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Length –Weight relationships for some rock pool fishes off Visakhapatnam, East Coast of India

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Abstract
The rock-out crops off Visakhapatnam coastal area are rich productive that supports important fishery activities, however, the increase in human population's exhibit heavy pressure on their resources. This issue had raised the importance of sustainable management tools for this rock pool ecosystem. Length-Weight Relationships (LWRs) are important fish stock assessment tools were investigated in the different rock pool areas off Visakhapatnam coastal waters. A total of ten (10) fish species were selected for this study that belong to seven families Scorpaenidae, Gerridae, Holocentridae, Chaetodontidae, Gobidae, Blenniidae and Acanthuridae. The highest species number (n= 3) were recorded for Scorpaenidae family. All length-weight regressions were significant with a coefficient of determination (r^2) varying from 0.828 (*Parascorpaena picta*) to 0.988 (*Gerres filamentosa*). Growth coefficient, *b* of the LWR ranged from 2.084 (*Gobiodon rivulatus*) to 3.250 (*Istiblennius lineatus*). In the present study out of 10 species, n= 3 are exhibited negative allometric growth pattern, n =5 are positive allometric growth and n =2 had isometric growth. We can conclude that our results are useful references for Visakhapatnam coastal waters management and particularly rock pool fishes.

Keywords: Length weight relationship, rock pool, Visakhapatnam.

1. Introduction
Length-weight relationships are beneficial for a wide variety of studies, including growth rate estimation, structure of age, and other aspects of fish population dynamics. The use of length-weight regressions has been extensively applied to studies on: the estimation of biomass from length observations required in yield assessment [1]. Length-weight relationship (LWR) is of great importance in fishery biology and assessment studies [2, 3]. Fisheries information is scarce for the species represented in different regions [4]. Length and weight measurements can give information on the stock composition, life span, mortality, growth and production of resources [5]. In fish studies, fish length is often more rapidly and easily measured than mass. The length-weight relationships make it more convenient to determine mass where only the length is well-known [6]. The present study describes the LWR studies for 10 species (5 families) represented in the tide pools of the rock-out crops off Visakhapatnam coastal area. The coastal area off Visakhapatnam coast supports important commercial fisheries. This rocky coast supports richest growth of algae and major food and shelter to macro and meiofauna. Such information is of immense value in fishery management for future regulation of catches.

2. Materials and Methods
The tidepool sampled at Lawsons Bay, Bheemunipatnam beach and Thenneti beach, off Visakhapatnam, Middle East Coast of India are located in a rocky flat exposed at low tide and thereby isolating a large number of pools. Using hand nets, trammel nets, cast nets, hook and line, three rock pools were sampled every week between January 2014 – June 2014. Samples were collected and total length was taken from tip of snout to caudal fin end (TL) measured to the nearest millimetre and weighed to the nearest grams. In the laboratory, fishes were identified to species level, based on following authors [7]. A total of 743 specimens were collected during the present study.
The monthly data was pooled and subsequently grouped into classes of 5 mm intervals. The length weight relationship was studied following [8].
The relationship between the length and weight of a fish is usually expressed by the equation, $W = aL^b$

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Where W – body weight (g)
  L- total length (mm)
  a – coefficient related to body form and
  b- exponent

Values of the exponent *b* provide information on fish growth. According to [9], b' values may range from 2.5 to 3.5. When *b* =3, increase in weight is isometric. When the value of *b* is other than 3, weight increase is allometric, (positively allometric if *b*>3) [10].

Table 1: Length-weight relationship for intertidal rockpool fishes from Visakhapatnam coastal waters, India.

Family – species	n	Length range (mm)	*a*	*b*	*r²*	Growth type
Scorpaenidae						
Parascorpaena picta **(Cuvier, 1829)**	365	92-179	0.0000309	3.125	0.828	Allometric(+)
Scorpaenopsis cirrosa **(Thunberg, 1793)**	207	86-192	0.000055	3.131	0.931	Allometric (+)
Scorpaenopsis rosea **Day, 1828**	18	66-188	0.000026	2.960	0.988	Allometric (-)
Gerridae						
Gerres filamentosus **Cuvier, 1829**	22	36- 58	0.00500	3.130	0.988	Allometric (+)
Holocentridae						
Myripristis murdjan **(Forsskal, 1775)**	28	140-194	0.0357	3.084	0.832	Isometric
Sargocentron rubrum **(Forsskal, 1775)**	40	111-212	0.0089	3.102	0.849	Allometric (+)
Chaetodontidae						
Chaetodon decussatus **Cuvier, 1829**	14	37-120	0.026	2.672	0.923	Allometric (-)
Gobidae						
Gobiodon rivulatus **(Ruppell,1828)**	22	28-64	0.020	2.084	0.986	Allometric (-)
Blenniidae						
Istiblennius lineatus **(Valenciennes, 1836)**	12	27-68	0.080	3.25	0.991	Allometric (+)
Acanthuridae						
Acanthurus mata **Cuvier, 1829**	15	15-32	0.021	3.004	0.980	Isometric

3. Results and Discussion

The length-weight relationships of 10 species of fish representing 10 families are presented in this study. The family name, species name, sample size (N), size range (minimum and maximum), length-weight parameters *a* and *b*, coefficient of determination (*r2*), and standard error of slope (*b*) are given in Table (1). This rockpool species studied belong to seven families, the families with the highest species number were Scorpaenidae (n =3), Holocentridae (n =2), Gerridae (n= 1), Chaetodontidae (n = 1) Gobidae (n=1) Blennidae (n= 1) Acanthuridae (n=1).

A total of 743 individuals were collected and samples size ranged from 12 individuals for *Istiblennius lineatus* to 365 *Parascorpaena picta*. Fish size as small as 27 mm *Istiblennius lineatus.* 212 mm *S. rubrum.*

In the world many workers have reported both isometric and allometric growth for different type of species from various water bodies [11]. Parameters of length weight relationships are affected by several factors such as season, sample size, habitat, gonad maturity, sex, diet and stomach fullness, health, fish activities, seasonal growth rates and preservation techniques [12].

This study provided the basic information on the length-weight relationships of 10 fish species from the Visakhapatnam rock pool system that will be useful for the management of fishery resources.

4. Acknowledgements

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