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LENGTH WEIGHT RELATIONSHIP AND BIOMETRIC STUDY ON THREE SPECIES OF SCIAENIDS FROM BOMBAY WATERS

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ABSTRACT

The length-weight relationship and biometric study of three species of sciaenids *viz. Otolithes cuvieri, Johnieops vogleri* and *Johnius macrorhynus* are reported. For all the three species the regression coefficient between the sexes was found to be not significant at 5% level. Biometric study indicates that correlation among the various characters compared was fairly good while the meristic data agree well with published data.

INTRODUCTION

The length-weight relationship in exploited fish stocks is determined (1) to express mathematically the relationship between the two variables to enable calculation of length if weight is known or *vice versa* (2) to calculate the relative condition factor (K_n) (Le Cren, 1951) and (3) to use the value of regression coefficient (b) in the yield equation of Beverton and Holt (1957) or the one modified by Jones (1957). The length-weight relationship also serves as a character for distinguishing "small taxonomic units" (Le Cren, 1951). In view of its importance the relationship is calculated in three sciaenid species and the results are presented here.

The identity of fish species stock could often be ascertained by morphometric studies. Recent studies on several species like *Nemipterus japonicus* (Acharya, 1980), *Upeneus sulphureus* and *Trypauchen vagina* (Acharya and Dwivedi, 1984, 1985) and on *Megalaspis cordyla* (Jaiswar and Devaraj, 1989) have amply demostrated that the range of variation used in identification is of considerable importance. A statistical analysis gives a better idea of their relationships in the species.

In the present communication the length-weight relationship and biometric sutdy of three species viz. *Otolithes cuvieri* (Trewavas), *Johnieops vogleri* (Bleeker) and *Johnius macrorhynus* (Mohan) is presented.

MATERIAL AND METHODS

Samples of these species were collected from New Ferry Wharf and Sassoon Docks landing centres of Bombay. The length and weight (to the nearest mm and g respectively) were recorded separarely for males and females. The length weight relationship was calculated by the method of least square using the equation of Le Cren (1951) given as

$$\text{Log } W = \log a + b \text{ Log } L$$

The analysis of covariance (Snedecor and Cochran, 1967) was adopted to test the significance of difference of regression at 5% level.

After bringing the fish to the laboratory they were cleaned and morphometric and meristic counts were taken. Measurements were recorded to the nearest of mm using a divider and measuring board as described by Lagler *et al.* (1962) and Laevastu (1965). Scattergram of various morphometric characters were plotted and then the relationship between the characters were worked out by the formula of linear regression.

$$Y = a + b X$$

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As the compared characters indicated considerable variation from the straight line, standard error of estimates (SYX) was worked out by the formula

$$SYX = \frac{\sqrt{\Sigma Y^2 - ((\Sigma XY)^2/\Sigma X^2))}}{n - 2}$$

The data used relates to 75 specimens of *O.cuvieri* with total length ranging from 146 to 310 mm, 88 specimens of *J.vogleri* with the length range of 171 to 276 mm and 119 specimens of *J.macrorhynus* with the length range of 140 to 242 mm.

RESULTS

Length - Weight relationship :

For *O.cuvieri* the study is based on 336 males ranging from 20 to 265 g and 326 females ranging from 41 to 298 g in weight in the length range of 25 to 324 mm.

The equations obtained were as follows

Males Log W = -5.23749985 + 3.0831 Log L (r^2 = 0.969945)

Females Log W = -4.71957982 + 3.0341 Log L (r^2 = 0.968778)

The ANOCOVA test indicated that the difference between the 'b' values of the sexes was not significant at 5% level (Table I). So data of males and females were pooled and relationship calculated for the species which could be written as

Log W = -5.3311 + 3.127248 Log L (r^2 = 0.989378)

For *J.vogleri* the study is based on 368 males in the length range of 124-248 mm weighing 19 to 185 g and 268 females in the length range of 22 to 267 mm weighing 20 to 248 g.

The equations obtained were :

Males Log W = -5.578258 + 3.27664 Log L (r^2 = 0.95579)

Females Log W = -5.329690 + 3.172794 Log L (r^2 = 0.9966144)

The ANOCOVA test indicated that the difference between the 'b' values of the sexes was not significant at 5% (Table I). So data of males and females were pooled and relationship calculated for the species which could be written as

Log W = -5.584377 + 3.27604 Log L (r^2 = 0.979386)

For the third species *J.macrorhynus* 258 males and 288 females were examined. The length of males ranged from 130 to 296 mm and the weight ranged from 20-246 g. The same for females ranged from 135-287 mm and 28-266 g respectively.

