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Length weight relationship of two marine catfishes *Plicofollis tenuispinis* (Day) and *Plicofollis dussumieri* (Valenciennes) from Andhra Pradesh, India

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Abstract

Thinspine sea catfish (*Plicofollis tenuispinis*) and Blacktip Sea Catfish (*Plicofollis dussumieri*) are the common catfish species of Andhra Pradesh coast of India. Length weight relationship study was conducted on these two species for which monthly sampling was done for two years from September 2012 to March 2014. A total of 429 specimens of *P. tenuispinis* and 393 specimens of *P. dussumieri* were collected from fishing boats of Vishakhapatnam fish landing centre, Andhra Pradesh. The regression coefficient values (b) in this study for male *P. tenuispinis* was 3.013 which indicates the growth was almost near to isometric in nature whereas for females and combined (both male and female together) were 2.837 and 2.934 respectively which indicates negatively allometric growth and regression coefficient values for male, female and combined sexes of *P. dussumieri* were 2.832, 2.872 and 2.845 respectively which indicates negatively allometric growth for both the sexes and pooled as well.

Keywords: LWR, catfish, ariidae, negative allometry, positive allometry

Introduction

Length-weight relationship (LWR) is an essential element in fisheries management [1]. LWR of an organism shows its pattern of growth, habitat support, feeding behaviour, competition and survivability [2] and is an important parameter in fish biology for calculating unknown weight from known length or vice versa. Investigations on the LWR enable to compare the population of same species from different localities [3, 4]. The factors influencing the variation in LWR of fishes may be due to food availability, sex, maturation, spawning seasons and water conditions. LWR are often used as an indicator for gonadal development of fish and are used to study the life history traits of different species [5, 6]. The establishment of LWR is often needed to estimate the production and biomass of any fish or shrimp population [7]. Cone (1989) indicated that the connection between fish weight and length is usually used to compare the effect of biotic and abiotic factors on the health or well-being of a fish population [8]. There are numerous studies on length weight relationship in different species of fishes from Indian sub continent [9, 10, 11] and even on catfishes [12, 13, 14, 15, 16, 17]. The marine catfishes viz., *Plicofollis tenuispinis* (Day, 1877) (thin spine sea catfish) and *Plicofollis dussumieri* (Valenciennes, 1840) (black tip sea catfish) belongs to the family ariidae are common species in the coastal waters of Andhra Pradesh. They contribute a big share to the catfish catches of India. We attempted to study the LWR of *P. dussumieri* and *P. tenuispinis* from Vishakhapatnam waters.

Materials and methods

A total of 429 specimens of *P. tenuispinis* and 393 specimens of *Plicofollis dussumieri* were collected during the study period. The specimens were sampled from the commercial trawl catches at Vishakhapatnam fish landing centre, Andhra Pradesh, India. Monthly sampling was done from September 2012 to March 2014. Data on length, weight and sex were taken from fresh specimens. Measurement of total length (TL) of each fish was taken from the tip of snout (mouth closed) to the extended tip of caudal fin using a measuring board in cm, and body weight (W) was measured with digital balance to the nearest 0.01 grams and sex was

determined for each specimen. $W = aL^b$ could be fitted to the data, where W = weight of the fish; L = total length of the fish, a (intercept) and b (regression coefficient) are two constants. The values of a and b were estimated by performing linear regression on log transformed equation: $\log W = \log a + b \log L$ [18]. The graph of log weight against log total length was plotted for both the species. Statistical analysis of data for the estimation of a and b , were carried out with Microsoft Excel 2010.

Results

A total of 429 specimens (219 male and 210 female) of *P. tenuispinis* and 393 specimens (201 males and 192 female) of *P. dussumieri* were collected from Vishakhapatnam fish landing centre of Andhra Pradesh. *P. tenuispinis* specimens vary in sizes from 14.8 to 51 cm in length, 36 to 835 gm in weight for female and 13.2 to 51 cm in length and 23 to 835

