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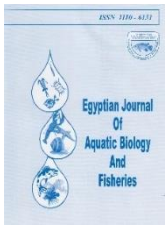

Growth Analysis of Threadfin Rainbowfish (*Iriatherina werneri* Meinken 1974) in Rawa Biru and Wanggo River, Merauke Regency, South Papua

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ABSTRACT

The threadfin rainbowfish (*Iriatherina werneri* Meinken, 1974) is a single species of the genus *Iriatherina* and was first discovered in Merauke Regency in 1973. This study aimed to examine the size distribution based on total length and body weight, length-weight relationship, and condition factors of the threadfin rainbowfish (*I. werneri*) in Rawa Biru and Wanggo River, Merauke Regency, South Papua. The study was conducted within six months, from November 2022 to April 2023. This exploratory research analyzed the distribution of total length and body weight, length-weight relationships, and fish condition factors. The results indicated that male fish from Rawa Biru typically ranged from 27.87–30.95mm in total length, while females measured 24.79–27.86mm. In contrast, specimens from the Wanggo River were smaller, with males and females ranging from 26.17–28.14mm. Based on the length-weight relationship analysis, hypoallometric, isometric, and hyperallometric growth patterns were obtained in male and female fish in the Rawa Biru and female fish in the Wanggo River. In contrast, hypoallometric and isometric patterns were found only in male fish in the Rawa Biru. The value of male and female fish condition factors varies in feeding times.

INTRODUCTION

The threadfin rainbowfish (*Iriatherina werneri* Meinken, 1974) is a freshwater fish belonging to the family Melanotaeniidae. This family is generally distributed in New Guinea and Australia below an altitude of 1500m and inhabits most freshwaters, such as rivers, lakes, and swamps **(Allen, 1991)**. In addition to New Guinea and Australia, Merauke Regency has also become one of the distribution areas of this fish. As the only species in the genus *Iriatherina*, *I. werneri* exhibits sexual dimorphism, with distinct morphological differences between males and females. **Tappin (2011)** outlines that male fish have brownish and black filaments on the second dorsal fin and anal fin; the filament extends to the tail and even exceeds it. In addition, this fish also has the sexual characteristic of dichromatism, where male fish have a more striking color and small body size ranging from 30 to 50mm.

As an ornamental fish in Indonesia, the threadfin rainbowfish *I. werneri* has various prices ranging from IDR 400 to IDR 5.000 per head for male fish and a cheaper rate for

females. In contrast, the price of male fish in the international market can reach 12-36 times higher **(Herjayanto *et al*., 2016)**. Due to this high demand, ornamental fish lovers try to develop this fish. Studies of the threadfin rainbowfish (*I. werneri*) were mainly conducted in a laboratory because researchers found a lack of information related to biology, ecology, and the history of the natural life of the fish in nature. Laboratory studies have been conducted on the rainbowfish threadfin, such as those of **Firmansyah *et al.* (2016)**, **Herjayanto *et al*. (2016)**, **Herjayanto *et al*. (2017)** and **Rahmadani *et al.* (2019)**.

It is essential to study fish growth because growth patterns can provide information on the relationship between weight length and fish condition factors. It is also vital in biology studies to describe the characteristics of fish populations between sexes and seasons **(Gomiero *et al*., 2012)** and see fish life cycles **(Wu-Shan *et al*., 2012)**. Conversely, fish condition factors can be used as an indicator reference of fish population health **(Moyle & Cech, 1988)** and parameters to show changes in fish conditions throughout the year **(Rahardjo *et al*., 2011)**.

This study examined class size distribution, total length, weight length relationships, and condition factors of the threadfin rainbowfish (*I. werneri*) in Rawa Biru and Wanggo River, Merauke Regency, South Papua. This first-found natural habitat result is expected to help enhance the information about the type of fish population growth.

MATERIALS AND METHODS

This study was conducted within six months, from November 2022 to April 2023. Fish samples from the Rawa Biru and Wanggo Rivers (Fig. 1) were taken by fine fishing gear and preserved in a 5% formalin solution to be analyzed in the Department of Aquatic Resources Management's laboratory, Faculty of Agriculture, Musamus University, Merauke.