The equations obtained were :

Males : Log W = -5.23401 + 3.0851 Log L (r^2 = 0.983987)

Females : Log W = -4.984396 + 3.0143 Log L (r^2 = 0.9973981)

In this species also the difference between regression coefficients of the sexes was found to be not significant at 5% level (Table I). So data of males and females were pooled and relationship calculated for the species which could be written as

Log W = -4.4672841 + 2.76974 Log L (r^2 = 0.9576844)

Biometric Study :

For *O.cuvieri* the coefficient of correlation of total length of this species against other morphometric characters ranged from 0.4855 - 0.9922666 (Table II). The same for head length against other morphometric characters ranged from 0.661302 - 0.888714 indicating a fairly good correlation except for total length against

Table I : *Comparison of reqression lines in length-weight relationship of males and females of three species of sciaenids from Bombay*

Species : *O.cuvieri*

	d.f.	ΣX^2	ΣY^2	ΣXY	Regression coefficient	Deviation from regression		
						d.f.	S.S.	M.S.
Within								
Males	335	2.4759	25.0180	7.6340	3.0831	334	1.499	0.0044308
Females	325	1.3727	13.4199	4.1651	3.0341	324	0.7819	0.00941327
						658	2.2618	0.0034373
Pooled within	660	3.8486	38.4379	11.7991	3.1272	659 658	2.2640 0.0022	0.00343552 0.00000334346
				Difference between slopes		1	0.0022	0.0022
Between	1	1.7486	12.5937	3.8464				
Total	661	5.02346	51.0316	15.6465		660	2.303896	0.0034907515
				Between adjusted means		1	0.042036	

Comparison of slope : F = 0.000972682; d.f. 1,659; Not significant at 5% level.
Comparison of Elevation : F = 1.016076605 d.f. 1,660; Not significant at 5% level.

Species : *J.vogleri*

	d.f.	ΣX^2	ΣY^2	ΣXY	Regression coefficient	Deviation from regression		
						d.f.	S.S.	M.S.
Within								
Males	367	1.3488	15.8536	4.4155	3.27664	366	1.3988	0.0038218
Females	267	0.9806	10.5769	3.1164	3.0341	266	0.6728	0.0025293
						632	2.0716	0.00327266
Pooled within	634	2.3294	26.4305	7.5319	3.27604	633 632	2.0768 0.0052	0.00328083 0.0000082278
				Difference between slopes		1	0.0052	0.0052
Between	1	0.3677	4.4593	1.2756				
Total	635	2.6971	30.8899	8.8075		634	2.1286	0.00335751
				Between adjusted means		1	0.0518	

Comparison of slope : F = 0.0025141016; d.f. 1,633; Not significant at 5% level.
Comparison of Elevation : F = 1.0233721 d.f. 1,634; Not significant at 5% level.

Species : *J.macrorhynus*

	d.f.	ΣX^2	ΣY^2	ΣXY	Regression coefficient	Deviation from regression		
						d.f.	S.S.	M.S.
Within								
Males	257	0.7901	8.0092	2.4381	3.0851	256	0.4857	0.0018972
Females	287	0.7783	8.0780	2.3461	3.0143	286	1.0059	0.0035173
						542	1.4916	0.0027469
Pooled within	544	1.5684	16.0872	4.7842	2.76894	543 542	1.4936 0.002	0.0027506 0.00000369
				Difference between slopes		1	0.002	0.002
Between	1	0.5772	1.6907	0.9879				
Total	545	2.1456	17.779	5.7721		544	2.2498	0.00413566
				Between adjusted means		1	0.7562	

Comparison of slope : F = 0.000972682; d.f. 1,659; Not significant at 5% level.
Comparison of Elevation : F = 1.016076605 d.f. 1,660; Not significant at 5% level.

Table II : *Linear regession statistics of various measurements against total length and head length*
Species : *O.cuvieri*

Measurement Code	Numbers	Coefficient of correlation	Intercept	Slope	Syx
Total length vs Standard lenght	75	0.992276	-6.70813	0.999106	9.074382
Total length vs Head length	75	0.957170	1.45428	0.239764	3.257257
Total length vs Body depth	75	0.908812	7.46986	0.243928	8.973581
Total length vs Pre ventral length	75	0.485511	18.61054	0.192549	58.47376
Total length vs Pre dorsal length	75	0.919992	-3.02860	0.282264	8.870367
Total length vs Pre anal length	75	0.973220	-8.74131	0.535747	15.95359
Head length vs Snout length	75	0.661302	3.594478	0.178870	1.579622
Head length vs Eye diameter	75	0.768027	3.001495	0.175852	0.949408
Head length vs Post orbital	75	0.821282	0.249306	0.554832	4.584338
Head length vs Body depth	75	0.888714	-5.24077	0.999468	9.936104
Head length vs Inter orbital	75	0.682838	2.389318	0.232083	1.993683
Maximum depth vs Minimum depth	75	0.868644	1.634349	0.314836	1.330862

