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Comparative length weight relationship and condition factor in *Alepes kleinii* (Bloch 1793) along Mumbai and Goa coast of India

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Abstract

The length weight relationships and condition factors of the two populations of *Alepes kleinii* (Bloch 1793) along Mumbai and Goa Coasts were calculated out for males and females, separately. The length weight relationship (LWR) was established as $\log W = -2.799 + 2.037 \log L$ for females, $\log W = -1.245 + 1.313 \log L$ for males, and $\log W = -2.103 + 1.721 \log L$ for pooled data for population of Mumbai Coast. Similarly, $\log W = -2.712 + 2.001 \log L$ for females, $\log W = -1.100 + 1.264 \log L$ for males and $\log W = -1.922 + 1.643 \log L$ for pooled data for population of Goa Coast. The coefficient of correlation “r” between length and weight was found to be higher in females at Mumbai (0.909) and Goa (0.921) Coast than in males. The values of condition factor “K” was found to be higher in males (2.0609- Mumbai Coast and 2.0962 - Goa Coast) than in females (1.5329 - Mumbai and 1.4879 - Goa Coast), from both the Coast.

Keywords: Length weight relationship, Condition factor, *Alepes kleinii*, Mumbai, Goa

Introduction

Carangids are fast swimming and predatory fishes. Razorbelly scad, *Alepes kleinii* is a small species of family, Carangidae. The species contribute significantly in catch of carangids along the west coast of India. Huxley (1924)^[1] initiated the allometric growth formula to describe the relationship between length and weight. The function suggested by him has proved to be a useful model for weight as a function of length^[2]. Length measurements are quicker and can be carried out in a range of circumstances than weight measurements, thus often limited number of weight observations are taken for the construction of length weight relationships^[3]. It is used to evaluate the relative condition of fish among populations^[4]. It is also useful in study of biological changes in fish stock^[5]. Length- weight relationship can be used to convert length-at-age to weight-at- age equivalents in a yield per recruit^[6]. The correlation coefficient ‘r’ is calculated to express the degree of linear association. The condition factor “K” is used as an index of fitness of an individual or a stock, which is different for different fish stocks. A fish is said to be in better condition if the value of K is above unity. If it is less than 1 then the fish is in poor condition, usually associated with the reproductive cycles, poor feeding and various environmental factors^[7]. Total of 456 specimens ranging from 86.23 to 175.13 mm in total length were considered for this study. The length-weight studies are made to determine mathematically the relation between two variables which enable to calculate the value of other if one is known. The length-weight relationships and condition factor record of *A. kleinii* from Mumbai and Goa coast is absent. Hence the present study was undertaken.

Materials and Methods

During the present study, a total of 456 specimens of *A. kleinii* was collected, randomly from the fish landing centers of Mumbai (337) and Goa (119) Coast, during July 2015 to March 2017. The total length and weight were recorded using a measuring board to nearest 1 mm and an electronic balance to nearest 1 gm, respectively. Each specimen was then dissected for the determination of the sex. Scatter diagrams of length-weight were plotted for female, male and pooled sexes separately. The Length – weight relationship was established using LeCren (1951) equation.

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$$W = aL^b$$

Where, W = body weight (g),

L = Total length (mm)

'a' = Y-intercept or Coefficient related to body form.

'b' = Slope or exponent indicating isometric / allometric growth.

This relationship can be transform logarithmically as,

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

Where 'W' is the weight of the fish in gm (g), 'L' is the length in mm, 'a' is the intercept and 'b' is slope. The null hypothesis that $b=3$ (isometric growth) was tested using t-test. Fulton's Condition factor (K) was determined using formula $K = 100 * W/L^3$ following Bagenal and Tesch [8]. All the statistical analyses were performed using statistical software PAST.

Results and Discussion

Length and weight for females, males and pooled (both sexes) were plotted (Fig- 1a, 1b, 1c and 2a, 2b, 2c). Length-weight relationship was established as

Mumbai Coast

Pooled	$\log W = -2.103 + 1.721 \log L$ ($r= 0.8318$)
Females	$\log W = -2.799 + 2.037 \log L$ ($r= 0.909$)
Males	$\log W = -1.245 + 1.313 \log L$ ($r= 0.7334$)

Goa Coast

Pooled	$\log W = -1.922 + 1.643 \log L$ ($r= 0.8426$)
Females	$\log W = -2.712 + 2.001 \log L$ ($r= 0.9219$)
Males	$\log W = -1.100 + 1.264 \log L$ ($r= 0.7238$)

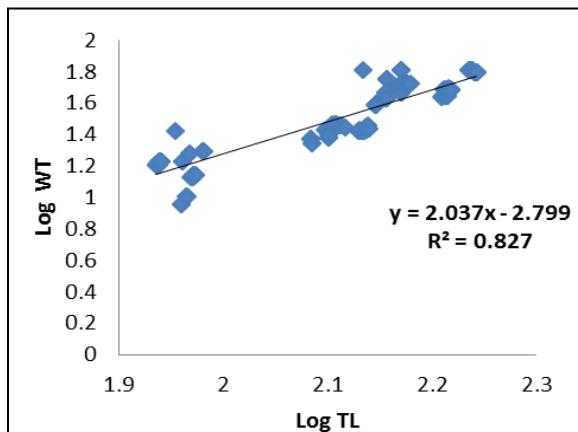


Fig 1A: LWR female, Mumbai.