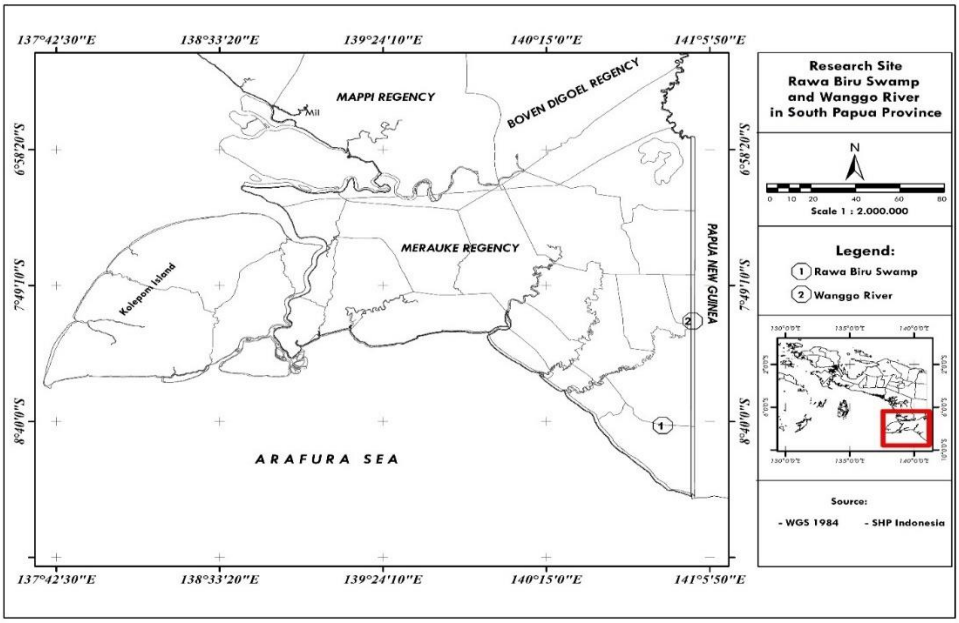

Fig. 1. Research location of threadfin rainbowfish (*Iriatherina Werneri* Meinken, 1974) in Rawa Biru and Wanggo River, Merauke Regency, South Papua

This research implemented a survey method concerning the distribution of length measures, length-weight relationships, and condition factors as the growth analysis data. The data analyses were elaborated as follows:

Length-weight relationship

The length and weight data were analyzed using the Microsoft Excel program by classifying the location and gender. The length-weight relationship of fish bodies was analyzed and determined using the following formula **(Omar, 2013)**:

$$W = a\ L^{\ b}$$

Where, W = body weight (g), L = total length (mm), a = intercept, and b = slope (regression coefficient)

The equation was transformed into a logarithm form so that a linear equation was obtained **(Omar, 2013)**:

$$\log W = \log a + b \log L$$

The values of a (intercept), b (regression coefficient), and r (correlation coefficient) were obtained through the least square method. Growth patterns in fish consist of two types: isometric growth (b = 3) if there is balance escalation in length and weight, and allometric (b ≠ 3) if there is imbalance growth in length and weight **(Omar, 2013)**. However, if b>3, then the growth is positive allometric (hyperallometric) or the weight gain is greater than the length, while if b<3, then the growth is negative allometric (hypoallometric) or the increase in length is more dominant than the weight gain **(Omar *et al*., 2016)**.

This research examined the value of b using a t-test with the following formula **(Omar, 2013)** to determine whether the pattern of the length-weight relationship is isometric or allometric:

$$t_{value} = \left[\frac{3-b}{Sb}\right]$$

Where, S_b = default error value b.

If the value of $t_{value} > t_{table,}$ then b is different from 3. Conversely, if $t_{value} < t_{table,}$ then b equals 3.

Further, this study conducted a test using the formula of **Fowler *et al.* (1998)** to compare the growth coefficients between male and female fish:

$$t_{value} = \frac{(b_1 - b_2)}{SE_{(b1-b2)}}$$

$$SE_{(b1-b2)} = \sqrt{(S_{b2})^2 + (S_{b2})^2}$$

Where, b_1 = regression coefficient of female fish, b2 = regression coefficient of male fish, SE_{b1} = deviation of error regression coefficient of female fish, SE_{b2} = deviation of error regression coefficient of male fish.

If $t_{value} < t_{table,}$ then there is an insignificant difference between the weight-length of female and male fish. Conversely, if $t_{value} > t_{table}$, it indicates a significant difference between the weight-length relationship of female and male fish. These analyses (total length and body weight) were conducted using Microsoft Excel.

Condition factors

Fish condition factors were calculated using the length-weight relationship of the sample **(Omar, 2013)** concerning the sex and observation time. It implemented the following formula to calculate a condition factor of an isometric fish growth **(Omar *et al*., 2020)**:

$$PI = \frac{W}{L^3} \times 105$$

Where, PI = Condition factor (Ponderal Index), W = Fish weight (g), L = Fish length (mm)

It used the following formula to calculate a condition factor of hypoallometric or hyperallometric pattern **(Omar *et al*., 2020)**:

$$PIn = \frac{Wb}{aL^b} \text{ or } PI_n = \frac{Wb}{W^*}$$

Where, PI_n = Relative condition factor, Wb = Weight of observed fish (g), = Weight of estimated fish (g)aL^b

RESULTS AND DISCUSSION

Total length class size distribution

The number of *I. werneri* rainbowfish threadfin caught during research in two locations was 677, consisting of 345 fish (160 male and 185 female) from Rawa Biru and 322 (162 male and 170 female) in Wanggo River. The range of length and weight of fish caught at the two sites were varied (Table 1). The length of males caught in Rawa Biru ranged from 27.87-30.95mm, and for females ranged from 24.79-27.86mm. Furthermore, based on the body weight distribution, most male fish caught were at the size of 0.1570-0.1933g, and female fish between 0.0842-0.1205g (Fig. 2).

