

## Bioecology of wild betta fish (*Betta schalleri*) of Bangka Island waters

*Bioekologi ikan wild betta (Betta schalleri) dari perairan Pulau Bangka*

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(Received: 3 January 2024, Revision accepted: 18 September 2024)

**Citation:** Khanati, O., Lista, D., Lindiatika, L., & Syarif, A.F. (2024). Bioecology of wild betta fish (*Betta schalleri*) of Bangka Island Waters. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands*. 13 (2): 160–165. <https://doi.org/10.36706/JLSO.13.2.2024.668>.

### ABSTRAK

Ikan *Betta schalleri* merupakan ikan *wild betta* endemik dari Pulau Bangka yang mempunyai potensi sebagai ikan hias. Namun status konservasi yang hampir punah dari ikan ini menjadi salah satu permasalahan dari upaya pelestariannya. Tujuan penelitian ini adalah menganalisis ikan *B. schalleri* berdasarkan karakteristik biologi dan ekologi ditemukannya habitat ikan ini. Metode penelitian ini adalah deskriptif kuantitatif. Parameter yang diukur pada penelitian ini meliputi morfologi, meristik, kualitas air dan karakteristik habitat. Sampel ikan diperoleh sebanyak 15 ekor ikan *B. schalleri*. Hasil pengamatan ciri fisik dari Ikan *B. schalleri* asal Bangka dan Bangka Barat berdasarkan karakter morfometrik, yaitu: panjang total (PT) (6,20 cm, vs. 5,44 cm); panjang standar (PS) (4,55 cm, vs. 3,98 cm); panjang kepala (PK) (1,48 cm vs. 1,16 cm); tinggi kepala (TK) (1,10 cm vs. 0,87 cm); dan tinggi sirip caudal (TSC) (1,48 cm, vs. 1,08 cm), sedangkan berdasarkan karakter meristik, yaitu: sirip dorsal (D.II.8); sirip anal (A.II.24-25); sirip ventral (V.I-II.4); sirip pektoral (P.II-12); sirip caudal (C.13) dan linea lateralis (LL.31-32). Ikan *B. schalleri* umumnya hidup di perairan gambut yang merupakan perairan air tawar yang tenang dan memiliki warna yang cenderung kecoklatan serta disekitar perairan ditumbuhi oleh tumbuhan air berupa *Pandanus* sp. dan *Utricularia* sp. Umumnya ikan *B. schalleri* dapat dijumpai pada pH 4-5, suhu 28-31°C dan oksigen terlarut 5,6-11 mg/l.

Kata kunci: ecology, endemic, morphometrics, *Tempalak*

### ABSTRACT

The *Betta schalleri* is a *wild betta* fish endemic to Bangka Island which has potential as an ornamental fish. However, the fish's endangered conservation status is one of the problems for its conservation efforts. The aimed of this study was to analyze the *B. schalleri* according to its biological and ecological properties. The research method was quantitative descriptive. Parameters measured in this study included fish morphology, fish meristics, water quality and habitat characteristics. The fish samples collected was 15 *B. schalleri*. Observations on the physical characteristics of the *B. schalleri* were based on morphometric characters, namely: total length (TL) (22355.59 mm); standard length (SL) (16386.74 mm); head length (HL) (3912.51 mm); head height (HH) (3112.72 mm); and caudal height (CH) (4922.29 mm), the meristic characters brought about the following 1) dorsal fin (D.II.8); 2) anal fin (A.II.24-25); ventral fin (V.I-II.4); pectoral fin (P.II-12); caudal fin (C.13) and linea lateralis (LL.31-32). The betta schalleri typically live in peat water, calm and fresh water that tend to be brown in color. The aquatic plants grow in the form of *Pandanus* sp. and *Utricularia* sp. In general, *B. schalleri* thrive in a pH of 4-5, a temperature from 28°C to 31°C, and dissolved oxygen of 5.6- 11 mg/l.

Keywords: ecology, endemic, morphometrics, *Tempalak*

## INTRODUCTION

The Bangka Belitung Islands have 106 river basins (Bangka Belitung Provincial Government, 2016) and have quite high potential for freshwater fish ichthyofauna. According to Ng and Kottelat (1994), there were 30 endemic fish species (11%) found on Sumatra Island, including the Bangka Belitung Islands. One of the areas in the Bangka Belitung Islands having quite high ichthyofauna potential is South Bangka District due to the existence of 21 secondary rivers spreading across 5 subdistricts. The ecosystems and habitats which were still maintained in the Watershed of South Bangka make the district have the potential for ichthyofauna in the form of fish endemic to Bangka Belitung (Isabela, 2022).

