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Morphometric, Meristic, and Species Identification of *Nemacheilus spp* in the Sibam River, Pekanbaru, Riau

Identifikasi Morfometri, Meristik, dan Spesies Ikan Tali-Tali di Sungai Sibam, Kota Pekanbaru, Provinsi Riau

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Abstract

A type of fish suspected to have morphological characteristics similar to *Nemacheilus* spp was found in the Sibam River. However, the species has not yet been identified with certainty. This study aims to identify the types of *Nemacheilus* spp in the Sibam River based on morphometric and meristic characteristics. This study was conducted from September to November 2024. Sampling was conducted six times in the upper reaches of the Sibam River at two-week intervals. The fish samples obtained were then measured for their morphometric characteristics and counted for their meristic characteristics, followed by species identification based on relevant literature. The results showed that 38 *Nemacheilus* spp were caught, comprising 18 males and 20 females. Morphologically, male fish tended to have more contrasting and brighter body colors than females, which were relatively paler. Among the 24 morphometric characters observed, four characters showed differences between male and female fish, namely the head height (HH) of male fish was relatively shorter than females, the body height (BH) of female fish was higher than males, the distance from the dorsal fin to the caudal fin (DFCF) of males is longer than that of females, and the eye diameter (ED) of males is smaller than that of females. The meristic characteristics of male and female fish show similarities, with fin formulas D.II 6-8, P 9-12, V 6-7, A 4-5, and C 13-16.

Keywords: Morphometric characters, Meristic characters, Fin formulas

Abstrak

Sejenis ikan yang diduga memiliki karakteristik morfologis serupa dengan ikan tali-tali (*Nemacheilus* spp.) ditemukan di Sungai Sibam, namun spesiesnya belum dapat diidentifikasi secara pasti. Penelitian ini bertujuan untuk mengidentifikasi jenis-jenis ikan loach di Sungai Sibam berdasarkan karakteristik morfometrik dan meristik. Penelitian ini dilakukan September s/d November 2024. Pengambilan sampel dilakukan enam kali di bagian hulu Sungai Sibam dengan interval dua minggu. Sampel ikan yang diperoleh kemudian diukur untuk karakter morfometriknya dan dihitung untuk karakter meristiknya, diikuti dengan identifikasi spesies berdasarkan literatur yang relevan. Hasil menunjukkan bahwa jumlah total ikan tali-tali yang ditangkap adalah 38, terdiri dari 18 jantan dan 20 betina. Secara morfologis, ikan jantan cenderung memiliki warna tubuh yang lebih kontras dan cerah dibandingkan dengan betina, yang relatif lebih pucat. Di antara 24 karakter morfometrik yang diamati, terdapat empat karakter yang menunjukkan perbedaan antara ikan jantan dan betina, yaitu tinggi kepala (HH) ikan jantan relatif lebih pendek daripada betina, tinggi tubuh (BH) ikan betina lebih tinggi daripada jantan, jarak dari sirip punggung ke sirip ekor (DFCF) ikan jantan lebih panjang daripada betina, dan diameter mata (ED) ikan jantan lebih

kecil dibandingkan betina. Karakter meristik jantan dan betina ikan menunjukkan kesamaan, dengan formula sirip D.II 6-8, P 9-12, V 6-7, A 4-5, dan C 13-16.

Kata kunci: Karakter morfometrik, Karakter meristik, Rumus sirip

1. Introduction

The Sibam River flows through two districts: Bina Widya and Payung Sekaki. The main source of water for this river is the swamps in the Payung Sekaki district of Pekanbaru City, which flow into the Siak River, also located in the Payung Sekaki district. The Sibam River is estimated to be about 8 km long and ±3 m deep during the rainy season. This river has the characteristics of peat swamp water, with blackish-brown water, a relatively acidic pH, and high turbidity. These conditions make the Sibam River a habitat for fish with specialized adaptive abilities to extreme environments.

One of the fish found in the Sibam River is the stringfish, a member of the *Nemacheilus* genus. This fish is characterized by its small, elongated body and lives at the bottom of the water (Rahardjo et al., 2011). Although its existence is well known to the local community, to date, the species of stringfish found in the Sibam River is not yet known with certainty (Fajri & Gustia, 2014). Given this issue, further study is needed to determine the species of stringfish, and research on their morphometry, meristics, and identification in the Sibam River is required.