Table III : *Linear regession statistics of various measurements against total length and head length*
Species : *J.vogleri*

Measurement Code	Numbers	Coefficient of correlation	Intercept	Slope	Syx
Total length vs Standard lenght	88	0.921356	-8.62051	0.885776	60.34313
Total length vs Head length	88	0.930899	-7.41794	0.273290	5.971658
Total length vs Body depth	88	0.937442	-10.8609	0.298721	7.589764
Total length vs Pre ventral length	88	0.942848	-1.83642	0.298326	4.808639
Total length vs Pre dorsal length	88	0.895662	0.418051	0.283820	8.250737
Total length vs Pre anal length	88	0.97420	-13.5474	0.551263	13.59245
Head length vs Snout length	88	0.586980	2.392445	0.238299	2.975807
Head length vs Eye diameter	88	0.518889	4.985962	0.156548	2.299926
Head length vs Post orbital	88	0.878130	1.929596	0.547129	3.031403
Head length vs Body depth	88	0.9357	-1.36930	1.1063304	5.204279
Head length vs Inter orbital	88	0.710362	-1.170005	0.246625	1.335177
Maximum depth vs Minimum depth	88	0.797753	1.566308	0.272564	1.651648

Table IV : *Linear regession statistics of various measurements against total length and head length*
Species : *J.macrorhynus*

Measurement Code	Numbers	Coefficient of correlation	Intercept	Slope	Syx
Total length vs Standard lenght	119	0.974502	-5.509757	0.8991709	11.85704
Total length vs Head length	119	0.134955	25.90413	0.099389	41.51627
Total length vs Body depth	119	0.007473	40.97416	0.02556	66.79276
Total length vs Pre ventral length	119	0.815633	-9.60759	0.327488	13.75364
Total length vs Pre dorsal length	119	0.425289	12.16292	0.218590	35.35851
Total length vs Pre anal length	119	0.801891	-13.8643	0.646000	55.88491
Head length vs Snout length	119	0.368912	-5.766766	0.1164301	3.969015
Head length vs Eye diameter	119	0.529466	4.235644	0.152395	1.290808
Head length vs Post orbital	119	0.001573	22.04201	0.02335	25.38462
Head length vs Body depth	119	0.668547	6.409401	0.849223	16.87747
Head length vs Inter orbital	119	0.73542	8.113697	0.067720	3.930649
Maximum depth vs Minimum depth	119	0.653450	2.931243	0.249559	1.716481

preventral length which is rather poor.

For *J.vogleri* the coefficient of correlation for morphometric characters plotted against total length ranged from 0.895662 - 0.9742 (Table III) and the same for head length against other morphometric characters ranged from 0.518857 - 0.9357. Head length vs snout length and eye diameter exhibited relatively poor relationship.

J.macrorhynus exhibited relatively poor correlation of total length against body depth and head length while head length against post orbital and snout length gave poor correlation (Table IV). The details of meristic characters coounted are presented in Table V.

gleri from Kakinada were not significant at 5% level. Rao (1983) and Vivekanandan (1985) did not observe significant differences in the regression coefficient at 5% level for *J.carutta* from Andhra/Orissa and Madras coasts respectively. In the present study also the same was observed for all the three species and the length-weight relationship compares well with the results obtained elsewhere on the Indian coast on lesser sciaenids.

The morphometric study indicates that correlation among various characters of *O.cuvieri* and *J.vogleri* is fairly good but the same is not true for *J.macrorhynus.*

Table V : *Meristic data of three sciaenid species from Bombay*

Meristic Charecters	*O. cuvieri*	*J. vogleri*	*J. macrorhynus*
No. of specimens	75	88	119
Dorsal spine	X + I	X + I	X + I
Dorsal rays	28 - 32	27 - 29	25 - 27
Anal spines	II	II	II
Anal rays	7	7	7
Lower gill rakers	12 - 16	4 - 6	5 - 7
Pectoral rays	16 - 18	16 - 18	16 - 19
Pelvic rays	7 - 9	6 - 7	7 - 9
Caudal rays	16 - 20	18 -20	16 - 20

DISCUSSION

The 'b' value of 3 indicates isometric growth and a fair number of species seem to approach this 'ideal' value (Ricker, 1958). The length - weight relationship of *J.vogleri* from Bombay waters has been studied by Muthiah (1982) but the ANOCOVA test was not performed by him. The value of regression coefficient b = 3.2861 for males and 3.22808 for females hawever, appears to be very close to the 'b' values of *J.vogleri* obtained in the present study. Murty (1979) and Murty and Ramalingam (1986) reported that the differences in the regression coefficients between the sexes of *Johnius dussumieri, Johnius carutta* and *Pennahia macropthalamus* and *Johnieops vo-*

The various meristic characters agree well with the range given by Trewavas (1977) and Mohan (1984).

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