Table 1. Total length and body weight of the threadfin rainbowfish (*Iriatherina werneri* Meinken 1974) in Rawa Biru and Wanggo River, South Papua

Sex	N (ind.)	Total length (mm)		Body weight (g)	
		Range	Mean±SE	Range	Mean±SE
		Rawa Biru			
Male	160	12.48-40.17	28.89±0.37	0.0114-0.3387	0.1500±0.0114
Female	185	20.15-32.18	25.85±0.19	0.0212-0.2130	0.1154±0.0062
		Wanggo River			
Male	162	19.31-36.04	29.24±0.25	0.0461-0.2733	0.1519±0.0033
Female	170	18.28-31.72	26.02±0.24	0.0168-0.1954	0.1031±0.0028

Note: n = number of fish (ind.), SE = standard error of mean

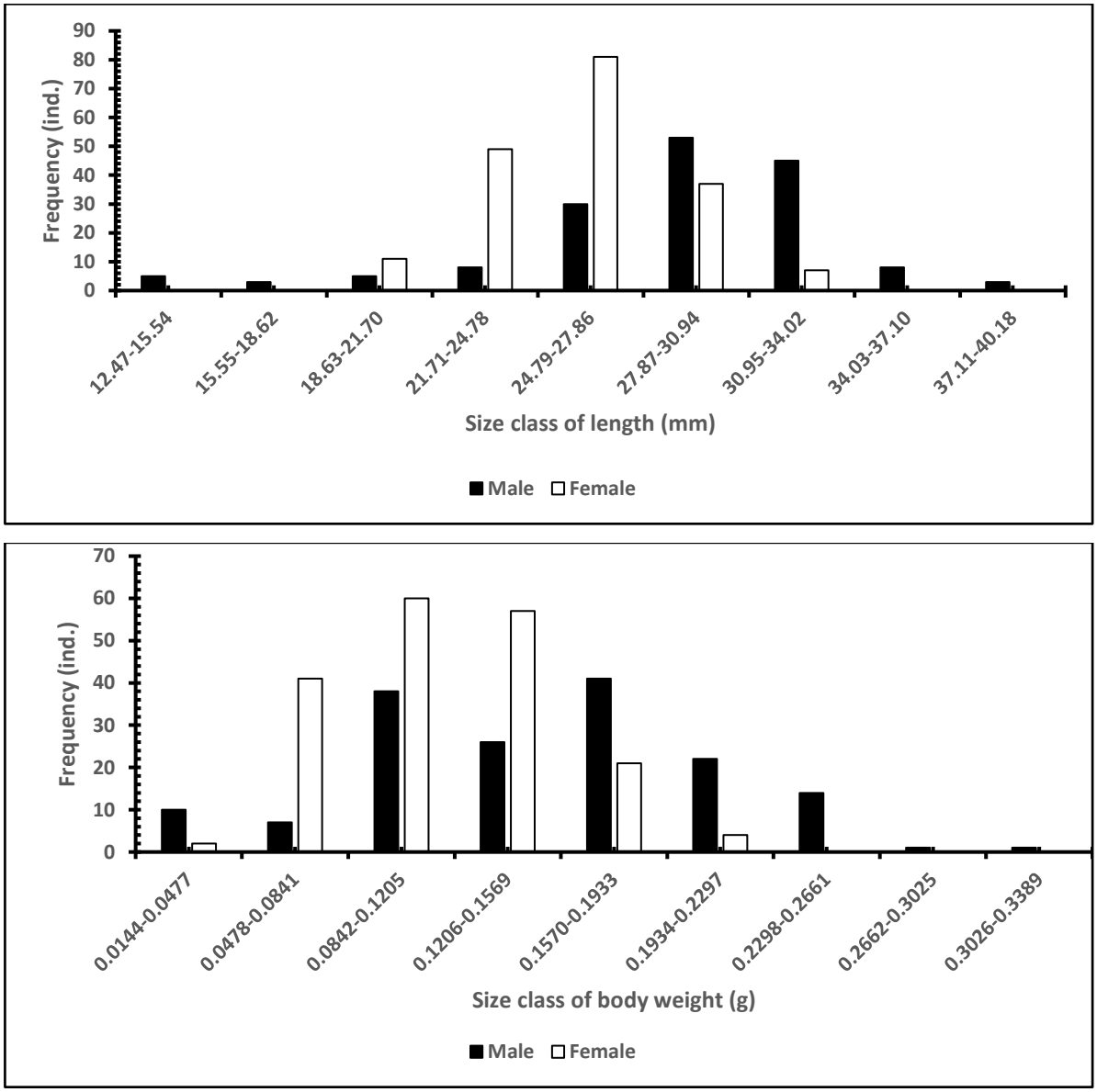

Fig. 2. Total length and body weight distribution of male and female threadfin rainbowfish (*Iriatherina werneri* Meinken 1974) in Rawa Biru, South Papua

The catch in Wanggo River was insignificantly different. Based on the total length distribution of male and female fish caught, the size was 26.17-28.14mm, and the distribution of body weight was 0.1312-0.1597g for males and 0.0740-0.1025g for females (Fig. 3).

