Morphometric Character of Puntius binotatus (Pisces Cyprinidae) Fish as the Sungi River Conservation Base of Tabanan Regency Bali

by Sang Ayu Made Putri Suryani

Submission date: 01-Jul-2023 08:43AM (UTC+0700)
Submission ID: 2124979182
File name: as_the_Sungi_River_Conservation_Base_of_Tabanan_Regency_Bali.pdf (241.45K)
Word count: 2844
Character count: 14848

Asian Journal of Applied Research for Community Development and Empowerment. Vol 5 (2021), No.2

AJARCDE
ASIAN JOURNAL OF APPLIED RESEARCH FOR COMMUNITY DEVELOPMENT AND EMPOWERMENT

Journal home page: http://ajarcde-safe-network.org ISSN 2581-0405

Morphometric Character of *Puntius binotatus* (Pisces: Cyprinidae) Fish as the Sungi River Conservation Base of Tabanan Regency Bali

S.A.M.Putri Suryani[1], *I Wayan Arya*[2], *A.A. Sagung Putri Risa Andriani*[2]

[1] *Study Program of Water Resources Management of Warmadewa University. Indonesia*
[2]*Agrotechnology Study Program, Warmadewa University, Indonesia*

ARTICLE INFO

Article History:
Received: 12 June 2021
Final Revision: 20 August 2021
Accepted: 22 August 2021
Online Publication: 30 August 2021

KEYWORDS

Puntius binotatus, morphometric Truss, endemic fish, local fish

CORRESPONDING AUTHOR

*E-mail: suryanip@rocketmail.com

A B S T R A C T

Puntius binotatus is a local fish whose population continues to decline because there is not much in cultivation. The introduction of this fish has a negative impact and affects species diversity. Introduced fish in common waters can threaten the presence of native fish due to the phenomenon of hybridization with endemic fish, habitat destruction, predation, and parasites. Invasive fish in rivers have the potential to urge endemic fish habitats so efforts are needed so that invasive fish do not cause local fish to go extinct. The purpose of this study was to study the Morphometric Character of *Puntius binotatus* (Pisces: Cyprinidae upstream, middle, and downstream of the river due to the process of adaptation to changes in the environment so that local species do not experience extinction because their habitat is disturbed. The difference in morphometric character in upstream, middle, and downstream is due to the adaptation process to environmental changes, namely water quality parameters that have exceeded the standard of quality standards upstream are temperature, ammonia pH, phosphate, and BOD5. In the middle of the parameters that exceed the standard of quality standards are temperature, pH, Ammonia, Phosphate, BOD5, and TSS and downstream, namely temperature, pH, Ammonia, phosphate, BOD5, COD, and TSS have exceeded the standard quality distribution of characters upstream, middle and downstream has a similarity of 75.6% which has similar shapes at all stations and has a close kinship by the form of four morphometric character clusters.

1. INTRODUCTION

1.1. Research Background

Indonesia has very wide freshwater and has great potential in the cultivation of various types of freshwater fish. Freshwater fish that are widely cultivated include goldfish, tilapia, *gurame, tawes*, and catfish. These types are popular with the community and have been widely cultivated by fish farmers [1]. In addition, there are still types of local fish that are also favored by the community but are currently not widely cultivated. One of them is Puntius fish. The market demand for these fish is quite high so that local fish populations will decline in nature due to continuous fishing of these fish.

The spread of fish in the waters is strongly influenced by environmental factors that can be classified into four types, namely: biotic factors, abiotic, technological factors, and human activities. Biotic factors are natural factors that live or live bodies, both plants and animals. Biotic factors include physical and chemical factors, namely light, temperature, current, organic salts, pH, dissolved oxygen, salinity, and BOD.

The study analyzed the morphometric variations of *Puntius binotatus* in the upstream, central and downstream habitats of the Sungi river and obtained a distribution of morphometric characters as the basis for the conservation of *Puntius binotatus* fish.

1.2. Literature Review

The genus Puntius belongs to the Cyprinidae subfamily of the Cyprinidae family with the characteristic of having two pairs of tentacles [2]. Puntius has characteristics on scales that have projections from the center to the edges looking like fingers on wheels. Sideways fingers do not curve backward and there are no hard protrusions [3]. Puntius is distributed in Sunda, Bali, Lombok, Philippines, and Indochina. Generally, this fish can be found in gutters, sewers, rivers, and ponds. This fish has a spreading area in the waters of Indochina, Singapore, the Philippines, Malacca, and Indonesian waters. The spread of this fish in Indonesian waters includes the Sunda Strait, Bali,

https://doi.org/10.29165/ajarcde.v5i2.65

Lombok, Sumatra, Nias, Java, Kalimantan, Bangka, and Belitung [4].

