Growth Patterns Analysis of Yellow-Finned Medaka (Oryzias profundicola) as Endemic Fish in Lake Towuti

by PDTI Master Turnitin

Submission date: 22-Jan-2024 05:33PM (UTC+0800)
Submission ID: 2275762555
File name: syahran_2022_IOP_Conf._Ser.__Earth_Environ._Sci._1118_012047.pdf (755.97K)
Word count: 2576
Character count: 13186

Growth Patterns Analysis of Yellow-Finned Medaka (*Oryzias profundicola*) as Endemic Fish in Lake Towuti

Growth Patterns Analysis of Yellow-Finned Medaka (*Oryzias profundicola*) as Endemic Fish in Lake Towuti

N Nursyahran[1], J Jayadi*[2], A Tamsil[2], and H Harlina[2]

[1]Doctoral Program in Fisheries Science, Muslim University of Indonesia
[2]Faculty of Marine and Fisheries Science, Muslim University of Indonesia

*jayadi.jayadi@umi.ac.id

Abstract. Lake Towuti has the potential biological resource and a wide diversity of endemic fish with ecological and economic value. Lake Towuti is also known as a biodiversity hotspot that needs attention to conservation because of the number of threads increasing. Fisheries resources in Lake Towuti has a significant role in increasing income, expanding job opportunity, and as a nutritional source for the community. Lake Towuti is also known as rich in endemic fisheries that have economic and ecological value. One of them is known as Yellow-Finned Medaka (*Oryzias profundicola*). Yellow-Finned Medaka is a biological native resource and endemic fish in Lake Towuti, South Sulawesi. A study about this fish has never been conducted before so it needs research to analyse the growth pattern in Lake Towuti. This study aims to determine the growth pattern of yellow-finned medaka in Lake Towuti. Samples were collected from January to July 2022 every month and measured their length and weight. During the study were found 2949 fish, consisting of 1202 males and 1747 females. The length-weight relationship was $W= 1.3366L^{0.0041}$ for males and $0.9127L^{0.0187}$ for females. These results indicate that the growth pattern for yellow-finned Medaka is negative allometric.

1. Introduction

Lake Towuti is one of the "biodiversity hotspots" that needs attention for its rescue because it has an area rich in endemic biota but its sustainability is increasingly threatened [1] Yellow-finned medaka (*Oryzias profundicola*) is one of two species of the *Genus Oryzias* in Lake Towuti. It is also known as Yellow-Finned Medaka [2]. Medaka fish from Sulawesi is also being proposed as potential model organisms for research in fields as diverse as the study of biological, evolution, and medical research [3],[5] Yellow-finned medaka as an endemic fish in Lake Towuti is almost endangered. This is reported at two endemic fish report sites. From the IUCN Red List, it is reported that this fish as near threatened[6] and FishBase state that the yellow-finned medaka is in a near threatened status [7]. Reducing the ability to recover the germplasm of the Yellow-finned medaka in its natural habitat is caused by less attention on its management policy in Indonesia.

The management of endemic fish in Lake Towuti has not received attention from the public and the government, so that until now there has been no protection effort to protect or save fish based on the Fisheries Law Number 31 of 2004, conservation of fish resources means carrying out activities to protect, conserve and utilize fish resources such as ecosystems, species, and genetics. This is because there is no area determination for conservation, there is no co-management management model, and there is no regulation of the size of fish to be caught. It also ensures the existence, availability, and sustainability of fish resources, as well as the preservation and expansion of both the quantity and quality of fish resources. Information about the yellow-finned medaka is still less. Only the taxonomic status and description[8] phylogenetic analysis and taxnomic[9], and Ichthyofauna of the endemic fish in Lake Towuti [10], [11]

Yellow-finned medaka in Lake Towuti was threatened with extinction due to the intensive and excessive exploitation and it's not environmentally friendly, this is evidenced by the number of operating lift nets are 30 pieces. Apart from the level of intensive and excessive exploitation, the cause of the decline in the population of medaka fish in Lake Towuti is the invasive fish that dominate the waters, namely *Oreochromis mossambicus* and *Cyprinus carpio* [13]. However, other invasive fish species were *Anabas testudineus, Trichogaster pectoralis, Channa striata, and Oreochromis niloticus*.