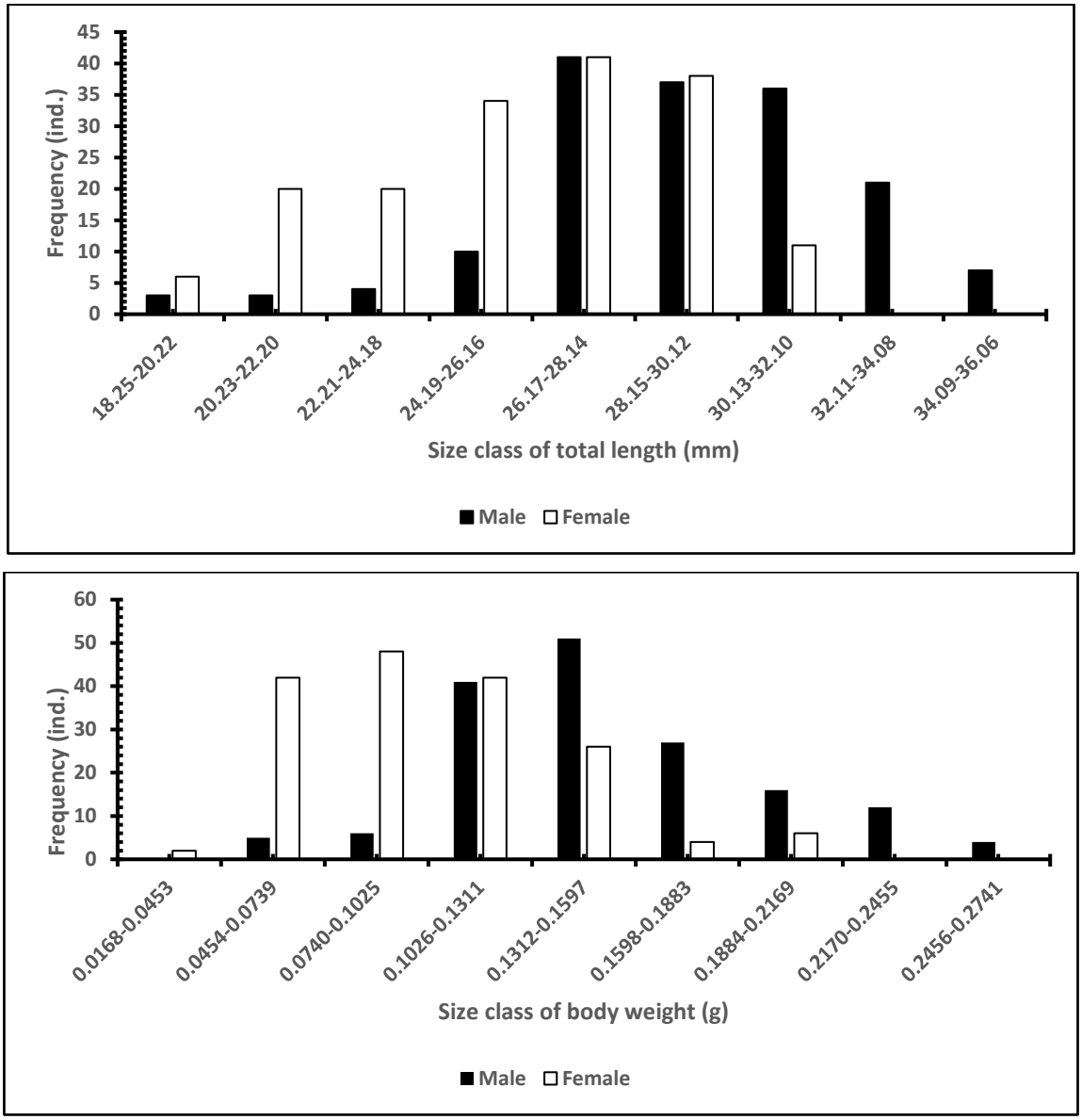

Fig. 3. Total length and body weight distribution of male and female threadfin rainbowfish (*Iriatherina werneri* Meinken 1974) in Wanggo River, South Papua

The total length and body weight of the male threadfin rainbowfish (*I. werneri)* obtained in both locations was higher than those of female fish. However, the size obtained in this research was smaller than that of **Allen (1991)** and **Tappin (2011)**. **Allen (1991)** stated that the maximum length of *I. werneri* can reach 35mm SL, although female fish has a smaller body size. According to **Satyani *et al.* (2007)**, the maximum size of the threadfin rainbowfish is 35mm. According to **Tappin (2011)**, it can reach a length of 50mm, although these fish individuals are only frequently caught at 30-40mm. The size declared by those prior researchers had no significant difference from the laboratory analysis, where male fish were 26-40mm SL and female fish were 25-31mm SL **(Trappet, *et al.*, 2013)**. The difference in size can be influenced by certain factors, including habitat **(Gundo *et al.*, 2014; Aisyah *et al.*, 2017; Syaiful *et al.*, 2019; Gani *et al.*, 2020)**, food availability, and reproductive behavior **(Gani *et al.*, 2020; Parawangsa & Tampubolon, 2023)**. **Nur *et al.* (2023)** declared that a

dissimilar range of length and weight from the same species at different times and places can be caused by a different habitat, food availability, environment, season, age, size of first-ripened gonads, spawning, and riparian vegetation. The difference in size found in this study is related to the different habitats where the fish were caught: Rawa Biru is lentic water, and Wanggo River is lotic water. Rawa Biru has calmer water types, Melaleuca tree vegetation, *Metroxylon sago*, as well as some water shrubs that *Hanguana malayana*, *Phragmites karka*, *Scleriaoszoides*, and types of water spikes *Nephrolepis*, Lotus (Nymphaea) dominating this area. In contrast, the Wanggo River is relatively calm on its riverbank and is not affected by the speed of the current (it has no current). This river is dominated by bamboo trees and some grassy vegetation of Ragmites Karka, which drowned due to overflowing water inland.

Length-weight relationship

The sample caught in Rawa Biru was 160 male and 185 female fish. Based on the analysis, both male and female fish growth patterns may vary each month (Table 2).