Puntius binotatus is a local fish with a habitat in freshwater that is at an altitude of 0 to 2000 meters above sea level. *Puntius binotatus* has a slippery body character, has four sumblings, perfect sideline, last fingers dorsal fin hardened and jagged, 4 1/2 scales between the sideline and the beginning of the dorsal fin, black spots on the front of the dorsal fin and, the middle of the tail trunk, young and adult fish have 2 to 4 dots or oblong in the middle of the body [3].

Puntius binotatus fish classified as benthopelagic, living in the freshwater waters of the tropics with a pH range of 6.0 - 6.5 and water temperatures of 24 - 26° C [5]. The color varies, from silvery gray to a greenish-gray, somewhat dark/black on the back, there are marks of spots of ribbon on the body of fish seeds and will disappear when the fish is mature or large, except the spots at the base of the tail, the maximum length can reach 20 cm. The structure of *puntius binotatus* fish population at the headwaters of the Sungi river is higher compared to the central and downstream regions because the water quality in the upper reaches of the Sungi river, especially the temperature is very suitable for the life of Puntius fish which is 24 ° C although the lowest feed availability is the abundance of plankton is 51,366 ind [6].

Sungi River is one of the ten rivers that experienced a decrease in quality caused by contamination by sewage [7]. Sungi River is a cross-district river that crosses Tabanan regency and Badung regency which in downstream water flow is used as a source of drinking water raw materials [8,9].

1.3. Research Objective

This research can provide information about the morphometric character of *puntius binotatus* populations in the upstream, middle and downstream parts of the river, as scientific information in the conservation of *Puntius binotatus* fish whose population is decreasing and also to improve the quality of puntius binotatus fish habitat in the Sungi river.

2. MATERIALS AND METHODS

2.1. Material

Water sampling is carried out in each habitat 3 times compositely. Fish samples were collected from the fishing results of *Puntius binotatus* in the upstream, central, and downstream parts of the Sungi River. Whereat each location is collected 20 tails so that a total of 60 tails (upstream, middle, and downstream of the river) to analyze the morphometric diversity with measurements truss morphometry as many as 45 tails (total upstream, middle, and downstream)

2.2. The observed variables

This study is an exploratory descriptive study on the Sungi river which is divided into 3 stations, namely upstream, middle and downstream. At the headwaters (8°21.45'S-115°10.49'E), midpoint (8°33,695'S-115°09,538'E) and downstream at the point (8°38,053'S-115°06,068'E). Sungi River water quality in upstream, central, and downstream areas such as temperature, DO, pH, Nitrate, Ammonia, Phosphate, TSS, TDS. BOD5 and COD. The morphometry character of the *puntius binotatus* fish population on the Sungi river by truss method of morphometry with observed measurement points (Tabel 1)

Table 1. Morphometric Truss character description

Character codes	Landmarks	Description of characters
A1	1-2	The anterior tip of the snout to the origin of the dorsal fin base
B1	2-3	Origin of the dorsal fin to the end of the dorsal fin base
C1	3-4	End of dorsal fin base to origin of caudal fin
D1	4-5	Upper to lower of caudal fin origin
E1	5-6	Origin of lower of the caudal fin to end of the anal fin base
F1	6-7	Origin of the anal fin to the origin of pelvic fin
G1	7-8	Origin of the pelvic fin to the origin of pectoral fin
H1	8-1	Origin of the pectoral fin to the end of snout tip
I2	2-7	Origin of the dorsal fin to the origin of pelvic fin
J2	2-6	Origin of the dorsal fin to the origin of anal fin
K2	3-7	End of dorsal fin base to the origin of pelvic fin
L2	3-6	End of dorsal fin base to the origin of anal fin
M2	3-5	End of dorsal fin base to lower caudal fin origin
N2	4-6	Origin of the upper caudal din to end of the anal fin base

2.3. Data Analysis

Morphological analysis and intra-morphometric character distribution and interpopulation are performed one-way ANOVA using SPSS and presented in canonical discriminant diagrams and continued with cluster analysis.

3. RESULT AND DISCUSSION

3.1. Character Morphometric

The distribution of individual morphometric characters of *puntius binotatus* fish suggests that the difference in the spread of morphometric characters does not travel far enough between upstream, middle, and downstream. The intensity of all characters is observed using the sharing component phenotype with an index of similarity between groups that its development is not influenced by the environment in which the fish lives, while some characters develop according to the environment in which it lives. It is a particular variable growing at different rates that are influenced by environmental factors. In terms of variable size equations (characters) is a symptom of mixing(sharing component)between each different group, namely upstream, middle and downstream.

