Length-Weight Relationship and Relative Condition factor of *Paratrypauchen microcephalus* (Bleeker, 1860) along the Mumbai coast

ABSTRACT

The length-weight relationship and relative condition factor of *Paratrypauchen microcephalus* (Bleeker, 1860) from Madh, Mumbai, was studied between October 2021 and December 2022. A total of 179 fish were examined, which included 81 males, 75 females, and 23 juveniles. The relationship between total length and weight was estimated by the least squares method, and the results indicated that the species exhibits a negative allometric growth pattern, with the exponent 'b' values obtained being 1.1545 for males, 1.1728 for females, 1.0260 for juveniles, and 0.9443 for the pooled observations. The regression values obtained were highly significant ($P<.01$), showing a good relationship between the length and weight of this fish. The mean value for the relative condition factor (Kn) obtained during the study was 0.5757, 0.6610, and 2.4730 for males, females, and juveniles, respectively, reflecting that males and females are not in a better health condition while juveniles are, having a Kn value greater than 1. The current study thus provides the first baseline data about LWRs and the relative condition factor of this fish species from the Mumbai coast.

[Keywords: *Paratrypauchen microcephalus*, length-weight relationship, least square method, allometric, relative condition factor]

INTRODUCTION

"The length-weight relationship in fish is one of the most important and studied characteristics in fishery science. In numerous population dynamics studies, they are useful in calculating growth rates, age structure, and fish stock segregation" [1]. "It must be noted, however, that LWRs differ among fish species depending on the inherited body shape and physiological factors such as maturity and spawning" [2]. "An additional important biometric tool is the relative condition factor (Kn) that was derived from the LWRs" [3]. "Kn measures the deviation of an organism from the average weight in a given sample to assess the suitability of a specific water environment for the growth of fish" [4]. "Thus, in

biometric studies, it is crucial to determine the growth characteristics related to the weight and length of the fish, in addition to the condition of the well-being of the species influenced by different biological and environmental factors". [5]

Around 120 species have been reported from the Mumbai coast with the Sciaenidae family being the most prevalent, followed by the Engraulidae, Penaeidae, Ariidae, Clupeidae, and Gobiidae families [6]. Based on the phylogenetic work discussed by the following authors [7-9], molecular evidence was found to support the division of the family Gobiidae into two major clades: Oxudercidae (= Gobionellidae by some authors) and Gobiidae. The family Oxudercidae contain about 86 genera and 598 species that involve sub-families: Gobionellidae, Oxudercinae, Amblyopinae, and Sicydiinae [10]. Murdy [11] reported a new genus, Paratrypauchen, with a key to the genus of the Trypauchen group. The genus Paratrypauchen is monospecific and is currently known as *Paratrypauchen microcephalus* (Bleeker, 1860) [12]. It has already been reported in India from Maharashtra [13], Andaman [14], the Sundarbans, West Bengal [15], Tamil Nadu, [16] and Odisha [17]. The IUCN [18] classified this fish as LC (Least Concerned) in 2016 [19, 35-38].

The present study is undertaken to carry out a comprehensive description of the length-weight relationship in this fish and to establish the pattern of growth that would contribute to population dynamics. Also, the study of the relative condition factor 'Kn' of *Paratrypauchen microcephalus* was carried out to assess the general condition of the fish along the Mumbai coast.

MATERIALS AND METHODS

Samples for the present study were collected every fortnight at regular intervals from Madh, Mumbai using trawl nets during a period of 14 months from October 2021 to December 2022. The fresh fish samples were brought to the laboratory and thoroughly washed, cleaned, and wiped.

Length-Weight Relationship Studies (LWRs)

The fish samples were weighed with an electronic balance sensitive up to 0.001g, and the total length (TL) and standard length (SL) of the fish were measured to the nearest mm with the help of fine calipers. The collected data was transformed into logs. The length-

weight and length-length equations were estimated using the method of least squares as suggested by Ricker [20]:

$$W = aL^b$$

Where W is total weight (g), L is total length (mm), 'a' is the intercept of the regression line at Y when x = 0, and 'b' is the slope of the regression line.

For practical use, this equation is used in its logarithmic form [3] as:

$$\text{Log } W = \text{Log } a + b \text{ Log } TL$$

The parameters of 'a' and 'b' were estimated by linear regression analysis (least square method) on log transformed data. When applying this formula to sampled fish, b may deviate from the "ideal value" of 3 that represents isometric growth [21] because of certain environmental circumstances or the condition of the fish themselves. When b is less than 3, fish become slimmer with increasing length, and growth will be negatively allometric. When b is greater than 3.0, fish become heavier, showing positive allometric growth and reflecting optimum conditions for growth.