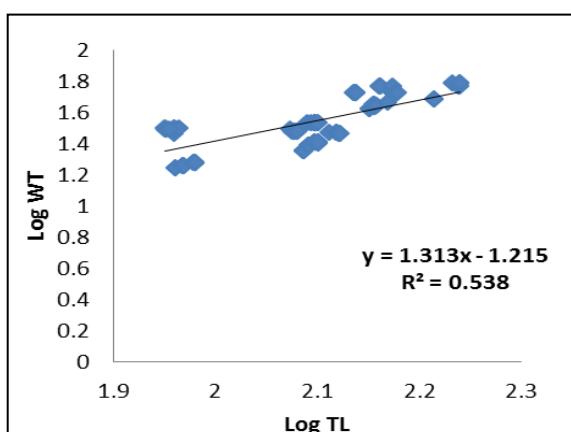


Fig 1B: LWR male, Mumbai.

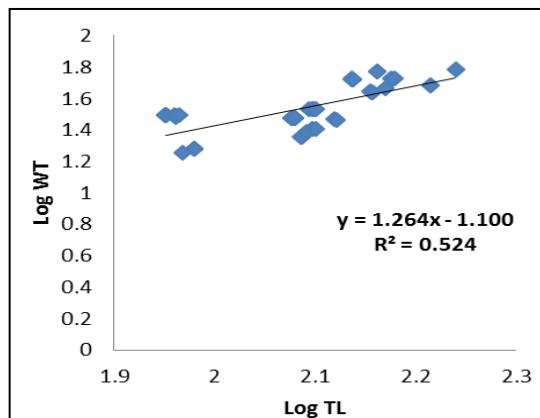


Fig 1C: LWR for pooled, Mumbai.

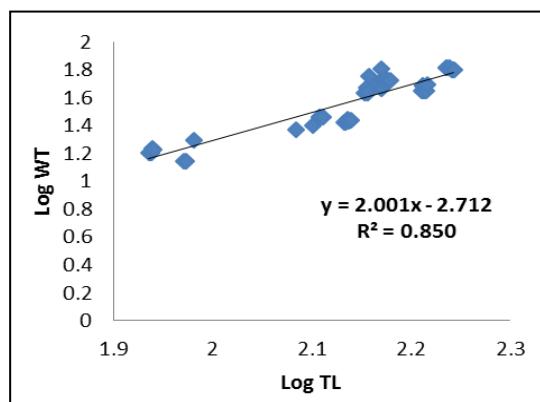


Fig 2A: LWR female, Goa.

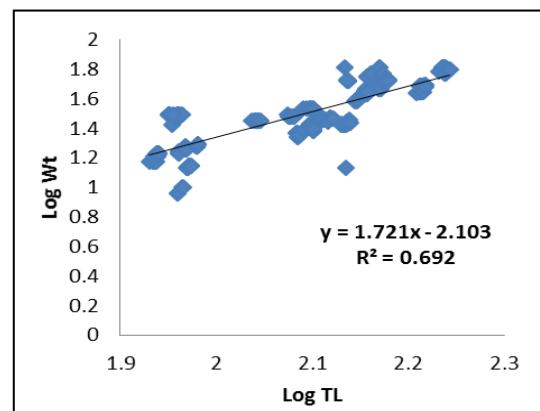


Fig 2B: LWR male, Goa.

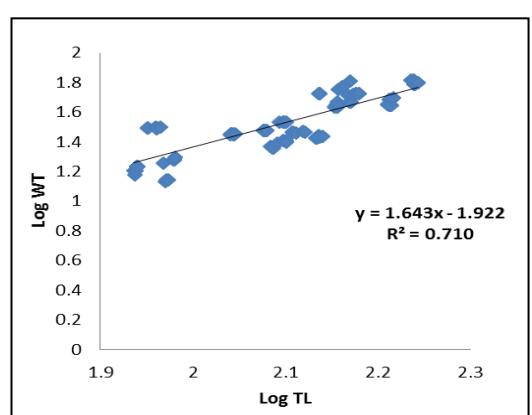


Fig 2C: LWR for pooled, Goa

The value of regression coefficient 'b' of the study of length-weight relationship was found to be less than 3 in both species, indicating negative allometric growth in the species from both the Coasts (table 1). Condition factor (K) values were higher in males; (2.0609 and 2.0962) for Mumbai and fishes of Goa, respectively. This indicate overall better condition of males than females (1.5329- Mumbai and 1.4879- Goa). However, overall pooled values for males and females did not differ significantly from both sites (1.7827 - Mumbai and 1.7978 - Goa) (Fig 3). Month wise study

revealed lowest K value in females during July (1.0603) at Mumbai Coast and May (1.2063) at Goa Coast. The K values, in male, were lowest in the month of November at both the Coasts; 1.5150 at Mumbai and 1.5630 at Goa (table 2). Condition factor (K) is a useful means to understand the health of the fish as well as monitor feeding intensity, age and growth rates [9]. The results of the present study indicate better health condition of the species at both coasts as the condition factor was higher than unity.