2. Material and Method

2.1. Time and Place

This research was conducted from September to November 2024. Samples of *Nemacheilus* spp were collected from the Sibam River in Air Hitam Village, Payung Sekaki District, Pekanbaru City, Riau Province. Observation and measurement of fish samples were carried out at the Aquatic Biology Laboratory of the Faculty of Fisheries and Marine, Universitas Riau.

2.2. Methods

Sampling was conducted at three points in the upper reaches of the Sibam River, each with different habitat characteristics. Fish were caught using a dip net (mesh size 0.1 inch) and a net with a mesh size of 0.1 inch. Fishing was carried out six times at two-week intervals during the day. The caught fish were placed in labeled plastic bags containing the time and location of the catch. The fish samples were taken to the laboratory for identification.

2.3. Procedures

2.3.1. Fish Morphometric Measurement Methods

Morphometric measurements were performed using digital calipers. Twenty-five morphometric characters of *Nemacheilus* sp were measured in this study, including total length (TL). Total length was chosen as the "reference" to compare with the other 24 characters.

2.3.2 Fish Meristic Calculations

Observation of the meristic characteristics of *Nemacheilus* spp using an Olympus SZ51 microscope. The parts of the *Nemacheilus* spp body that were counted were the number of dorsal fin rays, the number of pectoral fin rays, the number of pelvic fin rays, the number of anal fin rays, the number of caudal fin rays, fish scales, the number of upper jaw barbs, the number of lower jaw barbs, number of nostrils, and lateral line. The data obtained from meristic measurements of threadfin fish during the study were analyzed by examining the range of numbers per meristic characteristic.

2.3.3. Fish Identification

One way to identify the different types of *Nemacheilus* spp is through identification. The first step in identification is to group the various types of fish into easily recognizable groups, determine the important characteristics of each, and assign them scientific names according to internationally agreed taxonomic rules. Identification is carried out using the books by Saanin (1984), Kottelat (1993), FishBase, and other sources.

2.4. Data Analysis

Data All data obtained from measuring the morphometric and meristic characteristics of the *Nemacheilus* spp in the Sibam River were tabulated in tables and figures and analyzed descriptively. They were then identified in the existing literature to reach a conclusion.

Table 1. Morphometric Characteristics of the Body Parts of *Nemacheilus* spp

No.	Description Morphometric	Symbol	Explanation
1.	Total length	PT	The straight line distance from the leading edge of the head to the rear edge of the tail
2.	Standard length	PB	Straight line distance from the tip of the leading edge to the base of the tail fin
3.	Head length	PK	Distance from the leading edge of the head to the rear edge of the gill cover
4.	Height	TK	Vertical straight-line distance measured at the highest point of the head
5.	Height	TB	Vertical straight line distance measured at the highest point of the body
6.	Tail height	TBE	Vertical straight-line distance measured at the widest part of the tail
7.	Distance from mouth to base of dorsal fin	JMSD	The straight line distance between the tip of the mouth and the base of the dorsal fin
8.	Distance from mouth to eyes	JMM	The straight line distance between the corner of the mouth and the inner corner of the eye
9.	Distance from mouth to base of pectoral fin	JMSP	The straight line distance between the tip of the mouth and the base of the pectoral fin
10.	Distance from the mouth to the base of the pelvic fins	JMSV	The distance of the line drawn from the corner of the mouth to the base of the pelvic fin
11.	Distance from the mouth to the base of the tail fin	JSDSC	The straight-line distance between the tip of the dorsal fin and the base of the tail fin
12.	Eye diameter	DM	The length of the center line of the eyeball is measured from the height of the eyeball.
13.	Distance from the Eye to the Gills	JMTI	The straight line distance between the tip of the eye and the base of the gill cover
20.	Height of anal fin	TSA	The straight line distance measured from the base of the anal fin to its tip.
21.	Length of the Pelvic Fin Base	PDSV	The straight-line distance measured from the base of the pelvic fin to its tip.
22.	Abdominal fin height	TSV	The straight-line distance measured from the base of the longest abdominal fin to its tip.
23.	Length of caudal fin base	PDSC	The straight-line distance measured from the base of the longest caudal fin to its tip.
24.	Caudal fin height	TSC	The straight-line distance measured from the base of the longest caudal fin to its tip.
25.	Long mouth	PM	The straight line distance measured from the corner of the mouth to the base of the mouth.