gm in weight for male specimens and *P. dussumieri* vary from 19 to 52 cm in length and 70 to 1420 gm in weight for female specimens and 19.7 to 54.1 cm in length and 50 to 1250 gm in weight for male specimens. The regression coefficient values of male *P. tenuispinis* was 3.013, which indicates the growth is almost equal to isometric in nature whereas for females and combined sexes it was 2.837 and 2.934 respectively, shows negatively allometric growth and for male, female and combined sexes of *P. dussumieri* was 2.832, 2.872 and 2.845 respectively which indicates negatively allometric growth (Table 1). Scatter diagram of LWR was plotted for males, females and combined sexes separately for *P. dussumieri* (Figure 1) and *P. tenuispinis* (Figure 2). The r^2 value in LWR of *P. tenuispinis* and *P. dussumieri* was relatively high which indicates a strong relationship between the length and weight in both the species. The logarithmic equation for LWR of both species is as follows:

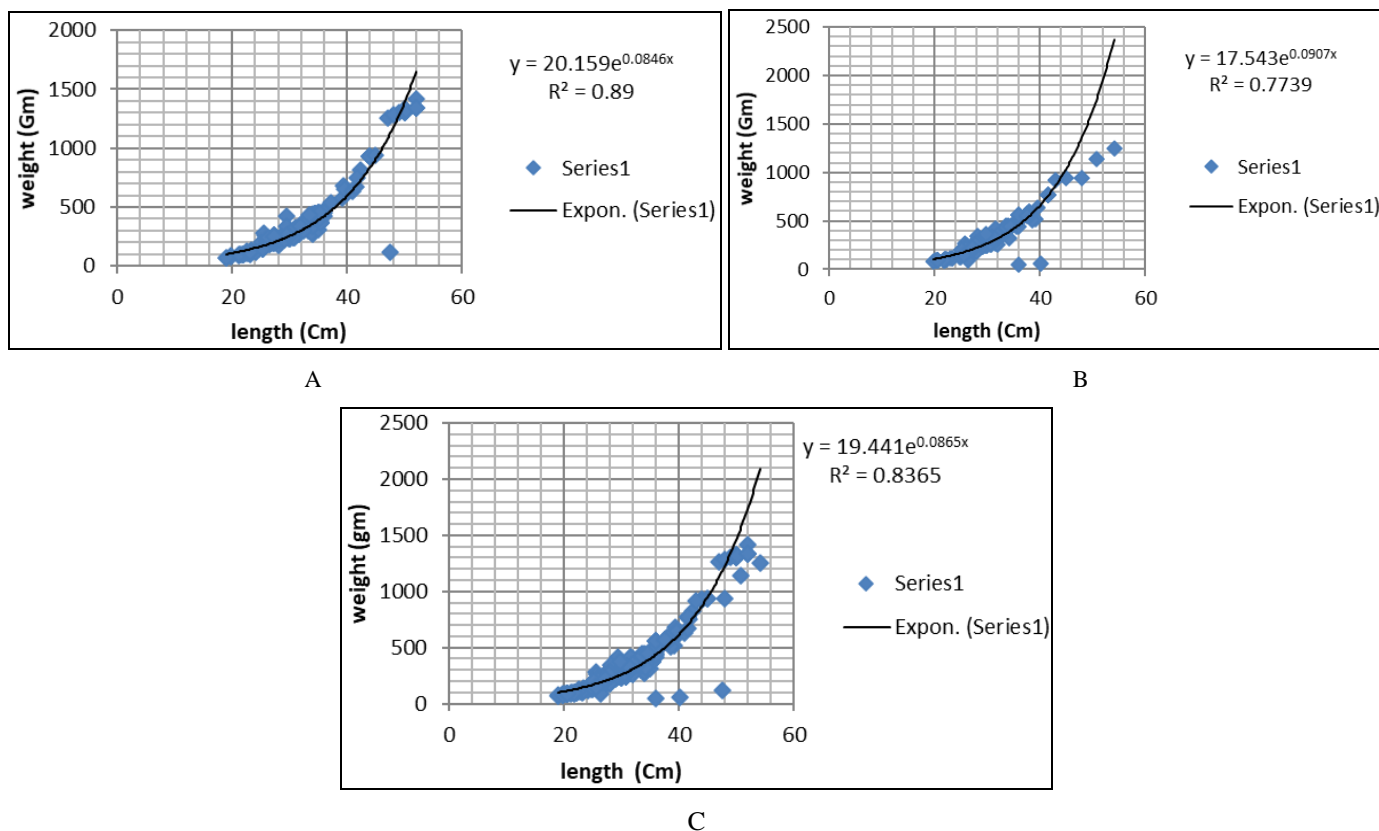
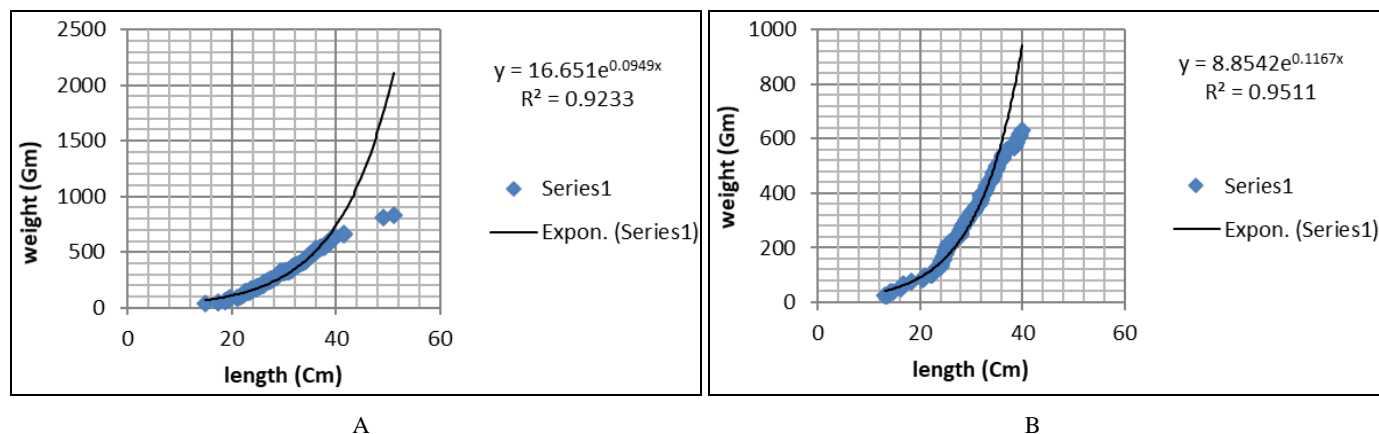
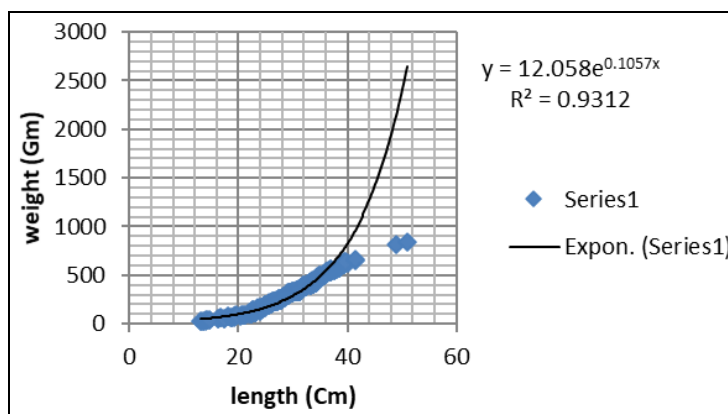


