.3 Fish sampling

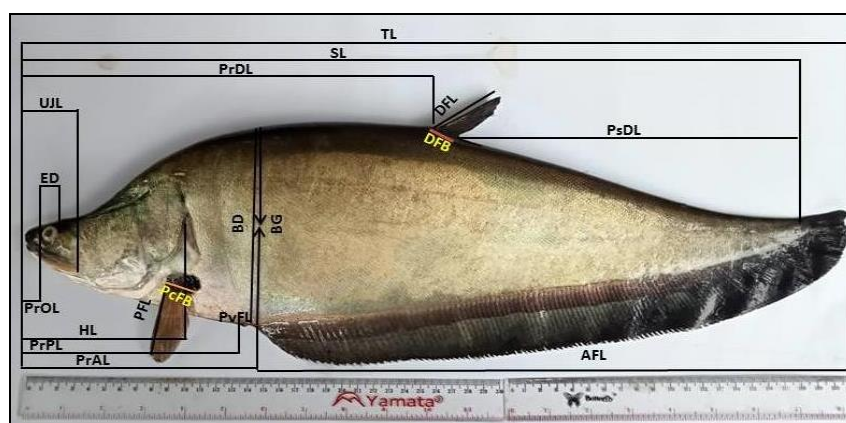
A total of 10 *C. hypselonotus* were collected in this study from July to September 2024. The *C. hypselonotus* specimens were subsequently transported to the Fisheries Basic Laboratory, Department of Fisheries, Faculty of Agriculture, Universitas Sriwijaya, Indralaya, Indonesia where they underwent morphometric character measurements and meristic character calculations.

2.4 Fish measurements

Nineteen morphometric and four meristic characters were analyzed in this study with standard procedures as previously followed by Prasad *et al.* (2020) ^[27] and Masood *et al.*, (2024) ^[28]. All these morphological parameters were represented along with their acronyms in Table 1 and Figure 2, respectively. The values of range, mean, and standard deviation of each morphometric or meristic character were presented in a table.

Table 1: Quantitative morphometric and meristic characters used for differentiation analysis of *Chitala hypselonotus* collected from Kelekar River, South Sumatra, Indonesia

No	Morphometric characters	Acronym
1.	Total length	TL
2.	Standard length	SL
3.	Head length	HL
4.	Interorbital width	IW
5.	Eye diameter	ED
6.	Body depth	BD
7.	Body girth	BG
8.	Pectoral fin length	PFL
9.	Ventral fin length	VFL
10.	Anal fin length	AFL
11.	Dorsal fin length	DFL
12.	Upper jaw length	UJL
13.	Pectoral fin base	PcFB
14.	Dorsal fin base	DFB
15.	Pre ventral length	PrVL
16.	Pre anal length	PrAL
17.	Pre dorsal length	PrDL
18.	Post dorsal length	PsDL
19.	Pre orbital length	PrOL
No	Morphometric characters	Acronym
1.	Number of soft rays of dorsal fin	DFSR
2.	Number of soft rays of pectoral fin	PFSR
3.	Number of soft rays of ventral fin	VFSR
4.	Number of soft rays of anal-caudal fin	A-CFSR

**Fig 2.** Measurements of morphometric characters of Sumatran featherback (*Chitala hypselonotus*).

The weight of *C. hypselonotus* specimens was determined using digital scales with an accuracy of 0.01 g. The total length, standard length, and morphometric characters were measured using a ruler with an accuracy of 0.01 mm and a digital caliper with an accuracy of 0.01 mm. The calculation of character proportions was performed using the following formula:

$$\text{Proportion (\%)} = \frac{\text{Characters value (mm)}}{\text{Standard length (mm)}} \times 100$$

2.5 Data analysis

The data collected were tabulated and calculated using the Microsoft Excel Windows program. All morphometric character parameters were compared to the standard length (SL), except for the SL itself compared to the total length. Data were analyzed descriptively and presented in tables.