Study of the relative condition factor (Kn):

The relative condition factor (Kn) measures the deviation of an individual fish from its average weight or length. The relative condition factor (Kn) must be closer to 1. The formula for Kn is as follows:

$$Kn = \frac{W}{aL^b}$$

(Kn is the relative condition factor, W is the weight in grams (g), a is the intercept, b is the slope, and L is the length in centimeters (cm).)

The good growth condition of the fish is deduced when $Kn \geq 1$, while the organism is in poor growth condition compared to an average individual with the same length when $Kn < 1$. The deviation from one will reveal information such as differences in nutrient levels and the impact of physiochemical factors on the life cycle of the fish species.

Statistical analysis

All the statistical analysis was done with the help of IBM SPSS (Statistical Package for the Social Sciences) Statistics 21 software.

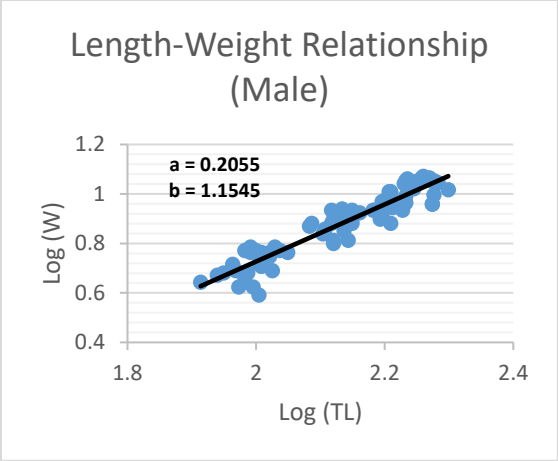

Fig.1 Relationship between Log (TL) v/s Log (W) (MALE)

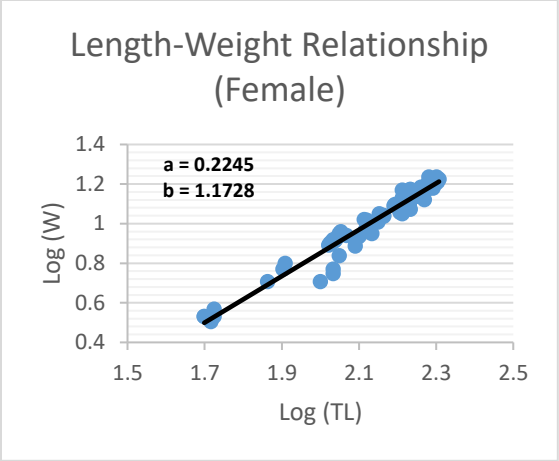

Fig.2 Relationship between Log (TL) v/s Log (W) (FEMALE)

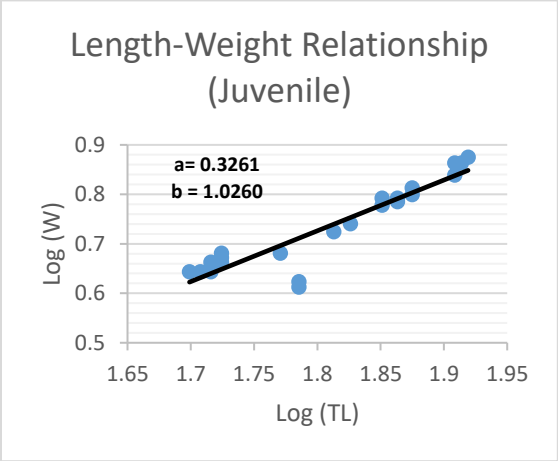

Fig.3 Relationship between Log (TL) v/s Log (W) (JUVENILE)

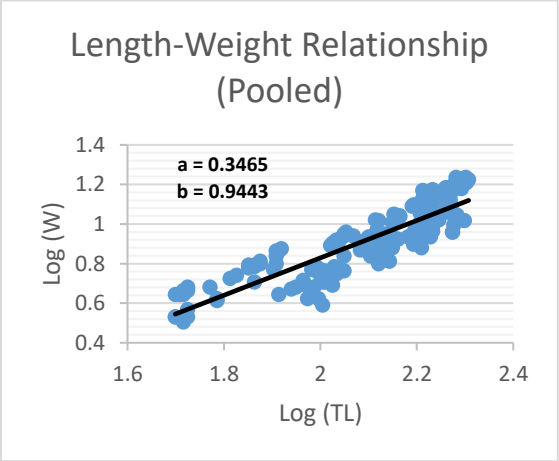

Fig.4 Relationship between Log (TL) v/s Log (W) (POOLED)

RESULTS AND DISCUSSION

Length-weight relationship

From the total of 179 samples of *P. microcephalus* collected during the study period, 81 (45%) were males, 75 (42%) were females, and 23 (13%) were juveniles. The values of 'a' and 'b' obtained from the calculation are as follows:

Male: Log W = -1.5821 + 1.1545. Log L

Female: Log W = -1.4937 + 1.1728. Log L

Juvenile: Log W = -1.1205 + 1.0260. Log L

Pooled: Log W = -1.0596 + 0.9443. Log L

The values obtained indicate a negative allometric growth (b < 3) with males having b value of 1.1545, females with 1.1728, and juveniles with 1.0260, and pooled (combined) data with a value of 0.9443. (Fig. 1-4). However, fluctuations in the b values of this fish have been seen in different localities, as shown in Table 2, ranging from 2.568 to 2.070 in New Caledonia, 2.628 in South Korea, and 2.882 to 3.050 in China [22].

