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Estimation of length-weight relationship of six coral reef fishes of order Perciformes from Gulf of Mannar, southeast coast of India

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Abstract
The length-weight relationship (LWR) of six coral reef fishes *Chaetodon octofasciatus, lutjanus decussatus, lutjanus rivulatus , lutjanus lutjanus, lutjanus johnii* and *Apolemichthys xanthurus* from the coral regions of Gulf of Mannar named Tuticorin, Vembar, Keelakarai, Mandapam and Rameswaram were studied using the allometric growth equation $W=aL^b$. The 'b' value of 4 species of reef fishes out of six were found very close to the isometric value of 3.0, other two showed negative allometry. The value of regression co-efficient(r) was greater than .9 in *Chaetodon octofasciatus*, *Lutjanus decussatus* and *Lutjanus lutjanus* indicating the proper fit of the model for growth.

Keywords: Length-weight relationship, *Chaetodon, Lutjanus, Apolemichthys*, Gulf of Mannar, Correlation co-efficient.

1. Introduction
Coral reefs are one of the most valuable and fragile resources in the earth. It holds the highest number of species in the ocean [1] and the highest number of families, orders, or any higher classification on the entire planet [2]. Gulf of Mannar in the southeastern coast of India is a home to many species of reef fishes.
Length-weight data are useful and are needed to estimate growth rates, length and age structures, and other components of fish population dynamics [3]. It is also useful for comparing life history and morphological aspects of population inhabiting different regions [4, 5]. Length-weight relationships (LWR) are usually calculated through linear regression on log transformed data. The known formula of [6] in which the weight of fish is expressed as a function of the length is $W=aL^b$, where 'W' is the weight of fish, 'L' is the total or standard length (in this case Total length) and 'a' is the initial growth index and 'b' is the regression coefficient. The above equation can be transformed to linear equation by taking the logarithm of the variables. Log W=loga+bLog L.

2. Materials and methods
Samples of different species of fishes of order Perciformes collected from different regions in Gulf of Mannar such as Tuticorin (N-08°47'37.5" latitude and E-078°09'37.0" longitude), Vembar (N-09°04'28.5" latitude and E-078°21'58.5" longitude), Keelakarai (N-09°13'34.8" latitude E-078°47'14.6" longitude), Mandapam (N-09°16'30.7" latitude and E-079°09'04.3" longitude) and Rameswaram (N-09°17'39.6" latitude and E-079°19'42.0" longitude) (Fig 1) during the period of 2012-2013.The study was based on 776specimens which include *Chaetodon octofasciatus* (87)*, Lutjanus decussates* (126)*, Lutjanus rivulatus* (127)*, Lutjanus lutjanus* (144)*, Lutjanus johnii* (106) and *Apolemichthys xanthurus (186).* Samples were measured for total length (from tip of the snout to tip of the lower caudal lobe) to the nearest mm and weight (at an accuracy of .5g). Co-efficient 'a' and 'b' of the length-weight relationship were determined by regression after log transformation. Goodness of fit determined using the co-efficient of determination (r^2) [7] values. The correlation coefficient 'r' also determined to check the degree of significance between length and weight of species.

3. Results and Discussion
The length weight relationships of six species of reef fishes are shown in table 1. The results of regression analysis are shown in table 2. Logarithmic relationship between length and weight

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with regression equation of fishes are shown in Fig.2. Growth of fish is positive allometric when 'b' is greater than 3(b>3) and negative allometric when 'b' is lesser than 3 (b<3). Here the value of 'b' varied between 1.6243 and 3.3812. The co-efficient of determination (r^2) explains the variation in weight in relation to variation in length. The 'r^2' values of undergone study include *Chaetodon octofasciatus* (.9612), *Lutjanus decussatus* (.953), *Lutjanus rivulatus* (.0529), *Lutjanus lutjanus* (.9454), *Lujanus johnii* (.8034) and *Apolemichthys xanthurus* (.4309). The correlation coefficient 'r' value ranged between .2300-.980385 for this selected species [8]. States that species follows the isometric growth equation $W=aL^3$ and significant variation from this are rare in fishes. Usually the value of 'b' varies between 2.5 and 4 but may change [9]. The dispersion of estimated values here shows that except *Lutjanus rivulatus*, all other fishes does not show significant difference in 'b' value from the isometric value of '3' as shown in table 2.The 'b' value obtained for *Lutjanus lutjanus* here conform the findings of [10]. The 'b' value of *Lutjanus lutjanus* was 2.932 from New Caledonia. The value of regression co efficient 'b' reported for *Chaetodon octofasciatus*, *Lutjanus decussatus*, *Lutjanus lutjanus* and *Apolemichthys xanthurus* as listed in Fish Base 2014 [11] are seen to range mostly between

2.73 and 3.99). The values of 'b' obtained for these species in the present study also fall in the same range. Slope value 3.0 indicates that fish become more slender as the increase in length (isometric) and slope lesser than 3 indicates the growth is negative allometric. Here The slope value was significantly lower than critical isometric value 3 in *Lutjanus rivulatus, Lutjanus lutjanus* and *Lutjanus johnii* indicating negative allometric growth whereas 'b' value was equal or higher in *Chaetodon octofasciatus, Lutjanus decussatus* and *Apolemichthys xanthurus*. The coefficient of determination (r^2) values explained the proper fit of the model for growth except *Lutjanus rivulatus* and *Apolemichthys xanthurus*. Lowest value of r^2 were recorded as *Lutjanus rivulatus* .0529 and highest recorded as .9612.Very few studies are available on the LWR OF coral reef fishes from India especially from south east coast of India (Gulf of Mannar regions). There are reports of LWR relationship of *Odonus niger* [12], *Siganus canaliculatus* [13], *Scatophagus argus* [14] from Gulf of Mannar. Coral reef ecosystems are fragile and sensitive. Gulf of Mannar is a home of rich diverse icthyofauna. The length weight parameters hereby reported may be considerable use in ongoing studies of coral reef fishes of Gulf of Mannar.

Table 1: The logarithmic regression equations showing the relationship between the length and weight of six species of reef fishes from Gulf of Mannar

SL. No	Species	Family	Length-weight relationship
1	*Chaetodon* octofasciatus	Chaeotodontidae	log W=2.9808 LogL-4.6249
2	*Lutjanus decussates*	Lutjanidae	log W=3.343 LogL-6.0464
3	*Lutjanus rivulatus*	Lutjanidae	log W=1.6243 LogL-1.991
4	*Lutjanus lutjanus*	Lutjanidae	log W=2.8114 Log L-4.6194
5	*Lutjanus johnii*	Lutjanidae	log W=2.6496 Log L-4.1957
6	*Apolemichthys xanthurus*	Pomacanthidae	log W=3.3812 log L-5.6385

Table 2: The result of regression analysis of coral reef fishes

Sl. No.	Species	b	r	r^2	No. Of ob.*	Length range (mm)
1	*Chaetodon octofasciatus*	2.9808	.980385	.961	87	64-92
2	*Lutjanus decussatus*	3.343	.976215	.953	126	90-165
3	*Lutjanus rivulatus*	1.6243	.2300	.0529	127	163-185
4	*Lutjanus lutjanus*	2.8114	.9729	.9454	144	110-197
5	*Lutjanus johnii*	2.6496	.8963	.8034	106	165-186
6	*Apolemichthys xanthurus*	3.3812	.6564	.4309	186	105-172

*Number of observations.

4. Acknowledgements

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