3. Results and Discussion

This study successfully measured twenty-one morphometric characters and calculated five meristic characters of *C. hypselonotus* from Kelekar River, South Sumatra, Indonesia. The results of morphometric character measurements are presented in Table 1, and the results of meristic character calculations are presented in Table 2. The body shape of *C. hypselonotus* is elongated flat, resembling a knife blade, so it is known as a knifefish. *C. hypselonotus* has a dorsal fin, a pectoral fin, an anal fin fused to the caudal fin, and a small pelvic fin. The digits on all fins are rays without spines. The head is concave near the back, with the mouth at the base of the head. The body is silver with black fins. The dorsal fin is small and shaped like a sheet of fur. The pelvic fins, fused at the base, are small (rudimentary). The anal fin is fused to the caudal fin. All dorsal fins except the pelvic fins are black. Adults fish have a black spot at the base of the pectoral fins (Figure 3).



Fig 3: Morphology of the Sumatran featherback (*Chitala hypselonotus*) from the Kelekar River, Ogan Ilir Regency, South Sumatra, Indonesia.

Table 2: Morphometric characters of Sumatran featherback (*Chitala hypselonotus*) from Kelekar River, Ogan Ilir Regency, South Sumatra, Indonesia.

Morphometric	Range (mm)	Mean (mm)	STDEV	Proportion (%)
TL	340-500	415	67.58	-
SL	310-470	390.75	68.09	94.16 TL
HL	100.4	85.275	13.95	21.82 SL
IW	4-13.6	10.875	4.59	2.78 SL
ED	10.9-13.9	12.325	1.34	3.15 SL
BD	86.4-127.2	99.25	18.93	25.40 SL
BG	190-290	222.5	45.73	56.94 SL
PFL	38.159.5	47.35	9.08	12.12 SL
VFL	42.8-.8	3.85	0.91	0.99 SL
AFL	250-360	304	50.04	0.99 SL
DFL	32.7-47.4	41.975	6.43	10.74 SL
UJL	29-43.6	34.5	6.69	8.83 SL
PcFB	9.1-10.9	10.2	0.79	2.61 SL
DFB	10.4-12.6	11.025	1.06	2.82 SL
PrVL	87.2-126.5	108.6	17.25	27.79 SL
PrAL	90.4-140.6	114.475	20.97	29.30 SL
PrDL	155-250	198.25	40.11	50.74 SL
PsDL	144-215	181.25	32.20	46.39 SL
PrOL	9.112.5	11.025	1.48	2.82 SL

Table 3. Meristic characters of Sumatran featherback (*Chitala hypselonotus*) from Kelekar River, Ogan Ilir Regency, South Sumatra, Indonesia.

Meristic characters	Range	Mean	STDEV
DFSR	9	9	0.00
PFSR	12-15	14	1.26
VFSR	2-3	2	0.50
A-CFSR	118-131	130	6.13

Morphometric and meristic traits are dynamic traits. They are used to measure differences between populations of the same species. Information on the morphometrics and meristics of *C. hypselonotus* is severely limited, representing a significant gap in the existing literature. This study represents the inaugural attempt to quantify the morphometric and meristic characteristics of *C. hypselonotus* (SL, 310-470 mm) from Kelekar River, Ogan Ilir District, South Sumatra, Indonesia. Our findings indicate the presence of nine dorsal fin rays, 118-131 anal fin fused to the caudal fin rays, 12-15 pectoral fin rays, and two to three pelvic fin rays. The findings of this

study diverge somewhat from those of Wibowo *et al.* (2023) [12]. *C. hypselonotus* from the Musi River (SL, 456.76-639.64 mm) exhibits eight dorsal fin rays, 140-144 anal fin rays, and nine to eleven pectoral fin rays. The discrepancy in the number of meristic characters observed in *C. hypselonotus* from the Musi and Kelekar rivers may be attributed to differences in habitat and body weight.

