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Length-weight relation and condition factor of *Coilia dussumieri* (Valenciennes, 1848) in the trawl fishery off Digha, West Bengal, India

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Abstract
A total of 546 samples (365 males and 181 females) of *Coilia dussumieri* were collected randomly from the trawl landings at Digha (West Bengal) Fishing Harbour during January 2014 to December 2016. Length ranged from 9.0 to 16.5 cm and weight from 4 to 16 g for males and in females, the length ranged from 12.0 to 17.0 cm and weight from 4 to 14 gm. The regression equation for length-weight relation in males and females was Log W = -1.30346 + 1.943241 logL (r =0.22596) (males) and Log W = -2.0008 + 2.53047 logL (r =0.44652) (females). The slope in the relation showed negative allometry in both the sexes. Highest condition factor of 0.34±0.20 in males was observed in December and January and the lowest of 0.28±0.16 was reported in March, July and October. For females, the highest condition factor was observed in January and September of 0.33±.019 and the lowest of 0.27±0.16 was in June and July.

Introduction
Coilia dussumieri is an economically important fish species. It is known as Gold spotted grenadier anchovy and Painted tail anchovy. The common name for this species is Mandeli (Gujarati and Marathi), Oorialli (Oriya) and Ruli mach (Bengal). It is landed in most maritime states. It inhabits more or less the shallow water and estuaries of the Bay of Bengal. The gold spotted anchovy, *Coilia dussumieri* is widely distributed in the Indian Ocean from Gujarat to West Bengal, Bangladesh, Myanmar, Thailand and Malaysia. It is an important pelagic resource along the West Bengal coast, landed by trawlers and 'Doll' netters. The length-weight relationship of a fish helps in establishing the mathematical relationship between the two variables (Le Cren, 1951) [1]. Length weight relationships are very important in fisheries management for comparative studies of growth according to Moutopoulos and Stergiou (2002) [2]. The relationship studies give important information in fishery assessment for predicting weight from length required for yield estimation (Garcia et. al. 1998) [3]. The length and weight relationship is important in fish biology, physiology, ecology and for fisheries assessment (Oscoz *et al*., 2005) [4]. Condition factor is an useful index for monitoring the feeding intensity, age and growth rate in fishes and also is required for fish culturist in comparing weights and for determining whether fishes are in good or poor condition (Ndimele *et al*, 2010) [5]. However several author; Fernandez *et al* (1988, 1989, 1996) [10-12], Shingadia (2014) [9], Mahapatra *et al* (2015) [13], Dhanya *et al* (2004) [14], Nurul Amin *et al* (2004) [15], Kwun *et al* (2010) [16] and Chaklader *et al* (2018) [17] had studied the length-weight relations and condition factors, stock assessments and reproductive traits for the species, but there is also no published information available till date on the trawl fishery of *Coilia dussumieri* from Digha, West Bengal, India. The present study aims to detail the length-weight relation and condition factor for the species from the coastal waters of Digha, India.

Material and Methods
Study area
The state of West Bengal lies between longitudes 85°50' N and 89°50'E and latitudes 21°38' E and 27°10'N. The state has a coastline of 158 km (Srinath *et al*., 2007) [6] along its two coastal districts viz., Purba Medinipur and South 24 Parganas. Digha Mohana is the biggest landing center. At Digha Mohana, both multiday trawlers and gillnetter are operated. The geographical location of Digha Mohana is 21° 41' 0" North and 87° 33' 0" East.

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Fig 1: Location of Digha in India

Materials and Methods

A total of 546 samples of *Coilia dussumieri* were collected randomly from the trawl landings at Digha (West Bengal) Fishing Harbour during January 2014 to December 2016. Total length (mm) and body weight (gm) were measured. Length - weight relationship was calculated as $W = aL^b$ (Le Cren, 1951) [1]. The significant differences in the slopes of the regression lines for males and females were ascertained by Analysis of Covariance ANACOVA (Snedecor and Cochran, 1967) [7]. The parameters 'a' and 'b' were estimated by the least-square method from logarithmically transformed data, and the association degree between weight-length variables was calculated by the determination coefficient (r^2). The statistical significance level of r^2 and 95% confidence limits of the parameters 'a' and 'b' were estimated. The value of regression co-efficient for isometric growth is 3 and if values are greater or lesser than 3, it indicates allometric growth. If the regression co-efficient is greater than 3 it indicates positive allometry and if it is less than 3 it indicates negative allometry. The null hypothesis of the isometric growth was tested by t – test (Snedecor and Cochran, 1967) [7] which is being done to find out whether the 'b' values for males and females are significantly different from 3, using the formula [t=b-3/ Sb], where b= regression coefficient and Sb= Standard error of 'b'. The Fulton's condition factor (K) determines the

physical and environmental condition of the fish (Le Cren, 1951) [1]. It is used for comparing the condition, fatness or well-being of fish. The condition factor (K) for *Coilia dussumieri* was calculated using the following equation, K =100 W/L^3 (Gayanilo and Pauly, 1997) [8], where K= condition factor, W= weight of fish (gm) and L= length of fish (cm). The significance of condition factor was tested by ANOVA.