Fig 1: Exponential scatterplot between length and weight of *P. dussumieri* A: female; B: male and C: pooled





C

Fig 2: Exponential scatterplot between length and weight of *P. tenuispinis* A: female; B: male; C: pooled

Table 1: a, b and r² values of *P. tenuispinis* and *Plicofollis dussumieri*

	<i>P. tenuispinis</i>			<i>Plicofollis dussumieri</i>		
	a	b	r ²	a	b	r ²
Male	0.1407	3.013	0.986	0.1765	2.832	0.807
Female	0.1811	2.837	0.978	0.1640	2.872	0.909
Pooled	0.1574	2.934	0.9827	0.1718	2.845	0.863

Table 2: a and b values of *P. tenuispinis* and *P. dussumieri* of earlier workers from different parts of the world

Species	Author	Location	'a' value	'b' value
<i>P. tenuispinis</i>	Dan and Mojumdar (1978)	off false point and off Visakhapatnam, India	0.0184	2.8860 (combined)
	Das et al., (1997)	India	0.415946 0.266229	2.2562 (male); 2.5589 (female)
	Raje (2003)	Mumbai, India	0.011374 0.006744	2.8052 (males) 3.0233 (female)
	Sawant et al., (2013)	Mumbai, India	0.25924 0.168976 0.598098	2.583 (male) 2.858 (female) 2.720 (Pooled)
	Taherimirghaed et al., (2013)	Northwest of Persian Gulf, Iran	0.000004 0.000006 0.000007	3.15 (male) 3.07 (female) 3.08 (combined)
	Mehanna et al., (2012)	Arabian Sea, Oman	0.0277	2.8324 (combined)
	Hashemi et al., (2013)	North of Persian Gulf, Iran	0.00009 0.00004 0.00005	3.15 (male) 3.07 (female) 3.08 (combined)
	Present work	Andhra Pradesh, India	0.1407 0.1811 0.1574	3.013 (male) 2.837 (female) 2.934 (combined)
<i>P. dussumieri</i>	Dutta and Hazra (2013)	West Bengal, India	0.00001	2.984 (combined)
	Menon and Muthiah (1987)	Mandapam, India	0.00001047	2.6479 (combined)
	Present work	Andhra Pradesh, India	0.1765 0.1640 0.1718	2.832 (male) 2.872 (female) 2.845 (combined)

P. tenuispinis

Male: log W = -1.96112 + 3.013 log L
 Female: log W = -1.7085 + 2.8374 log L
 Pooled: log W = -1.8484 + 2.934 log L

P. dussumieri

Male: log W = -1.7344 + 2.832 log L
 Female: log W = -1.8074 + 2.872 log L
 Pooled: log W = -1.7609 + 2.845 log L

Discussion

The parameter 'a' is a scaling coefficient for the weight at length of the fish species whereas the parameter 'b' is a shape parameter for the body form of the fish species, they may vary between sexes or different stocks. The change in b values

depends largely on the body shape and fatness/ thinness of the species [19]. In general, the value of 'b' ranges from 2.5 to 4.0 but for ideal fish which maintains same shape is '3' [20, 21, 22]. The 'b' value of males, females, and combined sexes in this study were highly significant (p < 0.05) in the t- test analysis. But 'b' values of male *P. tenuispinis* obtained from this study is not significantly different from '3', hence the male fish grows isometrically in this particular fish. Isometric growth generally refers to increase in body weight with increase in length.

A comparative study on the length weight relationship and condition factor of two ariid catfish species were carried out by Sawant et al. (2013) [23]. Other notable works on the length weight relationship of catfish species are that of Menon and Muthiah (1987) [13] on important catfishes of India, Das et al.,

(1997) [14] on *P. tenuispinis*, Sawant and Raje (2009) [15] on *Arius caelatus* and *Arius thalassinus*, Davies *et al.* (2013) [16] on *Clarias gariepinus*, Balamurugan *et al.* (2013) [17] on *Arius arius*, Dan and Mojumdar (1978) [12] studied the length weight relationship of *P. tenuispinis*. [24] Awasthi *et al.*, (2015) studied LWR of *Trichogaster lalius* from different pond ecosystems of eastern and central regions of India. The study indicated negative allometric ($b < 3$) growth and did not follow the cube law. The value of 'b' changes from season to season [25] and from month to month [26], availability of food is the major reason for its instability.

The present study revealed the existed difference of 'b' value between the sexes. Similar dissimilarities between the sexes of *P. tenuispinis* have been observed by earlier workers [12, 14, 23, 27, 28, 29, 30]. The values of *b* obtained for *P. dussumieri* in this study were 2.832, 2.872 and 2.845 for male, female and combined sexes respectively which indicates the negative allometric growth. Similar kind of results obtained for earlier workers [13, 31].

Conclusion

The *b* value indicates negative allometric growth for female and combined sexes and positive allometric growth for male in *P. tenuispinis*. The values of *b* obtained for *P. dussumieri* in this study for male, female and combined sexes indicates the negative allometric growth. The purpose of the length-weight relationships given here is to contribute to the knowledge of the length-weight relationships of two common catfishes from Vishakhapatnam coast, Andhra Pradesh. This study could help fishery researchers and managers for better understanding.

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