Table 1: Range of total length and weight, regression analysis, for length- weight relationship and test for isometry.

	Total Length (mm)		Weight (gm)		LWR Regression analysis			Test for Isometry		P value
	Min	Max	Min	Max	a	b	Se (b)	R2	t -stat	
Mumbai										
Pooled	85.19	175.13	9.03	65.16	-24.753	0.470	0.017	0.707	28.447	2.268
Female	86.23	175.13	9.03	65.16	-33.281	0.522	0.021	0.773	24.376	5.357
Male	89.21	173.68	17.61	61.24	-16.032	0.417	0.028	0.615	14.801	3.325
Goa										
Pooled	86.23	175.18	13.56	65.17	-23.490	0.468	0.027	0.723	17.480	2.044
Female	86.23	175.13	13.91	65.16	-14.203	0.408	0.047	0.597	8.608	1.938
Male	89.32	173.63	18.23	61.24	-34.508	0.536	0.037	0.789	14.467	1.445

*- P values are significant at 5% significance.

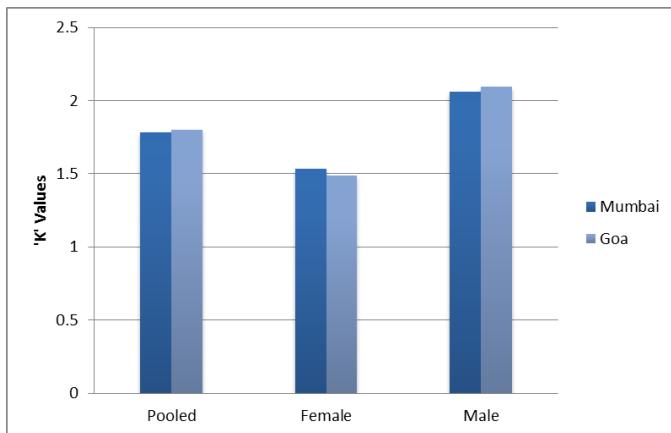


Fig 3: Distribution of Condition factor (K) for two locations- Pooled, female and male data

Table 2: Condition Factor "K" Values

Month	AK- Mumbai		AK- Goa	
	Female	Male	Female	Male
Jul	1.0603	—	—	—
Aug	1.3469	2.4083	—	2.4902
Sep	1.2872	2.2464	1.4443	2.417
Oct	1.5945	2.1078	1.3577	2.263
Nov	1.3916	1.515	1.5859	1.563
Dec	1.7724	2.0468	1.4938	1.8296
Jan	1.3663	2.2555	2.4622	2.2859
Feb	1.5091	1.829	1.5203	3.9971
Mar	1.6375	1.8382	1.4839	1.8219
Apr	1.6322	2.1895	1.3452	2.1895
May	1.2868	2.0404	1.2063	2.0404
Mean	1.5329	2.0609	1.4879	2.0962

The values of exponent b in length-weight equation were found to be less than 3, indicate negative allometric growth of the fish. The slope value (b) at Mumbai Coast was found slightly higher (1.721) than Goa Coast (1.643) indicating better food availability and faster growth rate. The experimentally determined value of b in several species of fish [10] has been shown to fluctuate around 3.0. According to Pauly (1984) [11] the value of b lies between 2.5 and 3.5,

usually close to 3.0; when 'b' is equal to 3, growth is considered to be isometric. The growth is said to be allometric when $b \neq 3$, it can be either positive ($b > 3$) or negative, ($b < 3$) allometric. A number of reasons have been proposed to influence the 'b' value of fish including the gender, age, season, ontogenetic changes, feeding, number of sampled fish, anthropogenic stressors and various maturity stages.¹²⁻¹⁶. Predominance of older or mature groups of fishes could significantly reduce b value.

Month wise study of condition factor (K) indicated high value in December (1.7724) in females and August (2.4083) in males of Mumbai Coast. At Goa Coast high K values were observed in January (2.4622) in females and in February (3.99) in males. (table-2).

According to Le Cren (1951), K>1 indicates good general condition of the fish. If K<1, the reverse condition can be stated. In the present study the highest value of 'K' was observed in males than in females along both the coast. The 'K' value is known to be strongly influenced by the biotic and abiotic conditions, and can be used as an ecological indicator of the ecosystem health [17]. During present study mean 'K' values are almost similar in pooled data, while sex wise comparison shows slightly higher values in male populations than female, at both the coast. This clearly indicates that the male population is in good health than female.

Conclusion

The study indicates nearly similar growth pattern in *A. kleinii* of Mumbai and Goa which also point towards similar ecological condition of the two sea areas as both are the part of Arabian sea. Variation in conditions of males and females in certain months is associated with the fluctuations in the local environmental conditions and reproductive activities.

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