MATSYA, 1991 **17** : 57-61.

Evaluation of morphometric and meristic characters of white sardine, *Escualosa thoracata* (Valenciennes) (Family : Clupeidae) from India

B.V. SHESHAGIRI RAO, B. RATNAMALA AND S. GIRIJAKUMARI
Department of Zoology, D.N.R. College (Autonomous), Bhimavaram - 534 202, AP, India. .

Abstract

Random samples of white sardine, *Escualosa thoracata* (Valenciennes) from four localities are compared using a heuristic stepwise procedure of multivariate analysis of variance for nine meristic characters and seven body measurements. Three meristic characters, namely pectoral fin rays, gillrakers on lower arm, prepelvic scutes and a single morphometric character, the prepelvic distance are important in discriminating the samples.

Key words : *Escualosa thoracata;* morphometry; meristic characters.

INTRODUCTION

The white sardine, *E. thoracata* forms an important fishery on the west coast of India. Using 't' test and Chi-square test (Bailey, 1959) for the meristic characters and Multivariate analysis (Rao, 1952) for body measurements, Rao (1978) has shown that the samples of *Escualosa thoracata* from Bombay (West coast) and Gollapalem (East Coast) belonged to two different stocks. Hence, the need was felt that a suitable biometric method to distinguish the stocks of *E. thoracata* from various localities in India which would be useful for future workers in the selection of best characters to discriminate the stocks and to solve the evolutionary and species problems.

MATERIAL AND METHODS

Random samples of *E. thoracata* were collected from Goa, Mangalore, Calicut (West Coast) and Tuticorin (East Coast) (Fig.1) (Table.1). Nine meristic and seven morphometric characters were analysed.

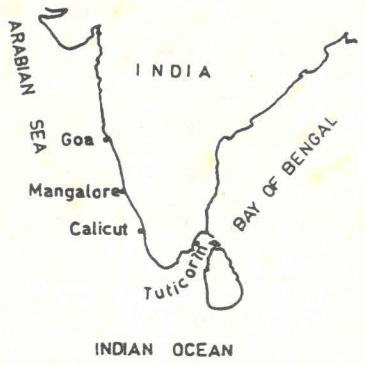

Fig. 1 The collection localities

Table 1: Length ranges of White Sardine in different localities

	Place	Date	n	Total length (mm)	Standard length (mm)
1.	Goa	29 Dec.,1978	60	95.0-115.0	74.0-90.0
2.	Mangalore	31 Dec.,1978	40	104.0-122.0	84.0-98.0
3.	Calicut	1 Jan., 1979	55	101.0-115.0	80.0-91.0
4.	Tuticorin	4 Jan., 1979	40	79.0-100.0	60.0-78.0

Table 2: Mean values (x) and standard deviation (S.D.) of 9 meristic characters in different localities.

Locality	D.rays	P.rays	A.rays.	Gr.u.	G.r.l.	Pre.s	Post.s	Pre.H.V.	H.V.
Goa (x)	16.100	12.450	18.750	19.016	31.316	18.56	610.483	20.483	19.833
S.D.	±0.629	±0.594	±1.002	±1.408	±2.012	±0.721	±0.724	±0.676	±0.615
Mangalore (x)	16.275	12.050	18.700	18.850	32.075	18.850	10.300	20.775	19.775
S.D.	±0.452	±0.552	±0.939	±1.406	±1.227	±0.483	±0.607	±0.619	±0.619
Calicut (x)	16.218	12.527	18.818	19.000	31.981	18.890	10.200	20.636	19.854
S.D.	±0.599	±0.503	±0.904	±1.440	±1.789	±0.314	±0.486	±0.588	±0.558
Tutucorin (x)	16.025	12.350	19.025	18.400	31.000	18.925	10.025	20.650	19.850
S.D.	±0.479	±0.579	±0.919	±1.215	±1.568	±0.266	±0.576	±0.579	±0.662

Table 3 Mean values (x) and Standard deviation (S.D.) of 7 body measurements

Locality	T.L.	S.L.	D	H.L	Pre.D	Pre.Pelvic	Pre. Anl
Goa (x)	103.300	81.516	26.600	20.183	37.700	39.216	58.850
S.D.	±4.358	±3.127	±1.380	±1.096	±1.860	±2.042	±2.996
Mangalore (x)	112 950	89.750	29.575	21.800	41.950	44.825	65.325
S.D.	±3.948	±3.425	±1.258	±1.042	±1.600	±1.946	±2.484
Calicut (x)	107.618	85.636	27.890	21.636	39.381	42.509	62.327
S.D.	±3.582	±2.876	±1.271	±1.111	±1.592	±1.783	±2.494

Table 4: Meristic characters - variables arranged in a step-wise decreasing order of importance with corresponding Wilk's value and Bartlett transformation.

Number of variables used	Serial number of variables used	Value of Wilks'^	Bartlett transformation
1.	2 (Pectoral fin rays)	0.910	17.685
2.	2,6	0.834	34.015
3.	2,6,5	0.782	46.232
4.	2,6,5,7	0.749	54.303
5.	2,6,5,7,1	0.727	59.953
6.	2,6,5,7,1,3	0.706	65.563
7.	2,6,5,7,1,3,8	0.687	70.704
8.	2,6,5,7,1,3,8,9	0.675	73.907
9.	2,6,5,7,1,3,8,,9,4	0.668	75.972

Table 5: Meristic characters - variables arranged in a step-wise decreasing order of importance with corresponding Wilk's value and Bartlett transformation.