This study aims to analyze the growth type of yellow-finned medaka in Lake Towuti and provide information about the growth type of yellow-finned medaka in Lake Towuti. This information is expected to be used as basic data for managing yellow-finned medaka to optimal and sustainable.

2. Materials and Methods

2.1. Time and Place of Research

This research was conducted from January to July 2022 in Lake Towuti with 5 sampling stations. Station I Tanjung Timbala (121° 26' 21,377" E 2° 49' 18,546" S); station II. Tanjung Lengkobutanga; station III. Tanjung Bakara, station IV. Tanjung Saone and Tanjung Tominanga V. station (Figure 1).

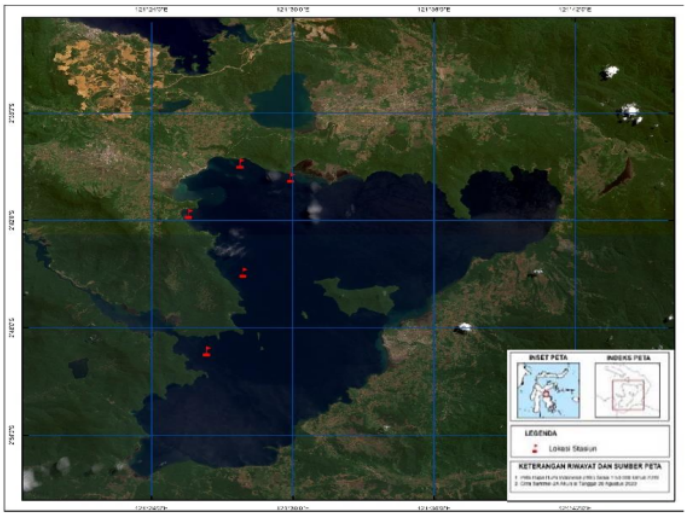

Figure 1. Research Station Map

The tools used during the study were a digital scale with an accuracy of 0.01 g to measure the total weight of the fish sample, iron ruler with an accuracy of 1 mm to measure the total length of the fish, a net for catching fish sample, and cool box as a container for storing fish samples. The materials used during this study were sample plastic zip locks to store sample fish and label paper as markers of sample fish based on time and location. In addition, to keep the fish fresh before being analyzed, the fish were stored in freezer and preserved in 5% of formalin. The procedure was carried out in this research process has three stages, determining the sampling station, sampling process, and measuring the length and weight of the fish.

2.2. Data Analyze

Length – Weight Relationship

The variable used in length-weight relationship is the total length (L; mm) and fish body weight (W; g). The relationship in total length and body weight can be analyzed using the formula $W = aL^b$ [14].

The above equation is logarithmic to simplify regression analysis so that the following linear regression equation is obtained log W = log a + b log L. To find out whether the pattern in relationship of the length-weight is isometric or allometric, the b value is tested using a t-test [15] with the following formula:

$$t\ count = \frac{3-b}{Sb}$$

Growth is said to be isometric if the value of b = 3 i.e. the increase in length is proportional to the increase in weight. Whereas if the value of b is greater than or less than 3 then the growth is said to be allometric, assuming if the value of b < 3 the increase in body length of fish is faster than the increase in weight, while if the value of b> 3 the weight of the fish is faster than the increase in length of the body.

3. Results and Discussion

3.1. Length-weight Relationship

The sample of Yellow-Finned Medaka for length-weight relationship consists of 2,949 fish consisting of 1202 male fish and 1747 female fish. The result is presented in Table 1.

Tabel 1. Result Of Length-Weight Relationship Analyze of Yellow-Finned Medaka (*O. profundicola*) in Lake Towuti

Parameter	Male	Female
Number Of Samples	1202	1747
Total Length Range (mm)	24,4-97,7	20-70,7
Weight Range (gram)	0,75-1,18	0,82-1,51
Log a	0,1260	-0,0376
Regression coefficient (b)	0,0041	0,0187
Kofisien determinasi (R^2)	0,36	0,53
Coefficient of determination (r)	0,60	0,73
Regression equation	$W = 1{,}3366L^{0{,}0041}$	$W = 0{,}9172L^{0{,}0187}$
t-test	^{t}count > ^{t}table	^{t}count > ^{t}table
Growth pattern	Allometrik negatif	Allometrik negatif

Table 1 shows the correlation coefficient (r) of the relationship between length and weight. yellow-finned medaka 36% for male and 53% for female. The results of the study regarding the length-weight relationship and growth patterns of *O. profundicola* were shown in Table 2.