Results

During January 2014 to December 2016, a total 546 *Coilia dussumeri* (365 males and 181 females) were examined. Length ranged from 9.0 to 16.5 cm and weight from 4 to 16 g for males and in females, the length ranged from 12.0 to 17.0 cm and weight from 4 to 14 gm. The regression equation for length-weight relation in males and females was Log W = -1.30346 + 1.943241 log L (r =0.22596) (males) and Log W = -2.0008 + 2.53047 log L (r =0.44652) (females). Growth exhibited negative allometry in both the sexes with significant differences (b<3, *p*<0.05). The scatter plots for the total length-weight relationship for males and females are illustrated in Figures 1 and 2.

The month-wise condition factor (K) of *Coilia dussumeri* from Digha in Bay of Bengal is presented in Figures 3 and 4. No significant differences (*p*>0.05) in condition factor were

observed between males and females. Highest condition factor of 0.34±0.20 in males was observed in December and January and the lowest of 0.28±0.16 was reported in March, July and October. For females, the highest condition factor was observed in January and September of 0.33±.019 and the lowest of 0.27±0.16 was in June and July.

Discussion

Present study provided detailed insights on the length-weight relationship for *Coilia dussumieri* in the trawl fisheries of Digha. Results of the present study are in agreement to that of Mahapatra *et al* (2015) [13]. Negative allometric growth was observed presently. Length-weight relation deviated significantly from the cubic law. Negative allometric growth indicated that the weight increase was at a slower rate than the body length. Several factors such as sex, age, stage of maturity, food availability, fishing ground and environmental conditions impact growth and the same was observed

presently, similar to that reported by Ama-Abasi (2007) [18]. The condition factor gives information on the physiological condition of the fish in relation to its welfare. According to Perry *et al* (1996) [21], fishes with a low condition index are believed to have not insufficient nutrition or are under adverse physical environmental conditions. Ujjania *et al* (2012) [22] stated that condition factor greater or equal to 1 is good, indicating a good level of feeding and proper environmental conditions. In the present study, average condition factor for males and females were 0.31 and 0.32, respectively, which are in agreement with Perry *et al* (2096) [21]. According to Bagenal and Teach (1978) [19], Ujjania *et al* (2012) [22] and Gupta and Banerjee (2015) [20] k value for a fish is affected by several factors such as feeding intensity, availability of food, fish size, age, sex, season, stage of maturation, degree of muscular development, the amount of reserved fat and life history; and the same was observed presently.
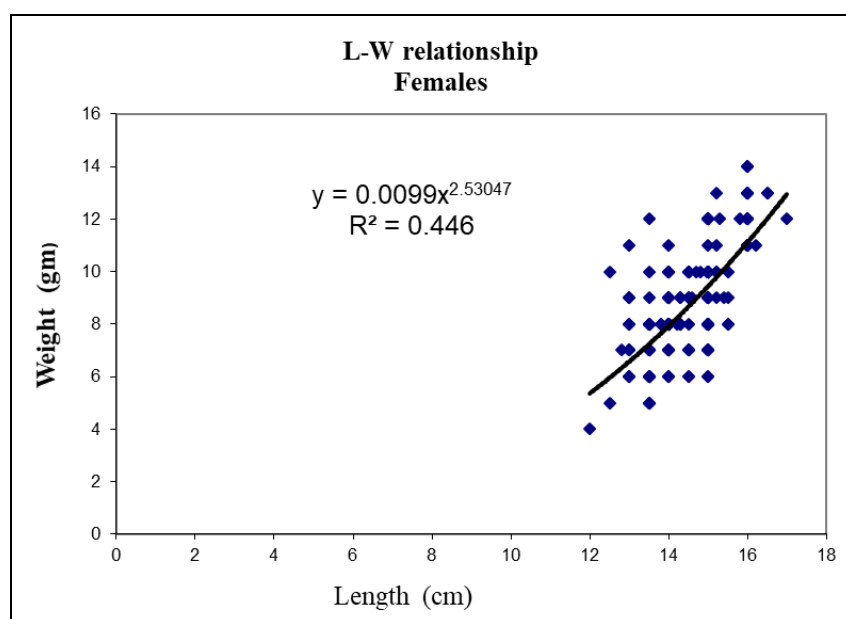