Table 2. Growth pattern of threadfin rainbowfish (Iriatherina werneri Meinken 1974) in Rawa Biru, South Papua, November 2022-April 2023

Time sampling	n	Length-weight regression parameters				Growth type
		a	B	R^2	r	
			Male			
November	23	0.0011	1.3476	0.7844	0.8857	Hypoallometric
December	27	0.000013	2.7539	0.8016	0.8953	Isometric
January	28	0.000026	2.5860	0.8760	0.9359	Hypoallometric
February	27	0.000410	1.7428	0.7392	0.8598	Hypoallometric
March	26	0.000038	2.4636	0.8485	0.9211	Hypoallometric
April	29	0.00000003	4.5136	0.9117	0.9548	Hyperallometric
Total	160	0.000056	2.3286	0.7355	0.8576	Hypoallometric
			Female			
November	27	0.003277	1.1020	0.1774	0.4212	Hypoallometric
December	31	0.000006	2.9984	0.8190	0.9050	Isometric
January	30	0.000011	2.8195	0.6304	0.7940	Isometric
February	31	0.000120	2.1084	0.4735	0.6881	Hypoallometric
March	32	0.000018	2.6969	0.8385	0.9157	Isometric
April	34	0.00000004	4.5433	0.8645	0.9298	Hyperallometric
Total	185	0.000016	2.7129	0.6316	0.7947	Isometric

Note: n = number of fish (ind.), a = intercept, b = slope (regression coefficient), R^2 = coefficient of determination, r = correlation coefficient

Based on the analysis, male fish had hypoallometric or negative allometric growth patterns in November '22, January '23, February '23, and March '23, while female fish were found in November '22 and February '23. In contrast, hyperallometric or positive allometric growth patterns were found in male and female fish in April '23. In the isometric growth patterns, male fish were revealed in December '22 and females in December '22, January '23,

and March '23. Therefore, it can be generalized that the growth pattern of male fish is hypoallometric and female fish are isometric.

Statistical analysis of the regression coefficients between the male and female threadfin rainbowfish in the Rawa Biru showed insignificant differences; this indicated that male and female fish have similar lengths and weights. Therefore, data in this analysis were merged to obtain the combined regression equation of $W = 0.000045\ L2.^{3942}$ (n=345, R^2=0.7130, r=0.8444) that indicated a hypoallometric or negative allometric growth type.

Varied growth patterns are also found in the Wanggo River. The total catch of males was 162 and females was 170 (Table 3). Hypoallometric growth patterns for male fish were found in January '23, February '23, and March '23, while female fish were found in November '22 and March '23. Hyperallometric growth patterns were only found in female fish in December '22 and April '23. Furthermore, isometric growth patterns of male fish were found in November '22, December '22, and April '23; female fish were found in January '23 and February '23. The data on male and female fish were unmerged due to the statistical analysis of the regression coefficient between the male and female threadfin rainbowfish in Wanggo River, which showed a significant difference.

Table 3. The growth pattern of threadfin rainbowfish (*Iriatherina werneri* Meinken 1974) in Wanggo River, South Papua, November 2022-April 2023

Time sampling	n	Length-weight regression parameters				Growth type
		a	B	R^2	r	
			Male			
November	25	0.000006	2.9598	0.7518	0.8671	Isometric
December	26	0.000017	2.6924	0.8388	0.9159	Isometric
January	27	0.000160	2.0172	0.6972	0.8350	Hypoallometric
February	26	0.005289	1.0087	0.2719	0.5214	Hypoallometric
March	29	0.000098	2.1541	0.5708	0.7555	Hypoallometric
April	29	0.000026	2.5434	0.7989	0.8938	Isometric
Total	162	0.000159	2.0234	0.5850	0.7649	Hypoallometric
			Female			
November	29	0.000410	1.7029	0.7497	0.8659	Hypoallometric
December	31	0.0000003	3.8657	0.8851	0.9408	Hyperallometric
January	24	0.000027	2.5337	0.8421	0.9176	Isometric
February	28	0.000005	3.0088	0.7637	0.8739	Isometric
March	26	0.000129	2.0354	0.5397	0.7346	Hypoallometric
April	32	0.00000001	4.7489	0.8712	0.9334	Hyperallometric
Total	170	0.000024	2.5519	0.7260	0.8520	Hypoallometric

Note: n = number of fish (ind.), a = intercept, b = slope (regression coefficient), R^2 = coefficient of determination, r = correlation coefficient

The length-weight relationship of fish was analyzed separately between males and females at both study sites. The length-weight relationship of threadfin rainbowfish in Rawa Biru for male fish has the equation of W=0.000056 L2.3286 (r=0.8576; N=160) and female W=0.000016 L2.7169 (r=0.7947; N=185). Male fish in Wanggo River have the equation of W=0.000159 L2.0234 (r=0.7649; N=162) and female W=0.000024 L2.5519 (r=0.8520; N=170). The graph of the length-weight relationship of the threadfin rainbowfish in Rawa

Biru can be seen in Fig. (4), while the length-weight relationship in Wanggo River is shown in Fig. (5).