Number of variables used	Serial number of variables used	Value of Wilks' ^	Bartlett transformation
1.	6 (Prepelvic distance)	0.415	131.576
2.	6,5	0.372	148.217
3.	6,5,4	0.328	167.051
4.	6,5,4,3	0.319	171.196
5.	6,5,4,3,2	0.312	174.540
6.	6,5,4,3,2,1	0.295	183.089
7.	6,5,4,3,2,1,7	0.286	187.324

RESULTS AND DISCUSSIONS

Specimens from Mangalore are larger in size followed by Calicut, Goa and Tuticorin. The Tuticorin sample contained immature specimens of smaller size group. The state of maturity of gonads suggests that the specimens from the west coast belong to a prespawning shoal; the gonads of Calicut specimens were in slightly advanced stage when compared to other localities.

Nine meristic characters (dorsal, pectoral, anal fin rays, gillrakers on upper and lower arms, prepelvic scutes, postpelvic scutes, prehaeamal vertebrae and haemal vertebrae) and seven body measurements (total length, standard

length, body depth, head length, predorsal distance, prepelvic distance and preanal distance) were used in the present analysis.

Mean values (x) and standard deviation were estimated for meristic characters and body measurements for samples from each locality (Tables 2 and 3). To test whether the samples from different localities belong to the same stock or two different stocks, dispersion and correlation matrices were computed. Wilks ^ criterion and Bartlett's transformation was used following Rao (1973). In addition, a heuristic stepwise procedure was followed to discriminate the stocks using the technique of Roy and Majumdar (1984). In case the samples belonged to different stocks, this technique also provides a way of determining the variables that are enough to obtain the discrimination as well as a measure of discrimination by using each variable after arranging them in a stepwise decreasing order of importance.

MERISTIC CHARACTERS

Table 4 provides Wilks ^ statistic and the Bartlett transformation in the samples from four localities. In this case Bartlett transformation is distributed as Chi-square on 27 degrees of freedom. Wilks ^ statistic is computed using all the nine variables to be 0.668 and the Bartlett transformation to be 75.972. The upper 5% value of Chi-square on 27 degrees of freedom is 40.113. Thus it is evident that the four samples differ significantly from each other.

The number of pectoral fin rays, is the most important character to differentiate the samples. The next important character is number of prepelvic scutes followed by number of gillrakers on lower arm and these three characters together are needed to show that the four samples are significantly different. In the order of their importance these three characters are followed by number of postpelvic scutes, dorsal fin rays, anal fin rays, prehaemal vertebrae, heamal vertebrae and gillrakers on upper arm. Thus the least important character is the number of gillrakers on upper arm (Table 4).

BODY MEASUREMENTS

Table 5 provides values of Wilks ^ statistic and the Bartlett transformation in the samples from three localities (West Coastal) as the three samples belonged to comparable length groups. Wilks ^ statistic is computed using all the seven variables to be 0.286 and the Bartlett transformation worked out to be 187.324. In this case the Bartlett transformation is distributed as Chi-Square on 14 degrees of freedom is 23.684. The prepelvic distance is the most important character to differentiate the samples. This character alone is enough to achieve the discrimination, followed by predorsal distance, head length, body depth, standard length, total length and preanal distance.

The samples from the three localities on the west coast do not show any taxonomic or evolutionary differences between them, but the sample from the east coast (Tuticorin) appears distinct although the distance involved between the western coast sample and that of Tuticorin sample is negligible from an evolutionary point of view.

ACKNOWLEDGEMENTS

We are very much indebted to Prof. J. Roy, Computer Science Unit, Indian Statistical Institute, Calcutta for help in the statistical analysis of data, and Dr. Andrew E. Jahn, Los Angeles Country Museum of Natural History, California for his critical comments on the manuscript. We express our gratitude to Prof. R.J.H Beverton. F.R.S., Department of Applied Biology, UWIST, Cardiff, U.K., for encouragement. We are thankful to the University Grants Commission, New Delhi for financial assistance.

LITERATURE CITED

BAILEY, N.T.J. 1959. *Statistical methods in Biology*. The English Universities Press Ltd, London. 200 pp.

RAO, B.V.S. 1978. Systematic studies on three genera of Clupeoid fishes from Indian waters and a biometric comparison of stocks of three species from two localities. *Ph.D. Thesis. Andhra University, Waltair.*

RAO, C.R. 1952. *Advanced Statistical Methods in Biometric Research*. John Wiley and Sons, N.Y. 390 pp.

RAO, C.R. 1973. *Linear Statistical Inference and its Applications*. 2nd. Ed. John Wiley and Sons, N.Y.

ROY, J. AND P.P. MAJUMDAR. 1984. Choosing a subset of variables for discrimination, *Tech. Report No. ASC/84/3*. Indian Statistical Institute. Calcutta.