Discriminant Function Analysis (DFA) results in 2 functions. Function 1 has an eigenvalue of 0.979 greater than function 2 which is 0.188. Both of these functions have a significant role in describing the three location groups. Function 1 with an eigenvalue of 0.979 describes 83.9% of the total variant and

https://doi.org/10.29165/ajarcde.v5i2.65

function 2 with an eigenvalue of 0.188 describes 16.1% of the total variant Both functions contribute to the character of morphometric Truss. Function 1 is the characters L2, I2, K2, D1, J2, H1, N2 while the 2-character functions that contribute are B1, A1, E1, M2, C1, F1, and G1 (Table 2).

Table 2. Eigenvalues, total variances, and canonical correlations of morphometric Truss characters

Function	1	2
Eigenvalue	0.979	0.188
% Variance	83.9	16.1
Canonical correlation	0.703	0.398
L2	**.701***	.154
I2	**.689***	.652
K2[b]	**.656***	.600
D1[b]	**.652***	.561
J2[b]	**.585***	.567
H1[b]	**.523***	.308
N2[b]	**.517***	.464
B1[b]	.589	**.606***
A1[b]	.503	**.600***
E1	-.098	**.584***
M2[b]	.509	**.535***

*. Largest absolute correlation between each variable and any discriminant function.

The results of cluster analysis found that the morphometric character on the Sungi river has 4 clusters based on the similarity of morphometric characters with 14 characters with the highest average distance namely cluster two (table 4). The distance between clusters can be seen in Table 5 wherein clusters four and two have the highest distance. Distances between clusters based on similarity can be seen on the dendrogram (Figure 1).

On a dendrogram, it can be seen that the morphometric character of the Sungi river forms 4 clusters. The cluster formed is the upstream character, middle character, downstream character, and the character of the fusion between the middle and downstream upstream. The formation of a fusion character between the three locations is due to the adaptation process of *puntius binotatus* fish to environmental changes and the area of the hybridization process.

Table 3. Phenotype similarities in and between groups based on the morphometric character of *puntius binotatus*

Classification Results[a,c]

		Code	Predicted Group Membership			Total
			Upstream	Middle	Downstream	
Original	Count	Upstream	11	1	3	15
		Middle	3	11	1	15
		Downstream	2	1	12	15
	%	Upstream	73.3	6.7	20.0	100.0
		Middle	20.0	73.3	6.7	100.0
		Downstream	13.3	6.7	80.0	100.0

Table 4. The average distance of cluster with centroid cluster

	Number of Observation	Within Cluster Sum of Squares	Average Distance From Centroid	Maximum Distance From Centroid
Cluster 1	15	13.2693	0.92292	1.32667
Cluster 2	8	10.8288	1.11350	1.77979
Cluster 3	16	16.3450	0.99088	1.43864
Cluster 4	6	2.3500	0.60019	0.84360

Tabel 5. Matrix Distance between Clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cluster 1	0.00000	2.26647	2.16687	3.01038
Cluster 2	2.26647	0.00000	4.29660	5.24533
Cluster 3	2.16687	4.29660	0.00000	1.17407
Cluster 4	3.01038	5.24533	1.17407	0.00000

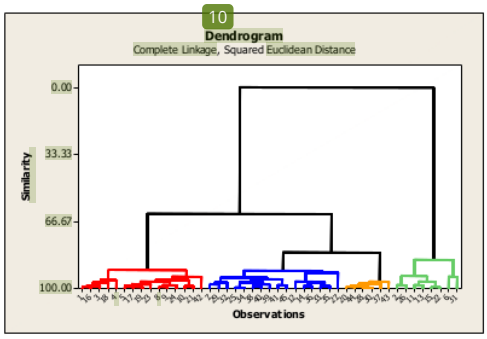

Figure 1. Dendogram based on character similarities

3.2. Water Quality Paremeter

The environmental conditions to three different stations are temperature parameters at upstream 25°C,in the middle of 26 ° C and downstream 28°C. temperature changes from upstream to downstream experience differences that can cause puntius binotatus fish to adapt to environmental changes. The optimal temperature of this fish for life is at a temperature of 24 ° C. In addition to temperature parameters there are several parameters that breakthe standard of quality standards are pH, TSS, Ammonia and Posfat. This means that the population of Puntius binotatus fish development of its morphometric character is influenced by the environment in which the fish is located. At all stations there is a change in morphometric character or develop according to the environment in which it lives. It is an indikasi that certain variables (organsof the body) are symptoms ofsharing components between each group through gene mixing or sharing component is the conservation of genes that are maintained by all populations even thoughhabitat are different. Puntius binotatus' morphometric similarity value has a value close to 80% which is 75.6% due to environmental influences and there is a tendency in the similarity of the shape of some individuals in all groups. The distribution of the individual morphometric character of puntius binotatus fish showed that the difference in fish growth studied was not far between each other in the morphometric distribution. In addition to genetic factors, morphometric diversity is also caused by several factors such as environmental conditions, topography, as well as different habitats. Increased water temperature can affect fish behavior such as eating behavior that decreaseseven though natural feed is available.