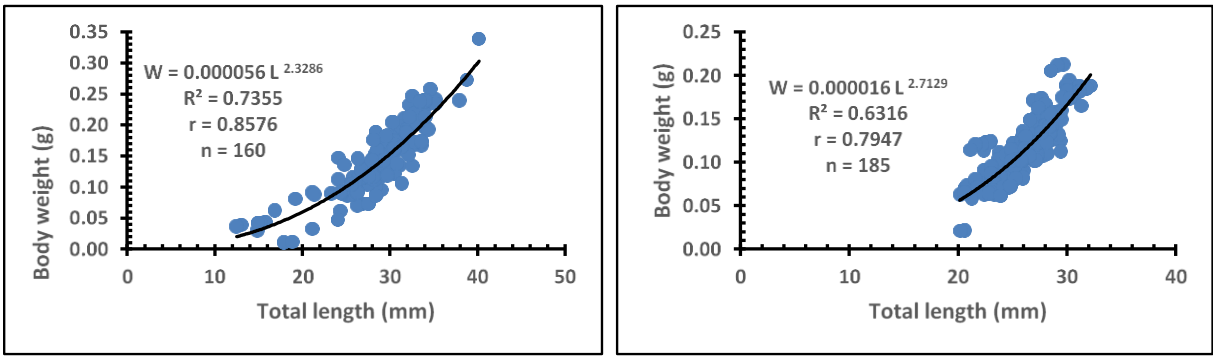

Fig. 4. Graph of length-weight relationship between male and female threadfin rainbowfish *Iriatherina werneri* Meinken 1974) in Rawa Biru, South Papua

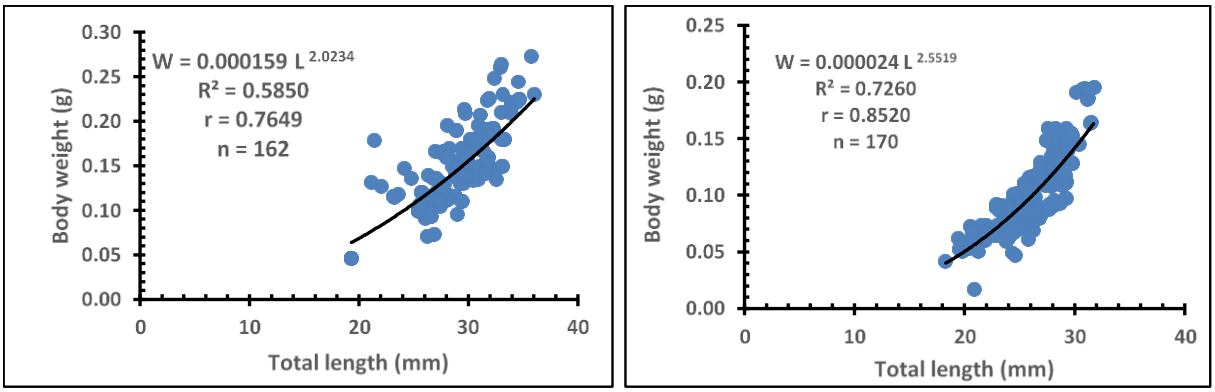

Fig. 5. Graph of the male length and female weight relationship of threadfin rainbowfish (*Iriatherina werneri* Meinken 1974) in Wanggo River, South Papua

The correlation coefficient value (r) of the male threadfin rainbowfish (0.8576-0.9548) in Rawa Biru is relatively higher than females (0.4212-0.9298). In contrast, the correlation coefficient value of female fish (0.8520-0.9408) is relatively higher than male fish (0.5214-0.9159) in Wanggo River. The coefficient of determination (R^2) value in the Rawa Biru was 0.1774-0.9117, while in the Wanggo River was 0.2719-0.8851. Based on the findings and analysis, it was found that high correlation coefficient values of male fish, which was close to 1.0 in the Rawa Biru, occurred in January '23, March '23, and April '23, and for females occurred in December '22, March '23, and April '23. Meanwhile, the high r-value of male fish in Wanggo River was only achieved in December '22, while female fish were found in December '22, January '23, and April '23 (Tables 2 and 3). The result of the r coefficient proved a significant correlation between total length and body weight in threadfin rainbowfish in South Papua; the high value of the coefficient of determination indicated good predictability and a small dispersion of data. Therefore, the length of measurement used in fish is valid for accurately estimating the weight. The r^2 coefficient of determination value,

greater than 0.90, was only found in male fish in the Rawa Biru in April '23. According to **Hanif *et al.* (2020)**, ideal fish growth has an R^2 coefficient value between 0.9 and 1.0. According to **Dizaj *et al.* (2020)**, a low number of individuals and the limited size of the sample used in research can affect the R^2 value.

Three growth patterns of the threadfin rainbowfish were obtained from both locations: hypoallometric or negative allometric, hyperallometric or positive allometric, and isometric. Hypoallometric refers to the domination of body length improvement over body weight due to the intense movement that accumulates the energy to enhance the body length. In contrast, hyperallometrics occurs because fish move slowly which affects their weight. Another one is the isometric pattern that shows a balance improvement in weight and body length.

