BIOMETRIC MEASUREMENTS OF FRINGE SCALE SARDINE- *SARDINELLA FIMBRIATA* (CUV. and VAL., 1847)

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ABSTRACT
Study of biometric characters of *Sardinella fimbriata* from Karwar coast, Karnataka was carried out during the period, December- 2011 to December- 2012. Present study was carried out to gain some knowledge about length-length relationship and the difference between the biometric characters of fish. The knowledge of biometric characters has various practical applications in fishery biology. Randomly sampled 100 fish were studied. Morphometric measurements were taken in order to compare the degree of association between various characters. The fish were grouped into various length groups by taking 5 mm class interval. Total Seventeen morphometric characters were studied. A fish measurement was calculated as a percentage of the head length / total length / standard length and processed statistically. The significant difference between variables was calculated and the regression equations were obtained for conversion of variables into head length or standard length, by using the formula: (Y=a+bX). The analysis of morphometric characters revealed that standard length has fastest growth rate when compared to total length while eye diameter has lowest growth rate when compared with head length.

KEY WORDS: Biometry, Fringe scale sardine, *Morphometric measurements, Sardinella fimbriata*

INTRODUCTION
The classification of clupeids, just as any other fish groups has been a challenging task to the taxonomists. There are several genera included under this family, mostly comprises closely related species among which the lesser sardines with a common generic name *Sardinella* is facing the problem of great controversy. Study of morphometric and meristic characters helps to identify the fish up to species level. During the study period morphometric and meristic characters of *S. fimbriata* were studied in order to find out the variations in different characters among various size groups.

MATERIALS AND METHODS
Karwar is located at $14^0 48'$ 30" N and 74^0 07' 42" E., in the Karnataka state.
Morphometric measurements of *S. fimbriata* were studied from January- 2012 to December- 2012 in order to compare the degree of association between various characters. Randomly sampled total 100 specimens of *S. fimbriata* (110 to 160 mm of total length) were studied for morphological details. The morphometric measurements were taken by using fish measuring board and with the help of pair of dividers. The observations were taken to the nearest millimeter. The fish were grouped into length groups by taking class intervals of 5 mm length each. Seventeen morphometric characters were studied. The collected data was analyzed and processed statistically. The significant difference between variables was calculated and the regression equations were obtained for the conversion of variables into head length or standard length, by using the formula: $Y = a + b X$.

MORPHOMETRY
The characters that were considered for morphometric study of *S. fimbriata* were- X- Total length; Y1- Standard length; Y2- Head length; Y3- Snout length; Y4- Eye diameter; Y5- Post orbital length; Y6- Inter-orbital distance; Y7- Snout to insertion of first dorsal; Y8- Snout to the insertion of the pectoral; Y9- Snout to the insertion of the pelvic; Y10- Snout to the insertion of the anal; Y11- First dorsal to ana1; Y12- Body depth; Y13- Caudal fin length; Y14- Dorsal fin base; Y15- Dorsal fin length; Y16- Anal fin base and Y17- Maxillary length (Fig. 1).

The proportion of variables was calculated in percentage of head length or standard length by using the formula:

$P = \frac{Y}{X} \times 100,$ (Where: X- represents the head length or standard length of fish). Here standard length (Y1) and Head length (Y3) was considered as X and Y2 to Y17 were the variables. Head length (Y3) was taken into consideration for the calculation of variables concerning with the head region and their proportion was obtained in relation to the head and for rest of the variables were co-related with the standard length (Day, 1889 and Regan, 1917). The calculated values for each variable were plotted against the head or standard length and the regression equations were obtained.
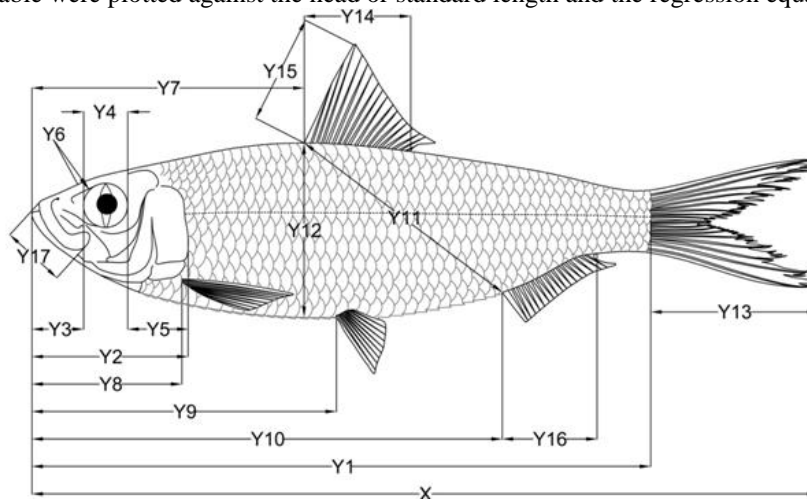

Fig. 1: *Sardinella fimbriata* (Cuv. & Val.)

Where: X- Total length;	Y6- Inter-orbital distance;	Y12- Body depth;
Y1- Standard length;	Y7- Snout to insertion of first dorsal;	Y13- Caudal fin length;
Y2- Head length;	Y8- Snout to the insertion of the pectoral;	Y14- Dorsal fin base;
Y3- Snout length;	Y9- Snout to the insertion of the pelvic;	Y15- Dorsal fin length;
Y4- Eye diameter;	Y10- Snout to the insertion of the anal;	Y16- Anal fin base and
Y5- Post orbital length;	Y11- First dorsal to anal;	Y17- Maxillary length

RESULT AND DISCUSSION

Species *S. fimbriata* was studied for various morphometric characters.

X- Total length of fish, ranged between 110-165 (mean- 138, Standard deviation ±55 and Standard Error- 0.1, Total length- 100% with variable 10).

Y1- Standard Length of fish, ranged between 87-130 (mean- 196, Standard deviation ±43 and Standard Error- 0.4, Total length- 70.40% with variable 7.04).

Y2- Snout Length of fish, ranged between 7-10.5 (mean- 8.8, Standard deviation ±3.5 and Standard Error- 0.2, Total length- 32.11% with variable 3.21).

Y3- Head length of fish, ranged between 22-32 (mean- 27.4, Standard deviation ±10 and Standard Error- 0.12, Total length- 13.97% with variable 1.3).

Y4- Eye Diameter of fish, ranged between 6-9.5 (mean- 7.75, Standard deviation ±3.5 and Standard Error- 0.3, Total length- 28.28% with variable 2.82).

Y5-Post orbital length of fish, ranged between 9-12.5 (mean- 9.67, Standard deviation ±3.5 and Standard Error- 0.11, Total length- 35.29% with variable 1.3).

Y6- Inter orbital distance of fish, ranged between 3.1-4.1 (mean- 3.6, Standard deviation ±1 and Standard Error- 0.1, Total length- 13.13% with variable 1.3).

Y7- Snout to insertion of 1st Dorsal fin, ranged between 38-57 (mean- 47.9, Standard deviation ±19 and Standard Error- 0.1, Total length- 24.43% variable 2.44).

Y8- Snout to insertion of pectoral fin, ranged between 21-31.5 (mean- 26.3, Std. deviation ±10.5 and Std. Error- 0.4, Total length- 13.41% with variable 1.34).

Y9- Snout to insertion of pelvic fin, ranged between 43-64 (mean value- 53.1, Std. deviation ±21 and Std. Error- 0.3, Total length- 27.09% with variable 2.7).

Y10- Snout to insertion of anal fin, ranged between 66-99 (mean value- 82.9, Std. deviation ±33 and Std. Error- 0.12, Total length- 42.29% with variable 4.2).