One of the fish endemic to Bangka Belitung thriving in the watershed of South Bangka district is the *Tepalak/Tempalak* (*Betta schalleri*). *Betta schalleri* is a natural *betta* fish which is generally known by local people as the *Tepalak/Tempalak* fish (Syarif et al., 2020). The records on *B. schalleri* obtained from the Bangka region in 1994 were the initial publication on *B. schalleri* (Kottelat & Ng, 1994).

According to the IUCN status (2019), the *B. schalleri* has endangered status found on Bangka Island. The endangered status of this species is thought to be due to the habitat degradation and environmental damage caused by human activities such as settlements, mining and plantations, seriously threatening the existence of this species in its natural habitat (Muslih & Syari, 2016).

Based on the above problems and potential, it is necessary to carry out research regarding the identification of morphometric characteristics and habitat characteristics of *B. schalleri* from Bangka Belitung waters as an effort to preserve fish endemic to the Bangka Belitung Islands and as an initial stage for domestication activities within the scope of aquaculture. The objective of this research was to analyze the *B. schalleri* according to its biological and ecological properties.

## MATERIALS AND METHODS

### Location and Research Methods

The research method was quantitative descriptive aiming to provide a situation description objectively. This research activity focused on two variables, namely morphometrics and meristics and habitat characteristics (Ramadhanu et al., 2023). The study was carried out from July to October 2023 taking the samples at two research locations, namely in the South Bangka River and in the Bangka River. The collected fish samples were 15 *tempalak* (*B. schalleri*). The sampling was carried out using several fishing tools in the form of fishing rods, traps/*sero* and coarse *sesers* (Syarif et al., 2021). The obtained samples were collected in the preserved and live form. Next, the identification of morphometric and meristic characters (Figure 1 & 2) (Syarif & Prasetiyono, 2019) was carried out at the Aquaculture Laboratory, Faculty of Agriculture, Fisheries and Marine of Bangka Belitung University.

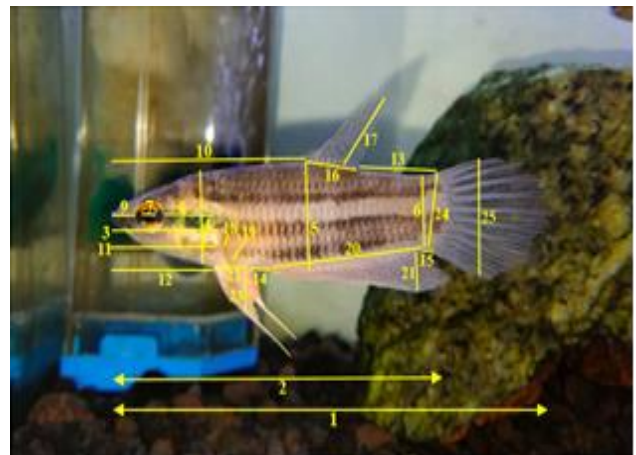


Figure 1. Morphometric Measurement Scheme for *Betta schalleri*

Note: 1. total length (TL); 2. standard length (SL); 3. head length (HL); 4. head height (HH); 5. body height (BH); 6. tail trunk height (TTH); 7. eye diameter (ED); 8. eye to gill cover distance (EGCD); 9. mouth to eye distance (MED); 10. distance from mouth to base of dorsal fin (DMBDF); 11. distance from mouth to pectoral fin base (DMPFB); 12. distance of mouth to base of ventral fin (DMBVF); 13. distance from dorsal fin to caudal fin base (DDFCFB); 14. ventral fin distance to anal fin base (VFDAFB); 15. distance of anal fin to caudal fin base (DAFCFB); 16. dorsal fin base length (DFBL); 17. dorsal fin height (dfh); 18. pectoral fin base length (pfb); 19. pectoral fin height (PFH); 20. anal fin base length (AFBL); 21. anal fin height (AFH); 22. ventral fin base length (VFBL); 23. ventral fin height (VFH); 24. caudal fin base length (CFBL); 25. caudal fin height (CFH).



Figure 2. Meristic measurement scheme for *Betta schalleri*

Note: 1). dorsal fin (D); 2). anal fin (A); 3). pectoral fin (P); 4). ventral fin (V); 5). caudal fin (C); 6). lateral line scales (LL)

### Habitat Analysis

The habitat characteristics were seen visually in the waters of the two *B. schalleri* sampling locations, with habitat characteristics in the form of peat swamp waters with a vegetation structure of peat aquatic plants. The water quality parameters at the research location were measured in-situ, including pH and DO (dissolved oxygen) temperature using water quality measuring instruments in the form of a thermometer, pH meter and DO meter.