Tables (2, 3) disclose different growth patterns of similar fish species (female and male) in different habitats due to different sizes, sampling times, habitats, seasons, food availability, spawning time, and catch pressure. The value of the b coefficient in fish was affected by several factors including species, sex, gonad maturity level, season, and habitat **(Dizaj *et al.*, 2020; Djumanto *et al.*, 2020; Esmaeili *et al.*, 2020; Omar *et al.*, 2020; Al Jufaili *et al.*, 2021; Ilmi *et al.*, 2021; Masoumi *et al.*, 2021; Mouludi-Saleh *et al.*, 2021; Situmorang *et al.*, 2021; Masoumi *et al.*, 2023; Parawangsa & Tampubolon, 2023)**. Physiological and environmental conditions such as climate change, conductivity, geographic location, temperature, dissolved oxygen, and sampling techniques were also among the factors influencing the regression coefficient **(Jisr *et al.*, 2018; Muthiadin *et al.*, 2020)**. The value of b might vary in species and stocks of the same species **(Omar *et al.*, 2020)**. The difference in length-weight relationship in the threadfin rainbowfish obtained during the study can be caused by a combination of one or more prior factors, although there has been no released research on the growth pattern of the rainbowfish threadfin in its natural habitat, particularly in Merauke and the surrounding areas. Therefore, the data obtained in this study were only compared with data on endemic species of the rainbowfish in several Indonesian waters, as shown in Table (4).

Table 4. Length-weight relationship coefficients and growth pattern of the rainbowfish from several locations in Indonesia

Species	Region	Sex	n	a	B	r	Growth pattern	References
Glossolepis incisus	Lake Sentani, Papua	M	404	0.000006	3.157	0.862	Isometric	Siby 2009
		F	394	0.00009	2.528	0.746	Hypoallometric	
Marosatherina ladigesi	Batu Puteh River, South Sulawesi	M	112	0.00001	2.88	0.98	Hypoallometric	Christo 2020
		F	123	0.000006	3.12	0.98	Hyperallometric	
	Bantimurung River, South Sulawesi	M	69	0.0000051	3.1707	0.9469	Isometric	Omar *et al.* 2020
		F	269	0.0000072	3.0872	0.9642	Isometric	
	Pattunuang River, South Sulawesi	M	88	0.000017	2.8542	0.8654	Isometric	Omar *et al.* 2020
		F	243	0.0000068	3.1047	0.9393	Isometric	
	Camba	M	54	0.0002	2.74	0.98	Hypoallometric	Nasyrah *et al.*

	River, South Sulawesi	F	173	0.00004	3.23	0.92	Hypoallometric	2021
	Sanrego River, South Sulawesi	M	33	0.0001	2.78	0.97	Isometric	Nasyrah *et al*. 2021
		F	55	0.0001	2.92	0.98	Isometric	
Melanotaenia arfakensis	West Papua	M	172	0.000019	2.965	0.988	Hypoallometric	Manangkalangi *et al*. 2018
		F	169	0.000012	3.131	0.976	Hypoallometric	
Paratherina striata	Lake Towuti, South Sulawesi	M	191	0.000004	3.1619	0.8506	Isometric	Aminah 2007
		F	145	0.000002	3.2498	0.9079	Hyperallometric	
Telmatherina antoniae	Lake Matano, South Sulawesi	M	1437	0.000008	3.210	0.979	Hyperallometric	Tantu 2012
		F	1270	0.00003	2.915	0.958	Hypoallometric	
Telmaterina celebensis	Lake Towuti, South Sulawesi	M	141	0.0093	3.1104	0.8958	Isometric	Furkon 2003
		F	132	0.0036	3.1556	0.9602	Isometric	
		M	812	0.00078	3.0729	0.9000	Isometric	Nasution 2007
		F	713	0.00005	3.0476	0.9487	Isometric	
Telmatherina prognata	Lake Matano, South Sulawesi	M	483	0.0004	2.5995	0.8544	Hypoallometric	Chadijah *et al*. 2019
		F	370	0.0006	2.4875	0.8660	Hypoallometric	
		M	1059	0.00020	2.7844	0.88	Hypoallometric	Chadijah 2020
		F	750	0.00078	2.4455	0.86	Hypoallometric	
Telmatherina sarasinorum	Lake Matano, South Sulawesi	M	2180	0.000009	3.218	0.980	Hyperallometric	Nilawati 2012
		F	985	0.00001	3.124	0.960	Hyperallometric	
		M	1212	0.000001	3.4782	0.9270	Hyperallometric	Al-Hakim 2022
		F	548	0.000004	3.1657	0.8678	Hyperallometric	

Note: F = female, M = male, n = number of fish, a = intercept, b = slope (regression coefficient), r = coefficient of correlation

Condition factors

Factor analysis of the threadfin rainbowfish conditions in Rawa Biru and Wanggo Rivers was carried out based on length-weight relationships. The range of fish condition factors in these two locations varies each month. The highest value of male fish condition factor in Rawa Biru was found in April '23, which was 0.6944-1.6965 with an average of 1.0887±0.0504, while for females found in November '22, which was 0.6423-1.2509 with an average of 1.0194±0.0369. The value of fish condition factors in Wanggo River was relatively higher than in Rawa Biru (Table 5). The highest male fish condition factor was found in March '23, which was 0.6174-1.8862 with an average of 1.0297±0.0461, while the highest female fish was found in April '23 (0.9120-1.9859), with an average of 1.3929±0.0428.