3. Result and Discussion

3.1. Catch of Nemacheilus spp

During the study, 38 *Nemacheilus* spp. were collected, comprising 18 males and 20 females. The number of fish caught during the study is shown in Table 2.

Table 2. Number of *Nemacheilus* spp caught during the study

No	Time of Arrest	Number of Fish Caught	Number of fish/sampling point (fish)					
			I		II		III	
			J	B	J	B	J	B
1	Week 1	4	1	2	-	1	-	-
2	Week 3	10	3	2	-	1	2	2
3	Week 5	7	3	1	-	1	2	-
4	Week 7	5	-	3	-	2	-	-
5	Week 9	7	-	2	2	2	1	-
6	Week 11	5	-	1	3	-	1	-
Number of fish		38	7	11	5	7	6	2
Number of fish/station			18		12		8	

Table 2 shows that during the study, 38 fish were caught using longlines, including 18 males and 20 females. The number of males and females was fairly balanced. The differences in the number of fish caught at each sampling point on the Sibam River indicate variations in habitat conditions that affect fish distribution and abundance. The highest catch was found at sampling point one, which is thought to have the most suitable water conditions, characterized by calm currents, sufficient depth, and dense riverbank vegetation cover, providing

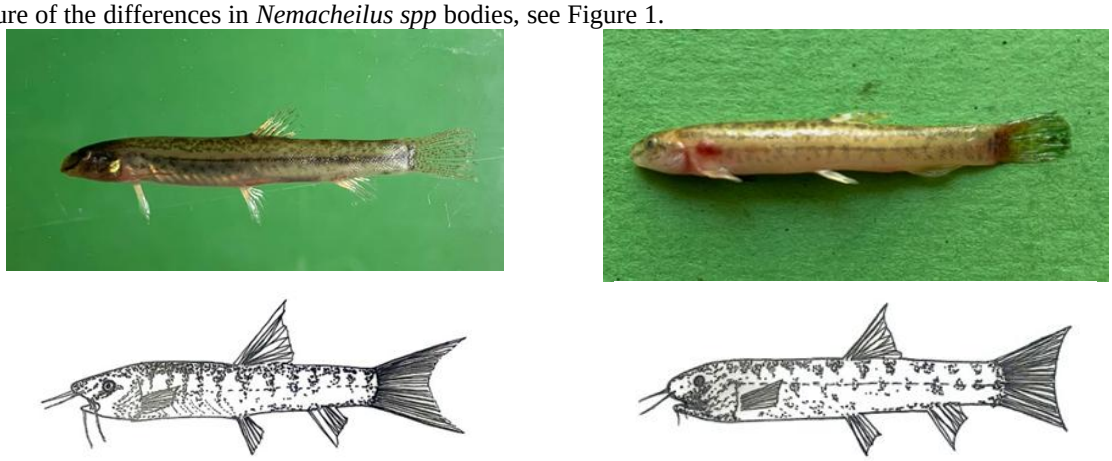
shelter and natural food sources. Sampling point two showed a lower catch, indicating a decline in habitat quality due to reduced vegetation and the influence of human activities around the water. Meanwhile, sampling point three had the lowest catch, likely due to shallower water, minimal vegetation, and greater environmental disturbance, all of which were less conducive to *Nemacheilus* spp. Thus, differences in the physical and environmental conditions of the Sibam River played an important role in determining the distribution and abundance of *Nemacheilus* spp at each observation site.

3.2. Identification

The classification of *Nemacheilus* spp in the Sibam River was based on a taxonomic approach following Saanin (1984), using morphological and meristic characteristics for observation. Based on the presence of a true bony skeleton and fins supported by fin rays, this fish belongs to the class Actinopterygii. Furthermore, the elongated body, absence of true teeth in the jaw, and the presence of barbels around the mouth place this fish in the Order Cypriniformes. At the family level, the fish is classified into the Family Nemacheilidae based on its slender body, inferior mouth, and the presence of more than one pair of barbels. The characteristics of a small body size, elongated slender body shape, very smooth scales, and the presence of 2–3 pairs of barbels indicate that this fish belongs to the Genus Nemacheilus. The species was identified based on the pattern of dark bands along the sides of the body and the uniformity of morphometric and meristic characteristics among individuals, which correspond to the description of *Nemacheilus fasciatus* by Saanin (1984). Thus, the fish found in the Sibam River were identified as *Nemacheilus fasciatus*. Based on the freshwater fish classification system proposed by Kottelat et al. (1993), Saanin (1984), the fish were classified as follows: Kingdom: Animalia; Filum: Chordata; Subfilum: Vertebrata; Class: Actinopterygii; Ordo: Cypriniformes; Famili: Nemacheilidae; Genus: *Nemacheilus;* Species: *Nemacheilus fasciatus* (Valenciennes, 1846)