Table 2. Length-Weight Relationship Yellow-Finned Medaka (*O. profundicola*) Male and Female in Every Research Station

Station	Sex	Length-Weight Equation	Growth Pattern
Tanjung Timbala	Male	$W = 1{,}3594L^{0{,}0029}$	Negative Allometric
	Female	$W = 0{,}00052L^{2{,}0046}$	Negative Allometric

Tanjung Lengkobutanga	Male	$W = 0{,}0143L^{1,495}$	Negative Allometric
	Female	$W = 0{,}0004L^{2,0844}$	Negative Allometric
Tanjung Bakara	Male	$W = 0{,}0019L^{1,6846}$	Negative Allometric
	Female	$W = 0.0052L^{1,4030}$	Negative Allometric
Tanjung Saone	Male	$W = 0{,}00003L^{2,6982}$	Negative Allometric
	Female	$W = 0{,}0002L^{2,1759}$	Negative Allometric
Tanjung Tominanga	Male	$W = 0{,}0004L^{2,7045}$	Negative Allometric
	Female	$W = 0{,}0036L^{1,4889}$	Negative Allometric

Those value in Table 1 indicates that the relationship of length and weight for both male and female Yellow-Finned Medaka has a low correlation, which means that increasing fish length does not affect the body weight gain of medaka fish. (Figure 2)

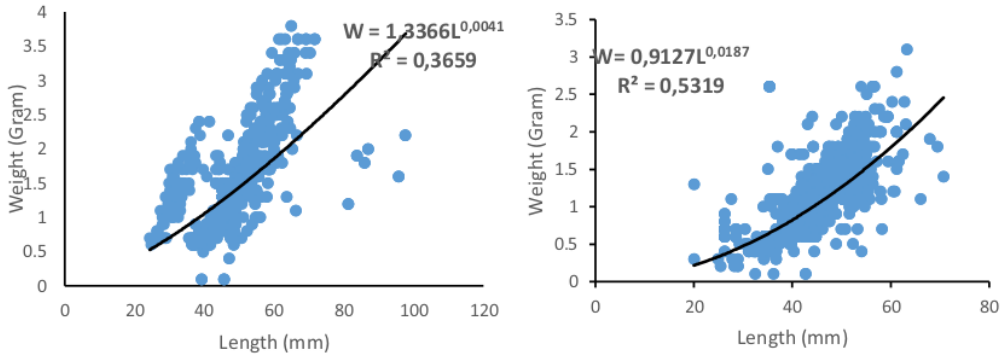

Figure 2. Graph of length-weight relationship of yellow-finned medaka (*O. profundicola*) (a=male) (b=female) at five research stations in lake Towuti

Based on the analysis of length-weight relationship of yellow-finned medaka, the "b" value of 0.0041 for male and 0.0187 for yellow-finned medaka, so that the equation of the relationship in length and weight of male yellow-finned medaka became $W= 1.3366\ L^{0.0041}$ and $W= 0.9127\ L^{0.0187}$ for female fish (Figure 2). The results of the t-test, the "b" value is not the same as "3". This indicates that the increase in length of body is not as fast as the increase in body weight. The growth pattern of male and female yellow-finned medaka was negative allometric which means that the length growth rate was more dominant than the weight growth rate ($b<3$). The negative allometric growth pattern can be assumed from the value of b obtained by each fish by environmental factors, which are supported by food, geographical location, and sampling techniques as well as the time is taken [16]. The low b value can be resulted from the behavior of fish; for example, inactive swimming fish shows a lower amount of b than active fish [17]. Negative allometric growth of fish which might be attributed to environmental conditions or linked to morphological characteristics specific to each species [18]. Negative allometric growth pattern could be attributed to low

food items for this species in the ecosystem or reduction of their body size to escape predation or high fishing mortality or intensity and adverse effects of oil pollution on the growth [19]. This value (b<3) is similar with the research from Lake Towuti on the endemic fish opudi (*Telmatherina prognatha*) and also to the research in the Barumun river for Gulamah fish (*Johnius trachycephalus*) [20], [21]. The "b" value between male and female medaka fish occur in difference. [22] states that the effect of length and body weight of fish can be shown by the "b" value so indirectly affecting the pattern variation of the "b" value. Fish behavior is very influential in carrying out active movements and migration. [23].