4. CONCLUSION

Based on the results of the research that has been carried out, the following conclusions can be drawn: (1). Differences in morphometric character in upstream, middle, and downstream due to the adaptation process to environmental changes, namely water quality parameters that have exceeded the standard of quality standards upstream are temperature, ammonia pH, phosphate, and BOD5; (2) On The middle parameters that exceed the standard of quality are temperature, pH, Ammonia, Phosphate, BOD5 and TSS and downstream are temperature, pH, Ammonia, phosphate, BOD5, COD and TSS already exceed the standard quality standards; (2). The distribution of characters upstream, middle and downstream has a similarity of 75.6% which has similar shapes at all stations and has a close kinship that forms four clusters.

Acknowledgment

We thank the Rector of Warmadewa University and Mr. Chairman of Yayasan Kesejahteraan Korpri who have funded the implementation of basic research on institutional grants in 2021 under the letter of agreement number: 134 / UNWAR / LEMLIT / PD-13 / 2021

REFERENCE

[1] Budiharjo, A., 2002. Seleksi dan potensi budidaya jenis-jenis ikan wader dari genus Rasbora. Biodiversitas, 3(2), pp.225-230.

[2] Nelson, J. S. 1994. Fishes of the World. 3th ed. Jhon Wiley & Sons, Inc. New York.

[3] Kottelat, M., Whitten, A. J., Kartikasari, S. N., Wirjoatmodjo, S. 1993. Freshwater Fishes of Western Indonesia and Sulawesi. Periplus Eds. (HK) Ltd and EMDI: Indonesia, Singapore.

[4] Vitri, D. K., Roesma, D. I., Syaifullah. 2012. Analisis Morfologi Ikan Puntius binotatus Valenciennes 1842 (Pisces: Cyprinidae) dari beberapa Lokasi di Sumatera Barat. Jurnal Biologi Universitas Andalas. 1(2):139-143.

[5] Roberts, T.R., 1989. The freshwater fishes of Western Borneo (Kalimantan Barat, Indonesia). Mem. Calif. Acad. Sci. 14:210 p.

[6] Suryani, S. A. M. P., Arya, I. W. 2020. Population structure of Wader Fish in the Polluted Water. Journal of Biological and Chemical Research. 37 (1): 100-105.

[7] BLH Prov. Bali. 2009. Status Lingkungan Hidup Daerah Provinsi Bali. Denpasar

[8] Setiari, N. M., Mahendra, Sudiana, M. & Suyasa, I.W.Y. 2012. Identifikasi Sumber Pencemar dan Analisis Kualitas Air Tukad Yeh Sungi Di Kabupaten Tabanan Dengan Metode Indeks Pencemaran. Ecotrophic. Vol 7 (1). p. 40-46.

[9] Suryani, S. A. M. P., Arya, I. W., Darmadi, N. M., Kawan, I. M. 2021. Community Structure, abundance and distribution oh Phytoplankton in Sungi River, Bali Province. IOP Conference Series: Materials Science and Engineering: 1-6.

https://doi.org/10.29165/ajarcde.v5i2.65

Morphometric Character of Puntius binotatus (Pisces Cyprinidae) Fish as the Sungi River Conservation Base of Tabanan Regency Bali

ORIGINALITY REPORT

21%	21%	16%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	ZAINAL ABIDIN MUCHLISIN. "Morphometric Variations of Rasbora Group (Pisces: Cyprinidae) in Lake Laut Tawar, Aceh Province, Indonesia, Based on Truss Character Analysis", HAYATI Journal of Biosciences, 2013 Publication	7%
2	media.neliti.com Internet Source	6%
3	Submitted to Universitas Andalas Student Paper	2%
4	S A M P Suryani, I G P Wirawan, R Dwiyani, M Sritamin. "Genetic diversity and differentiation of cytochrome oxidase subunit I (COI) gene of Rasbora lateristriata bleeker in different habitat", IOP Conference Series: Materials Science and Engineering, 2021 Publication	2%
	talenta.usu.ac.id	

5	Internet Source	1 %
6	repository.warmadewa.ac.id Internet Source	1 %
7	K Sayuti, R Yenrina, Y Febri. "Characteristic of Analogue Jerky Made from Moringa Leaves (Moringa oleivera L) with the addition of Tapioca Flour", IOP Conference Series: Earth and Environmental Science, 2020 Publication	1 %
8	docplayer.net Internet Source	1 %
9	www.researchgate.net Internet Source	1 %
10	Submitted to University of Sheffield Student Paper	1 %
11	B.A. Crispim, A.B. Grisolia, L.O. Seno, A.A. Egito, F.M. Vargas Junior, M.R. Souza. "Genetic diversity of locally adapted sheep from Pantanal region of Mato Grosso do Sul", Genetics and Molecular Research, 2013 Publication	1 %

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		