3.3. Morphology of the Nemacheilus spp

In general, *Nemacheilus spp* do not exhibit clear sexual dimorphism. The morphological differences between male and female fish are relatively small, making it difficult to distinguish them visually without examining their gonads. This aligns with Effendie's (2006) view that secondary sexual characteristics are external signs that can be used to distinguish the sex of fish. In this study, secondary sexual differences in *Nemacheilus spp*. were observed in body color, with males tending to exhibit more contrasting coloration than females. For a clearer picture of the differences in *Nemacheilus spp* bodies, see Figure 1.



a. Male b. Female

Figure 1. Observations show that the threadfin fish have different body colors.

3.4. Morphometry and Meristics of the Nemacheilus fasciatus

The proportion of each morphometric character is calculated based on the comparison or ratio between the measured character length and total length (TL), as shown in Table 3. Of the 24 morphometric characters analyzed, only four characters showed differences in ratio to total length between male and female threadfin bream, namely head height (TK), body height (TB), distance from dorsal fin to caudal fin (JSDSC), and eye diameter (DM). Female fish have a relatively larger head height and body height ratio compared to male fish, which is thought to be related to the physiological needs of females, particularly in gonad development. Conversely, male fish show a larger dorsal fin to caudal fin distance ratio, indicating a relatively longer posterior body.

In contrast, female fish tend to have a larger eye diameter than male fish. Although there are differences in certain characters, in general, the resulting differences in ratios are relatively small, indicating that threadfin fish exhibit weak sexual dimorphism and are difficult to distinguish without more detailed morphometric analysis. The meristic characters of fish observed in this study will be compared with those reported in the ichthyological literature (Kottelat et al., 1993).

Table 3. Proportion of Morphometric Characters to Total Length and Ratio

No	Morphometric Characteristics	Male		Female	
		Average (%)	Ratio	Average (%)	Ratio
1	PB	81,4%	4/5	81,5%	4/5
2	PK	15,9%	1/6	17,4%	1/6
3	TK*	9,1%	1/11	9,9%	1/10
4	TB*	9,7%	1/10	11,7%	1/9
5	TBE	9,3%	1/11	9,4%	1/11
6	JMSD	48,0%	1/2	49,0%	1/2
7	JMM	6,9%	1/14	7,0%	1/14
8	JMSP	16,4%	1/6	16,4%	1/6
9	JMSV	43,8%	4/9	45,3%	4/9
10	JSDSC*	40,6%	2/5	41,9%	3/7
11	DM*	4,4%	1/23	4,6%	1/22
12	JMTI	11,9%	1/8	12,0%	1/8
13	JSVSA	23,5%	1/4	24,2%	1/4
14	JSASC	19,8%	1/5	20,4%	1/5
15	TSD	12,4%	1/8	12,7%	1/8
16	PDSP	12,2%	1/8	12,6%	1/8
17	TSP	14,2%	1/7	14,7%	1/7
18	PDSA	8,9%	1/11	9,1%	1/11
19	TSA	10,7%	1/9	10,9%	1/9
20	PDSV	12,4%	1/8	12,8%	1/8
21	TSV	14,1%	1/7	14,7%	1/7
22	PDSC	18,5%	1/5	19,1%	1/5
23	TSC	16,5%	1/6	17,3%	1/6
24	PM	3,8%	1/26	3,9%	1/26

Note * =Morphometric ratios differ between males and females.

