A STATISTICAL STUDY OF THE DATA OF GROWTH IN SHELL OF *TROCHUS NILOTICUS* LINN. IN ANDAMAN WATERS.

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For examining the rate of growth in *T. niloticus* the following three points have been considered :—

(1) The rates of growth at specific age-periods as defined by the size of the shell (maximum diameter).

(2) The effect of seasonal factors in stimulating or retarding growth.

One such seasonal factor may be the variability of the food supply available to these organisms. As sunshine plays an important part in regard to the growth of aquatic vegetation, the criteria for classifying the seasons that suggested themselves were the monthly values for (1) cloud amount, (2) the rainfall and (3) the number of rainy days. These data for the twelve months of the year are set out below.[1] The readings are for Port Blair and for Indian Standard Time.

Mean monthly figures for cloud amount, rainfall and number of rainy days.

Month.	Cloud amount.	Rainfall.	No. of rainy days.
January	5·2	1·63″	2·0
February	3·6	0·87″	1·2
March	3·5	0·74″	1·0
April	4·6	2·48″	3·9
May	9·2	15·86″	16·0
June	10·0	19·34″	20·1
July	8·9	15·25″	19·5
August	9·8	14·69″	19·3
September	8·4	18·07″	20·0
October	8·5	11·07″	15·7
November	7·0	9·51″	12·2
December	6·3	6·91″	7·7

[1] They represent 'normals' calculated from the figures given in the Monthly Weather Reports for 1935 of the Indian Meteorological Department.

On the basis of these figures it was decided that, from our point of view, the seasons could be classified into two (1)—December-April and (2) May-November.

(3) The effect of sex.

The available data relating to the monthly rates of growth of these animals were, therefore, classified according to the three factors, size or age, season and sex. The data are given in a statement attached to this note.

In carrying out a statistical analysis to evaluate the separate influences of age, sex and season on growth there are two difficulties. One is that, for particular ages, no figures are available. This will not justify us in assuming that the rates of growth at these ages are zero. The blank areas merely indicate failure to secure specimens falling into these age groups during the experiment. Under the circumstances, two lines of treatment are open, namely, either to put in expected mean values in the missing places on the information afforded by the table as a whole or to confine our statistical analysis to those age groups in which the data are complete for the two sexes. The latter procedure was adopted on the assumption that the general picture of the relationship of these three factors to growth will be adequately expressed by taking into consideration the age groups for which complete data are available.

The second difficulty is that inequality of frequencies in the different classes renders the application of the usual methods of analysis of variance unsuitable. Hence the treatment adopted was an approximate analysis of variance suggested by Yates, as given by Snedecor[1] (1934). The results of analyses are given below.

Mean monthly rates of growth classified according to size or age, season and sex.

Size in centimetres (Age).	Males.		Females.	
	December to April.	May to November.	December to April.	May to November.
4—4·99	0·3155	0·3205	0·3342	0·3362
5—5·99	0·3079	0·3044	0·3122	0·3539
6—6·99	0·2609	0·2824	0·2694	0·2934
7—7·99	0·2053	0·2140	0·2329	0·2129
8—8·99	0·1331	0·1460	0·1485	0·1592
9—9·99	0·0916	0·0900	0·1072	0·0945

[1] Snedecor, G. W.—Calculation and Interpretation of Analysis of Variance and Covariance, p. 52, (Collegiate Press Inc. Ames, Iowa, U. S. A.), 1934.

Univariate Analysis of Variance.

Source of variation.	Degrees of freedom.	Sum of squares.	Mean squares.
(1) Between the 24 class means	23	1·617,562,9	0·070,328,8
(2) Within the classes	257	0·697,890,1	0·002,715,5
TOTAL	280	2·315,453,0	

The harmonic mean of the frequencies in the classes-0·107,975
Experimental error=0·107,975 × 0·002,715,5=0·000,293

Bivariate Analysis of Variance of Mean Rates of Growth.

(Males).

Source of variation.	Degrees of freedom.	Sum of squares.	Mean squares.
(1) Between season means	1	0·000,154,09	0·000,154
(2) Between age means	5	0·085,847,81	0·017,170
(3) Residual .	5	0·000,217,99	0·000,044

The mean rates of growth are significantly different from age to age while the two seasons show no significant difference.

Bivariate Analysis of Variance of Mean Rates of Growth.

(Females).

Source of variation.	Degrees of freedom.	Sum of squares.	Mean squares.
(1) Between season means	1	0·000,174,23	0·000,174
(2) Between age means	5	0·092,970,52	0·018,594
(3) Residual	5	0·001,323,10	0·000,265

Here again the influence of the season is not significant while that of age is.

Trivariate Analysis of Variance of Mean Rates of Growth.

(Both sexes).

Source of variation.	Degrees of freedom.	Sum of squares.	Mean squares.
(1) Between season means	1	0·000,327,82	0·000,328
(2) Between age means	5	0·178,616,42	0·035,723
(3) Between sex means	1	0·001,393,85	0·001,394
Interactions.			
(4) Season and age .	5	0·000,789,09	0·000,158
(5) Sex and age .	5	0·000,201,72	0·000,040
(6) Season and sex	1	0·000,000,31	0·000,000,31
(7) Residual	5	0·000,752,19	0·000,150
Experimental error	257	..	0·000,293

The trivariate analysis shows that season has no effect on the rate of growth, that age has a definite effect and that sex may have an effect as the probability for the observed difference in the mean rates of growth(0·0153) of the two sexes or something higher lies between 0·05 and 0·01. The rate of growth is higher in the female.