Table 5. Factor value of the threadfin rainbowfish (Iriatherina werneri Meinken, 1974) condition in Rawa Biru and Wanggo River, South Papua, November 2022-April 2023

Time sampling	Male		Female	
	Range	Mean ± se	Range	Mean ± se
		Rawa Biru		
November	0.7231-1.6467	1.0591±0.0485	0.6423-1.2509	1.0194±0.0369
December	0.3450-0.6621	0.5448±0.0119	0.5035-0.8595	0.6379±0.0163
January	0.7682-1.1673	0.9984±0.0152	0.4494-0.8865	0.6306±0.0195
February	0.7592-1.4053	1.0122±0.0304	0.7527-1.4642	1.0136±0.0267
March	0.7880-1.3132	1.0109±0.0216	0.5018-0.8086	0.6725±0.0159
April	0.6944-1.6965	1.0887±0.0504	0.5770-1.3183	0.9474±0.0285
Total	0.2268-1.8558	1.0262±0.0182	0.2464-1.2171	0.6570±0.0105
		Wanggo River		
November	0.4127-0.7331	0.5670±0.0162	0.8315-1.1594	1.0036±0.0165
December	0.4529-0.8195	0.6009±0.0184	0.8178-1.4345	1.0887±0.0233
January	0.8082-1.3419	1.0065±0.0253	0.4472-0.7486	0.5983±0.0174
February	0.7339-1.5378	1.0220±0.0437	0.4115-0.7736	0.5661±0.0152
March	0.6174-1.8862	1.0297±0.0461	0.7704-1.2046	1.0017±0.0199
April	0.4156-0.7712	0.5717±0.0157	0.9120-1.9859	1.3929±0.0428
Total	0.5851-2.2829	1.0223±0.0168	0.3008-1.3978	1.0200±0.0136

Based on the fish condition value, fish fatness was closely related to its habitat condition. This fact correlates with the theory of significant factors determining the health and level of individuals and populations, which is the condition of the fitness of the fish body **(Peig & Green, 2009; Gubiani *et al*., 2020)**. Based on the analysis, the average value of the male threadfin rainbowfish was higher than females in the Rawa Biru and Wanggo River. However, the results obtained are contrary to that of **Maturbongs *et al*. (2020)** at *Kurtus gulliveri* in Maro River, Merauke, where the average condition factor value was higher than 1.0. According to **Lloret-Lloret *et al*. (2022)**, a condition factor value which is greater than 1.0 indicates a good condition of fish, and smaller than 1.0 is otherwise. **Mouludi-Saleh and Eagderi (2019)** and **Mouludi-Saleh *et al*. (2021)** stated that PI values > 1.0 indicated the suitability of good aquatic environmental conditions for fish growth. Table (4) showed spatial and temporal variations in male and female fish conditions during the study. This result can be attributed to both sampling sites' biotic and abiotic environmental conditions (Rawa Biru and Wanggo River). Other factors that can affect differences in the value of condition factors in fish are sex, abundance of organisms in the aquatic environment, food availability, gonad weight, size, and water quality parameters **(Zuh *et al*., 2019; Nur *et al*., 2020; Omar *et al*., 2020; Nasyrah *et al*., 2021)**. Table (6) displays the value of the rainbowfish condition factors found in several regions in Indonesia. The value of *I. werneri* condition factor obtained during research in Rawa Biru and Wanggo River had insignificant differences compared to other reported studies.

Table 6. Condition factor of the rainbowfish from several locations in Indonesia

Species	Location	Sex	Condition factor	References
Glossolepis incisus	Lake Sentani, Papua	M	0.558-1.597	Siby 2009
		F	0.723-1.649	
Marosatherina ladigesi	Bantimurung River, South Sulawesi	M	0.5938-2.1399	Omar et al. 2020
		F	0.4938-2.1224	
	Pattunuang River, South Sulawesi	M	0.1830-1.5781	Omar et al. 2020
		F	0.1132-2.4219	
	Batu Puteh River, South Sulawesi	M	0.868-0.994	Nasyrah et al. 2021
		F	0.903-1.077	
	Camba River, South Sulawesi	M	0.728-1.012	Nasyrah et al. 2021
		F	0.921-1.069	
	Sanrego River, South Sulawesi	M	0.795-0.987	Nasyrah et al. 2021
		F	0.786-1.196	
Paratherina striata	Lake Towuti, South Sulawesi	M	0.9058-0.9897	Aminah 2007
		F	1.3265-1.6183	
Telmatherina antoniae	Lake Matano, South Sulawesi	M	0.85-1.19	Sumassetiyadi 2003
		F	0.90-1.20	
		M	1,032±0.109	Tantu 2012
		F	1,006±0.212	
		M	0.80-1.18	Tussadiyah 2021
		F	0.70-1.13	
Telmatherina celebensis	Lake Towuti, South Sulawesi	M	0.93-1.21	Nasution 2007
		F	1.09-1.26	
Telmatherina prognatha	Lake Matano, South Sulawesi	M	0.9864±0.2084	Chadijah et al. 2019
		F	1.0121±0.1571	
Telmatherina sarasinorum	Lake Matano, South Sulawesi	M	1,088±0.154	Nilawati 2012
		F	1,040±0,156	

Note: F = female, M = male.

CONCLUSION

The analysis concluded that the male and female threadfin rainbowfish (*Iriatherina werneri* Meinken 1974) caught in Rawa Biru have a shorter body size than those brought from the Wanggo River. Further, growth patterns of hypoallometric or negative allometric, isometric, and hyperallometric or positive allometric were found in male and female fish in Rawa Biru and Wanggo River. It is worthnoting that the male fish have higher average condition factor values than females in the Rawa Biru and Wanggo River.

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