### Data Analysis

The data obtained was then analyzed descriptively and the taxonomic analysis was carried out based on the references of Tan and Ng (2005). The habitat characterization was presented in the form of numbers and tables, described, and compared with the related literature (Figure 3).



a



b



c



d

Figure 3. Habitat characteristics of *Betta schalleri*

Note: (a and b) *B. schalleri* habitat in the South Bangka River; (c and d) *B. schalleri* habitat in the Bangka River

## RESULTS

### Morphometric Characteristics and Habitat of *Betta schalleri*

The measurements of *Betta schalleri* samples were carried out on 25 morphometric characters and 6 meristic characters. The data of measurements of the morphometric and meristic characters of *B. schalleri* were presented in Table 1 & Table 2. The water quality parameters measured in-situ included temperature, pH and DO (dissolved oxygen). The data from the measurements regarding the habitat characteristics including the water quality were presented in Table 3.

Table 1. Results of measuring the morphometric characteristics of *Betta schalleri* in the Bangka and South Bangka Rivers

Code	Remarks	Means of Morphometric (cm)	
		<i>B. schalleri</i> of South Bangka	<i>B. schalleri</i> of Bangka
TL	Total length	5.44	6.20
SL	Standard length	3.98	4.55
HL	Head length	1.16	1.48
HH	Head height	0.87	1.10
BH	Body height	1.04	1.28
TTH	Tail trunk height	0.71	0.76
ED	Eye diameter	0.22	0.21
DEGC	Distance from eye to gill cover	0.58	0.80
DME	Distance from mouth to eye	0.20	0.27
DMBDF	Distance from mouth to base of dorsal fin	2.51	2.94
DMBPF	Distance from mouth to base of pectoral fin	1.31	1.60
DMBVF	Distance from mouth to base of ventral fin	1.35	1.61
DDFCFB	Distance from dorsal fin to caudal fin base	0.95	1.09
DVFBFAF	Distance from ventral fin to base of anal fin	0.44	0.51
DAFCFB	Distance from anal fin to caudal fin base	0.09	0.11
DFBL	Dorsal fin base length	0.56	0.58
DFH	Dorsal fin height	0.85	0.83
PFBL	Pectoral fin base length	0.19	0.21
PFH	Pectoral fin height	0.27	0.33
AFBL	Anal fin base length	1.95	2.46
AFH	Anal fin height	0.83	0.65
VFBL	Ventral fin base length	0.49	0.18
VFH	Ventral fin height	0.55	0.46
CFBL	Caudal fin base length	0.72	0.79
CFH	Caudal fin height	1.08	1.48

Table 2. Results of measuring the meristic characteristics of *Betta schalleri* in the Bangka and South Bangka Rivers

Code	Remarks	<i>B. schalleri</i> South Bangka	<i>B. schalleri</i> Bangka	Kottelat & Ng (1994)
D	Dorsal rays	D.II.8	D.II.8	D.II.8-9
A	Anal rays	A.II.24	A.II.25	A.II-IV.23-25
V	Ventral rays	V.I-II.4	V.II.4	-
P	Pectoral rays	P.11-12	P.11	-
C	Caudal rays	C.13	C.13	-
LL	Lateral line scales	31	31-32	-

Table 3. Water quality values at the research location

Water Quality Parameter	Sampling Location	
	South Bangka	Bangka
Temperature (°C)	28-31	26-28
pH	4-5	4-5
DO (mg/l)	5.6	11
Water Color	Light brown	Brown

## DISCUSSION

Based on the results of the observations, the morphological character of the *Betta schalleri* species found in the Bangka and South Bangka rivers showed a special characteristic of a greenish blue color on the eyes, operculum to the anal fin in accordance with the findings of Kottelat & Ng in Bangka in 1994. The greenish

blue color in *B. schalleri* becomes the feature of this species to be a member of the *Pugnax complex*.

The observation results from morphometric studies showed that *B. schalleri* measured on 25 morphometric characters from Bangka and South Bangka locations obtained the total length (6.20 cm, vs. 5.44 cm), standard length (4.55 cm, vs. 3.98 cm), head length (1.48 cm, vs. 1.16 cm),