Fig 2: Total length - weight relationship in females of *Coilia dussumeri* sampled from Digha during January 2014 to December 2016.
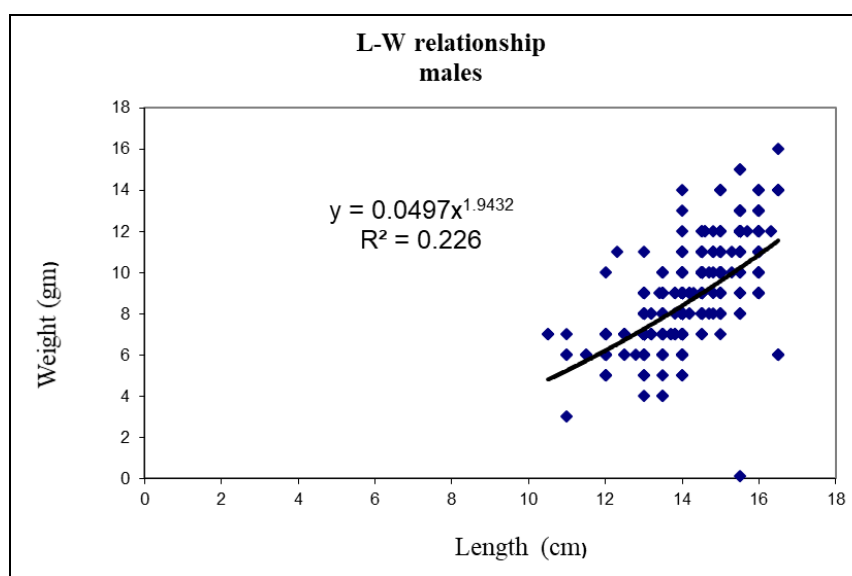

Fig 3: Total length - weight relationship in males of *Coilia dussumeri* sampled from Digha during January 2014 to December 2016.
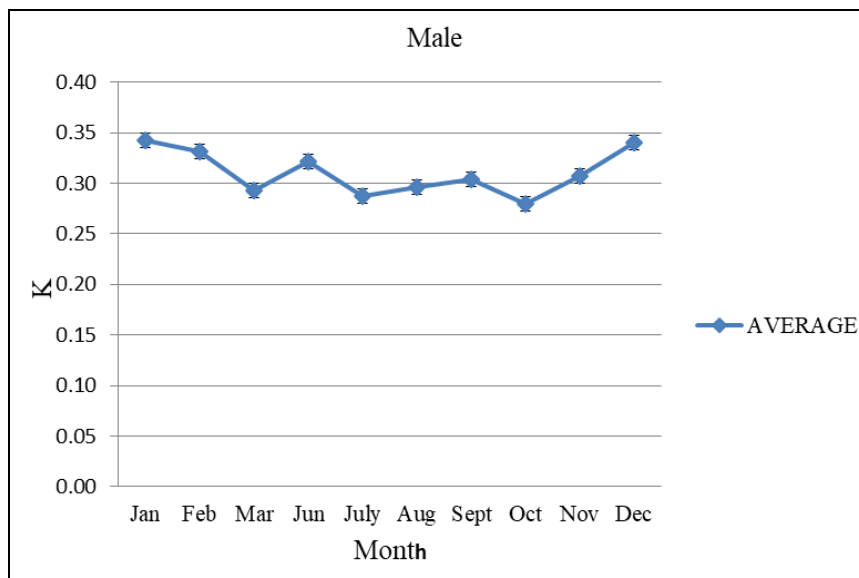
Fig 4: Average condition factor in males of *Coilia dussumeri* sampled from Digha during January 2014 to December 2016.
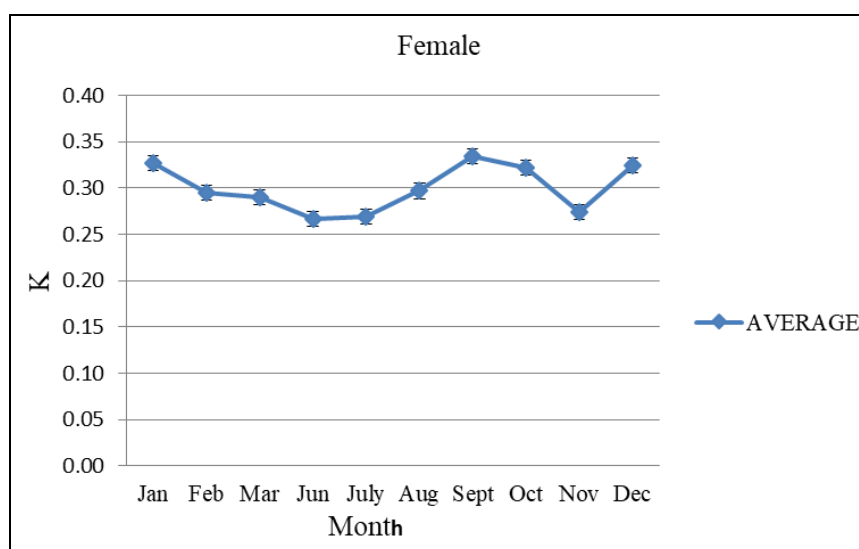

Fig 5: Average condition factor in females of *Coilia dussumeri* sampled from Digha during January 2014 to December 2016

Conclusion
Present study provided detailed insights on the length-weight relationship for *Coilia dussumieri* in the trawl fisheries of Digha. This is a first study paper of *Coilia dussumieri* at Digha coast. This suggests that the weight is slower than length growth. This paper will be helpful for further study.

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