Water characteristics affect fish growth patterns due to the availability of food and suitable habitat. The growth pattern of fish was determined by the value of "b" which is obtained from the length-weight relationship equation. Dominant animals that have a large "b" value generally live-in calm waters, while active swimming fish will also show a relatively low "b" value compared to passive swimming fish. This result was related to the level of their movement behavior which is closely related to the type of water where this fish species lives. The other of factors that affect the "b" value are biological conditions of the fish.

4. Conclusion

The Length-weight relationship for male and female yellow-finned medaka in Lake Towuti was showed a negative allometric in growth pattern. It means that growth of length was faster than body weight gain.

References

[1] N. H. Arief, Hutama A and Hadiaty R K 2016 *Treubia*, **43** 17–30
[2] D. S. H. Said 2015 *101 Ikan Hias Air Tawar Nusantara* (Jakarta : LIPI press) (in Indonesian)
[3] L. R. Parent 2008 *Zool. J. Linn. Soc.* **3** 494–610
[4] D. F. Mokodongan and K. Yamahira, 2015 *Mol Phylogenet Evol.* **93** 150–160
[5] I. F. Mandagi, D. F. Mokodongan, R. Tanaka, and K. Yamahira 2018 *Copeia* **106** 297–304
[6] D. Lumbantobing 2019 *IUCN Red List Threat. Species* **e.T15578A9** 1–11
[7] https://www.fishbase.de/summary/Oryzias-profundicola. html 2018
[8] Kottelat M 1990 *Ichthyol. Explor. Freshwaters* **1** 151–166
[9] Parenti LR 2008 *Zool. J. Linn. Soc* **154** 494–610
[10] R. K. Hadiaty 2018 *J. Iktiologi Indones* **18** 175 - 190
[11] Jayadi, Nessa, M. N., Tamsil, A., Harlina, Ernaningsih, Nursyahran, and Muqtadir, A 2021 *Asian J. Fish. Aquat. Res* **12** 20–30
[12] Kottelat M 1990 *Ichthyol. Explor. Freshwaters* **1** 49-67
[13] S. Samuel, H. Husnah, and S. Makmur 2009 *J. Penelit. Perikan. Indones* **15** 123-131 (in Indonesian)
[14] Le Cren E D 1951 *J. Anim. Ecol* **20** 201–219
[15] J. H. Zar 1999 *Biostatistical analysis*. Pearson Education India.
[16] I Dewiyanti et al 2020 IOP Conf.Ser:Earth Environ.Sci.493 01 2020
[17] Muchlisin Z A, Musman M and Siti Azizah M N 2010 *Indo. J. of Appl. Ichthyology* **26** 949-953.
[18] Nazek Jisr, Ghassan Younes, Carol Sukhn, Mohammad H. El-Dakdouki, 2018 *The Egyptian Journal of Aquatic Research*: **44** 299-305
[19] Law R. 2003. *ICES J Mar Sci* **57** 659–669.
[20] A. Chadijah, S. Sulistiono, G. Sri Haryani, R. Affandi, and A. Mashar 2019 *J. Ilmu Pertan. Indonesia* **24** 295–303 (in Indonesian)
[21] S. Napisah and R. MaChrizal 2021 *Biosci. J. Ilm. Biol* **9** 63–71 (in Indonesian)
[22] Effendie.M.I 2002 *Biologi Perikanan* (Yogyakarta: Yayasan pustaka nusatama) (in Indonesian)
[23] M. Utami, S. Redjeki, and E. Supriyantini 2014 *Diponegoro J. Mar. Res* **3** 99–106 (in Indonesian)

Growth Patterns Analysis of Yellow-Finned Medaka (Oryzias profundicola) as Endemic Fish in Lake Towuti

ORIGINALITY REPORT

7%	7%	7%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

9%

★ repository.ppnp.ac.id

Internet Source

Exclude quotes	On	Exclude matches	< 4%
Exclude bibliography	On		