head height (1.10 cm, vs. 0.87 cm), body height (1.28 cm, vs. 1.04 cm), tail stem height (0.76 cm, vs. 0.71 cm), eye diameter (0.21 cm, vs. 0.22 cm), eye to gill cover distance (0.80 cm, vs. 0.58 cm), distance of mouth to eyes (0.27 cm, vs. 0.20 cm), distance of mouth to base of dorsal fin (2.94 cm, vs. 2.51 cm), distance of mouth to base of pectoral fin (1.60 cm, vs. 1.31 cm), distance of mouth to ventral fin base (1.61 cm vs. 1.35 cm), distance of dorsal fin to caudal fin base (1.09 cm, vs. 0.95 cm), anal fin distance to caudal fin base (0.11 cm, vs. 0.09 cm), dorsal fin base length (0.58 cm, vs. 0.56 cm), dorsal fin height (0.83 cm, vs. 0.85 cm), pectoral fin base length (0.21 cm, vs. 0.19 cm), pectoral fin height (0.33 cm, vs. 0.27 cm), anal fin base length (2.46 cm, vs. 1.95 cm), anal fin height (0.65 cm, vs. 0.83 cm), ventral fin base length (0.18 cm, vs. 0.49 cm), ventral fin height (0.46 cm, vs. 0.55 cm), caudal fin base length (0.79 cm, vs. 0.72 cm), caudal fin height (1.48 cm, vs. 1.08 cm).

The results of measuring the morphometric characters of *B. schalleri* in two research locations, South Bangka and in Bangka, showed that *B. schalleri* in Bangka had a range of higher morphometric values than those found in South Bangka (Table 1). However, the data of the observations of the meristic characters of *B. schalleri* obtained at two research locations showed that the number of meristic characters was the same, comprising dorsal fin 2 spines and 8 branched rays, anal fin 2 spines and 24-25 branched rays, ventral fin 1-2 spines and 4 branched rays, pectoral fin 11-12 rays, and caudal fin 13 rays. There are 31-32 scales along the lateral line (*linea lateralis*). The morphometric characters were used as a basis for identifying fish (Ihwan et al., 2020; Valen et al., 2022, Syarif et al., 2023) through several characters such as total length, standard length, body length and height, eye diameter and so on (Syarif et al., 2021). Meanwhile, the meristic characters were used to find out the fish species in one genus, such as calculating the number of fin bones, number of scales and so on (Kurniawan et al., 2022; Valen et al., 2023). In addition, the morphometric and meristic characters can be used to estimate the genetic diversity of a particular population and species because the morphometric and meristic

characters are related to genetic variation (Gustomi et al., 2019; Syarif et al., 2021).

The aquatic environment at the research location is classified as still maintaining its ecological composition. The forest around the research location is still well maintained and under the water there is a large colony of *Cryptocoryne bankaensis* providing shelter for the species found in the waters at the research location. Apart from the *Cryptocoryne bankaensis*, the typical peat swamp plants such as *Pandanus helicopus*, *Pandanus lais*, *Hydrilla* sp. and *Utricularia* sp, grow around the waters of the research location.

The flow of the Bangka and South Bangka Rivers has the characteristics of calm flowing water without being influenced by tidal patterns (Figure 2). The waters of both research locations have a pH value of 4-5. Based on Tan and Ng (2005), *wild betta* fish generally inhabit swamp water habitats with a fairly low pH value. The statement is in accordance with the characteristics of the waters in the Bangka Belitung Islands which have peat swamp waters with high tannin levels (Syarif et al., 2021; Lindiatika et al., 2024). The temperature value in the waters of the research location ranged from 26<sup>0</sup>C to 31<sup>0</sup>C and DO ranged from 5.6 to 11 mg/l and the color of the waters was light brown to dark brown. Optimal temperature and oxygen values in waters can be influenced by water flow and the occurrence of photosynthesis processes in aquatic plants such as rasau (Khanati et al., 2023; Lindiatika et al., 2023).

The visual observations of the water in the Bangka and South Bangka Rivers showed a light brown to dark brown color to be the characteristic of peat swamp waters. Syarif et al. (2021) state that the brown color of waters can be caused by high levels of dissolved organic substances in the form of humic acid and its derivatives and can be caused by the organic plant material turning into peat.

## CONCLUSION

The research results conclude that *Betta schalleri* obtained from the two different locations showed specific differences in morphometric characters, namely: total length

(TL), standard length (SL), head length (HL), head height (HH), and caudal height (CH). meanwhile, the meristic characters showed the dorsal fins (D.II.8), anal fins (A.II.24-25), ventral fins (V.I-II. 4), pectoral fins (P.11-12), Caudal Fins (C.13) and linea lateralis (LL.31-32). The habitat of *B. schalleri* generally inhabits peat swamp waters with a fairly low pH ranging from 4 to 5 with a light brown to dark brown water color.

## ACKNOWLEDGEMENTS

We would like to thank the Institute for Research and Community Service (LPPM) of Bangka Belitung University having facilitated the research and publications through the *Merdeka Belajar Kampus Merdeka* (MBKM) program.

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