According to Al-Hassan (1990) [29], meristic differences can be considered as environmental effects. It is well known that morphometric traits can exhibit high phenotypic plasticity due to environmental variation, and these environmental factors include temperature and food abundance. In general, fish, compared to all other vertebrates in the world, show remarkable variation in morphological characters both between and within populations, and they were more susceptible to environmentally induced variation in morphological traits [30,31]. The morphometric variations can be due to the age, the diet, and the physiological conditions of the fish [32].

Indonesia has many endemic fish species. *C. hypselonotus* is one of the freshwater fish species endemics to the Kelekar River, Ogan Ilir Regency, South Sumatra, Indonesia. Based on observations conducted at the sampling sites, the habitat characteristics of *C. hypselonotus* can be described as follows: slow-moderate river water currents, a substantial quantity of organic matter at the bottom of the water, a considerable amount of aquatic vegetation, a water temperature ranging from 25 to 30 degrees Celsius, a pH level ranging from 5.5 to 7, and a dissolved oxygen concentration ranging from 5 to 7 milligrams per liter.

C. hypselonotus belongs to the demersal fish species. This species is a predator that feeds on small fish, crustaceans, and insects. Its diet and feeding habits are similar to those of other Notopteridae species. According to Ashraf *et al.* (2022) [33], *C. chitala* feeds on approximately 15% insects, Crustaceans (10%), Rotifers (4%), Chlorophyceae (8%), Protozoa (3%), sand and mud (4%), stones and other miscellaneous (4%), Myxophyceae (4%), and Annelids (5%).

In South Sumatra, *C. hypselonotus* is utilized by the community as food and also as aquarium ornamental fish. This fish meat is used as an ingredient in pempek, fish crackers, and tekwan, a culinary specialty of South Sumatra. Consumer demand for *C. hypselonotus* continues to increase

along with the culinary industry in South Sumatra. The increasing demand has led to overexploitation in nature. The population of *C. hypselonotus* is declining, and fishermen are catching less. Data from the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia shows that Notopteridae production (including *C. hypselonotus*) was 13,174.52 tons in 2018, 6,055.04 tons in 2019, 4,555.08 tons in 2020, and 3,419.67 tons in 2021^[34]. From these data, there has been a significant decline in Notopteridae production from 2018 to 2021. If the trend of population decline continues, it could lead to the extinction of *C. hypselonotus* species. To prevent the extinction of Indonesia's native and endemic Notopteridae (*C. hypselonotus*, *C. borneensis*, *C. lopis*, and *N. notopterus*), the Government of the Republic of Indonesia, through the Ministry of Maritime Affairs and Fisheries, issued Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2021 concerning protected fish, including *C. hypselonotus*, *C. borneensis*, *C. lopis*, and *N. notopterus*^[35].

4. Conclusion

This study has successfully measured nineteen morphometric characters and quantified four meristic characters of *C. hypselonotus* from the Kelekar River in Indonesia. The total length of the *C. hypselonotus* samples ranged from 340 to 500 cm, with a standard length ranging from 310 to 470 cm. The body weight of the samples ranged from 276 to 1066 g, with a proportion of standard length to total length of 94.16%. The head length to standard length ratio was 21.28%. The number of fins on the dorsal fin was nine (D.9), the pectoral fins were between 12 and 15 (P.12-15), the pelvic fins were between two and three (V.2-3), and the anal fins merged with the caudal fin, ranging from 118 to 131 (A-C.118-131). The findings of our current research may prove useful in the future for students, fisheries biologists, and taxonomists engaged in the accurate identification and classification of *C. hypselonotus*. It is recommended that further research be conducted on the morphometric characteristics and other biometric parameters of the endangered and commercially important fish *C. hypselonotus* for population management and conservation in natural waters.

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Author Contributions

All author contributions are equal for the preparation research in the manuscript.

Conflict of Interest

The authors declare that they have no conflict of interest.

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