Y11- 1st dorsal to anal of fish, ranged between 35-72 (mean value- 45.9, Std. deviation ±37 and Std. Error- 0.1, Total length- 23.41% with variable 2.34).

Y12- Body depth of fish, ranged between 24-37 (mean value- 30.7, Standard deviation ±13 and Standard Error- 0.3, Total length- 15.66% with variable 1.56). Y13- Caudal Fin Length of fish, ranged between 23-37 (mean value- 29.4, Standard deviation ±12 and Standard Error- 0.2, Total length- 15% with variable 1.5). Y14- Dorsal Fin Base of fish, ranged between 14-23 (mean value- 18.3, Std. deviation ±9 and Std. Error- 0.5, Total length- 9.35% with variable 0.935).

Y15- Dorsal Fin Length of fish, ranged between 16-24 (mean value- 19.6, Standard deviation ±8 and Standard Error- 0.2, Total length- 10% with variable 1). Y16- Anal fin base of fish range 13-20 (mean value- 16.2, Standard deviation ±7 and Standard Error- 0.3, Total length- 8.26% with variable 0.83) and

Y17- Maxillary Length of fish, ranged between 8-13.5 (mean value- 10.8, Std. deviation ±5.5 and Std. Error- 0.3, Total length- 5.51% with variable 0.55).

Regression equations obtained for Different body part measurements of *Sardinella fimbriata* are shown in the Table 1.

Table- 1. Regression equations obtained for Different body part measurements of *Sardinella fimbriata* (Head/Standard length Vrs. Variables)

Characters considered	Equations obtained
Total length (X)	: $Y = 0.783 X + 0.456$ (r = 1, P < 0.05);
Head length (Y2)	: $Y = 0.302 X + 0.523$ (r = 0.963, P < 0.05);
Snout length (Y3)	: $Y = 0.251 X - 0.030$ (r = 0.990, P < 0.05);
Eye diameter (Y4)	: $Y = 0.303 X - 0.575$ (r = 0.972, P < 0.05);
Post-orbital length (Y5)	: $Y = 0.353 X + 1.078$ (r = 0.892, P < 0.05);
Inter-orbital distance (Y6)	: $Y = 0.477 X - 0.903$ (r = 0.998, P < 0.05);
Snout to the insertion of first dorsal fin (Y7)	: $Y = 0.090 X + 1.126$ (r = 0.969, P < 0.05);
Snout to the insertion of pectoral fin (Y8)	: $Y = 0.254 X - 1.363$ (r = 0.979, P < 0.05);
Snout to the insertion of pelvic fin (Y9) Snout to the insertion of anal fin (Y10)	: $Y = 0.520 X - 3.655$ (r = 0.948, P < 0.05); : $Y = 0.765 X - 0.622$ (r = 0.997, P < 0.05);
First dorsal to the anal fin (Y11):	: $Y = 0.383 X + 2.080$ (r = 0.995, P < 0.05);
Body depth (Y12)	: $Y = 0.286 X - 0.454$ (r = 0.991, P < 0.05);
Caudal fin length (Y13)	: $Y = 0.276 X - 0.761$ (r = 0.990, P < 0.05);
Dorsal fin base (Y14)	: $Y = 0.195 X - 3.023$ (r = 0.983, P < 0.05);
Dorsal fin length (Y15)	: $Y = 0.173 X + 0.628$ (r = 0.940, P < 0.05);
Anal fin base (Y16)	: $Y = 0.521 X - 3.475$ (r = 0.946, P < 0.05);
Maxillary length (Y17)	: $Y = 0.160 X - 1.271$ (r = 0.944, P < 0.05);

The analysis of morphometric characters revealed that standard length has fastest growth rate when compared to total length while eye diameter has lowest growth rate when compared with head length. During present study, the results obtained for morphometric and meristic characteristics of *S. fimbriata* were closely similar to the findings by Day (1889), Regan (1917) and Bhat (1981).

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