The regression (b) values are usually expected to range between 2.5 and 4.0 for an ideal fish [6, 23]. However, there are differences in the b value between sexes in a large number of specimens, indicating that one sex might be heavier than another one with the same length, which might be due to differences in fatness, gonadal development, and less metabolic activity, as stated by Hossain and Sultan (2014) [24]. It has also been reported that variation in b value in fish might be due to several factors, including season, species, habitat, sex, gonad maturity, diet, stomach fullness, health, preservation techniques, and locality [6, 25]. These differences in the LWRs could be due to the combination of one or more of the above factors. The 'b' values were reported as 3.7169 for males and 3.4444 for females of *B. dussumieri* [26]; 2.5324 for males and 2.0726 for females of the same species [27]. Soni and George (1986) [28] reported a b value of 2.7590 for *B. dentatus*. N. Shettu (1993) [29] for the same species: 1.1533 for females, 1.2008 for males, and 1.0482 for juveniles; 1.2435 for males and 1.3119 for females were seen in *B. boddaerti* [30].

	b	**t value**		**Significance**
Male	1.1545	-15.96	$P < .01$	Significant
Female	1.1728	-22.69	$P < .01$	Significant
Juvenile	1.0260	-6.81	$P < .01$	Significant
Pooled	0.9443	-13.27	$P < .01$	Significant

Table 1: Significance of variations in the estimates of regression coefficient value 'b' from '3' using t test

The significance of variations in the values of regression coefficient 'b' from '3' was tested using the t-test and is presented in Table 1. The regression values obtained were found to be highly significant ($P < .01$), showing a good relationship between length and weight in these fish. However, differences in the regression values were seen in *P. ocellatus* for juveniles, which were not significant at $P < .01$, whereas males and females showed a highly significant *P* value [31].

Relative condition factor

The relative condition factor Kn obtained in this present investigation for males, females, and juveniles as well as the pooled data, is closer to 1. The mean Kn values were 0.5757, 0.6610, and 2.4730 for males, females, and juveniles, respectively, whereas the pooled observation has a value of 2.2542.

The values obtained reflect that males and females are not in a better health condition, having a Kn value not closer to 1, while juveniles are in a better health condition, having a Kn value greater than 1. "The decreasing trends of 'Kn' values from 1 may be attributed to the development of gonadal stages and a resource transfer to the gonads during reproductive periods" [32]. "Also, environmental conditions such as rainfall and the productivity of the ecosystem can influence Kn values" [33].

CONCLUSION

The outcome of the present study provides information on LWRs of *P. microcephalus* along with its relative condition factor from Madh Island. The regression (b) values are less than 3 ($b < 3$) and the Kn values are much less than 1, indicating a negative allometric growth pattern along with unhealthy conditions in the fish. Along with other characteristics such as season, habitat, sex, gonad maturation, nutrition, stomach fullness, health, etc., large-scale sewage pollution [34] on Madh Island may be one of the causes of the fish having a low b value. It is also revealed that juveniles are in better health conditions than males and females, having a Kn value of more than 1. The difference in the condition factors may be influenced by several factors, of which feeding, reproductive activity, and changes in the environment are probably the most important. With this distinctive elongated body, the fish may increase more in length than in weight, especially during the breeding season. The body form and shape may strongly affect the LWRs and the Kn values.

Conference disclaimer:

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Country	Ref No	Locality	n	Sex	a	b	L min	L max	r^2
New Caledonia	26587	-	23	unsexed	0.0444	2.07	4.5	11.5	0.806
New Caledonia	55787	-	23	mixed	0.0144	2.5679	4.5	11.5	0.806
China	111256	Bohai Bay 2011-14	25	unsexed	0.0055	2.882	5.7	9.7	0.962
China	112063	Haizhou Bay / 2011	60	mixed	0.0025	3.05	5.2	11.7	0.957
Korea (South)	112072	Suer River estuary / 2009-10	22	unsexed	0.0079	2.628	9.3	12.4	0.913

Table 2. Length-weight parameters of *Paratrypauchen microcephalus*[23]

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