Table 4. Meristic Characters of *Nemacheilus spp* fish

No	Type	This research	Kottelat (1993)
1	Dorsal fin rays	D II, 6-8	D II, 6-8
2	Fingers of the pectoral fin	9-11	10-12
3	Ventral fin rays	6-7	7-8
4	Anal fin rays	4-5	5-6
5	Caudal fin rays	13-16	14-16
6	Fish Scales	Cycloid	Cycloid
7	Number of rostral jaw barbs	1	1
8	Number of maxillary teeth	2	2
9	Number of nostrils	2	2
10	Lateral Line	unclear	unclear

The meristic characters in this study have fewer pectoral, ventral, anal, and caudal fins than those reported in Kottelat (1993). The meristic characters of male and female *Nemacheilus fasciatus* are uniform, including complete fins with the formula D.II 6-8, P 9-12, V 6-7, A 4-5, C 13-16. It is estimated that the difference in the number of fins is influenced by the rate of development of the shape and meristic structure of the fish with age.

3.5. Growth Patterns of Male and Female Nemacheilus fasciatus

From the morphometric characteristics analyzed, the growth pattern of *Nemacheilus fasciatus* is relatively uniform between males and females as their body size increases. No significant differences were found in the morphometric characteristics of the two sexes, so that changes in body size occur proportionally after the fish reach adulthood. Limited variation in size among individuals makes morphometric characteristics difficult to use for sex discrimination, consistent with the absence of clear sexual dimorphism in external morphology. Therefore, identifying the sex of *Nemacheilus fasciatus* requires additional approaches, such as examining the reproductive organs, as morphometric measurements alone cannot provide a clear distinction between males and females.

3.6. Water Quality

Yustina (2001) states that water quality is a factor that affects the success of fishery production. In general, the upstream waters of the Sibam River are brown (peat swamp) with a muddy sand substrate. The upper reaches of the Sibam River exhibit the characteristics of peat swamp waters, with brown-colored water that results in low light levels. The brightness value ranges from 12.6 to 27.5 cm, which is still within the range that supports fish life and is suitable for the natural habitat of the *Nemacheilus fasciatus*, which generally lives in waters with low to moderate brightness. The water depth ranges from 21 to 174 cm, and the current speed is relatively low (0.1–

0.52 m/s), indicating shallow to moderate water conditions, calm water typical of peat swamp ecosystems, and suitability for bottom-dwelling fish such as *Nemacheilus fasciatus*.

The water pH is around 5, indicating acidic conditions, but still within the tolerance range of the peat swamp ecosystem and the stone loach. Dissolved oxygen levels range from 3–5 mg/L, and free CO_2 content is 15–18 mg/L, indicating water conditions with relatively low to moderate dissolved gases, which are still tolerable for *Nemacheilus fasciatus*. Overall, the water quality parameters of the Sibam River remain within the ecological tolerance range of the stone loach, supporting its survival and biological activity in the river. The water quality at the research location, based on measurements, is shown in Table 5.

Table 5. Water Quality Measurement Results at Three Sampling Points

Parameters	Unit	Location of the Upper Sibam River		
		1	2	3
Physics				
Temperature	˚C	26-28	27-29	27-29
Brightness	Cm	12.6-26.7	23.7-26.8	26.1-27.5
Depth	Cm	11-115	25-174	60-167
Current Speed	m/s	0.1-0.35	0.12-0.52	0.5-49
Chemistry				
pH	-	5	5	5
(DO)	mg/L	3-5	4-5	4-5
CO_2	mg/L	15-18	16-17	16-17

4. Conclusions

The loaches found in the Sibam River are a single species, *Nemacheilus fasciatus*, as indicated by the uniformity of morphological, morphometric, and meristic characters across all individuals caught. Morphologically, male and female fish differ in body color: males have a more contrasting, brighter color, while females tend to be paler. However, no significant morphometric differences were found between male and female stone loaches in the Sibam River. The meristic characteristics of male and female threadfin fish show uniformity, which includes complete fins with the formula D.II 6-8, P 9-12, V 6-7, A 4-5, C 13-16, cycloid scales, three pairs of barbels consisting of one pair of rostral barbels and two pairs of maxillary barbels, two pairs of nostrils, and an indistinct lateral line on the body. The water quality of the Sibam River is generally still supportive of the stone loach's survival, although the peat swamp's acidic characteristics influence it. Thus, the Sibam River can be considered a suitable habitat for the survival of the *Nemacheilus fasciatus* population.

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