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ON THE PERCENTAGE EDIBILITY AND THE INDEX OF CONDITION OF THE OYSTER *CRASSOSTREA GRYPHOIDES* (SCHLOTHEIM)

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INTRODUCTION

THE oysters are known to show a variation in the quality of their meat depending on their physiological condition, environmental factors and also the seasons. Several methods have been in vogue to assess this quality. The use of dry weights, glycogen estimation or even the total chemical analysis has been widely adopted (Coulson, 1933 ; Humphrey, 1941 ; Galtsoff *et al.* 1947 ; Jacob, 1951 and Fieger *et al.* 1958). These methods though more precise, cannot be employed for the examination of larger samples. They are also time consuming.

Assessment of quality by objective methods, like estimating the percentage edibility and index of condition have been employed by Odlaug (1946), Ingle (1949), Venkataraman and Chari (1951), Korringa (1955), Rao (1956) and others. The methods used by these workers being less time consuming, can be effectively adopted when large samples are to be examined.

The present investigation was undertaken with a view to assessing the quality of the meat and its seasonal variation in the case of the oyster *Crassostrea gryphoides.* An attempt is also made to compare the two methods, namely the percentage edibility and the index of condition, to determine the suitability of each method.

MATERIAL AND METHODS

For the determination of the percentage edibility, the oysters were brought in fortnightly samples of about 60 each, from a cultivated oyster farm and the extraneous growth on their shells was scraped off. They were thoroughly cleaned under running water with a hard tooth-brush and weighed individually, correct up to 0.1 g. and shucked. The shucked meats were preserved in 5.0% sea water-formalin in separate bottles for eight days. At the end of this period, the meats were blotted individually on a filter paper and weighed. This ensured the constancy in the procedure of weighing as well as in weights.

For the determination of the index of condition, previously cleaned oysters were kept immersed for at least twelve hours in sea water before examination. The oysters were removed in batches of five each and the index of condition was determined by the method of Baird (1958), based on the meat volume and cavity volume. The usual precautions for this type of study were taken. About 50 oysters were examined fortnightly. The observations on the percentage edibility were made by examination of 889 oysters during the period January 1957 to February 1958, while those on the index of condition were made on 1191 oysters, during the period July 1958 to June 1959. During the determination of index of condition, dimensions of shells were also noted. These were measured correct up to 0.1 mm. with a Vernier callipers

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Results and Discussion

Figs. 1 & 2 show the monthly variation in the average percentage edibility in total oysters and in the different sexes *viz.* males, females and indeterminates. It would be seen from Fig. 1 that the percentage edibility remained high from January to June, the highest value (8.75) being in March. Values were slightly low in June. Considerable fall in the edibility is seen from July and the lowest value of 1.28 was seen in the second half of August. These variations closely correlate with the sexual cycle of the oyster under investigation. The spawning in *C. gryphoides* commences in July with the commencement of south-west monsoon and ends in early October along with the monsoon. It appears that the considerable fall in the percentage edibility observed from July to September is due to spawning. From October, as the oysters recover to normalcy and enter resting phase after spawning, the values of

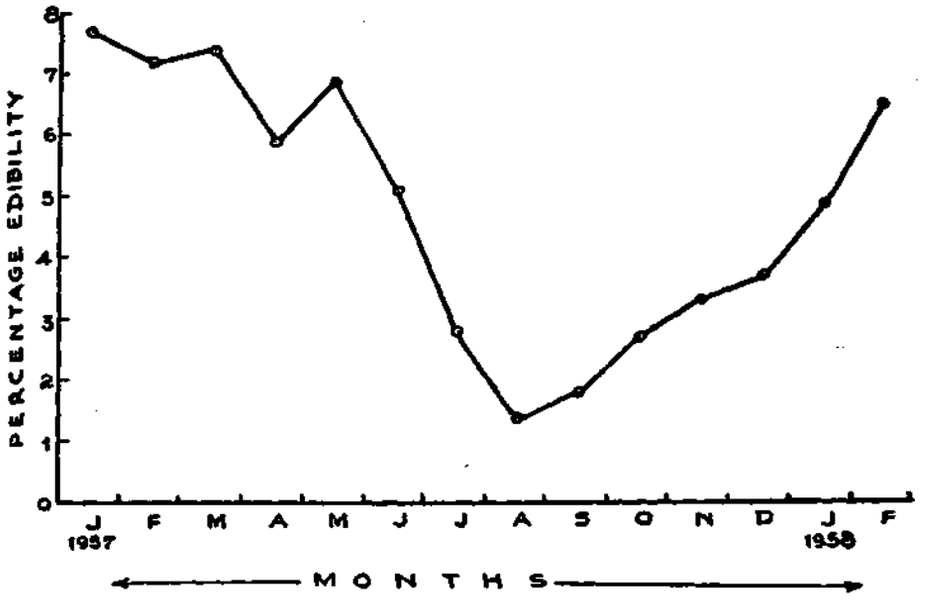

Fig. 1. The monthly variations in the average percentage edibility of *C. gryphoides* during the period, January 1957 to February 1958.

percentage edibility also rise and remain high from December to the following spawning season commencing from July.

The monthly variations in the percentage edibility of males, females and indeterminates follow the same sequence as that of the average edibility of the oysters taken as a whole. However, a close scrutiny of Fig. 2 reveals that the fall in the edibility of females is more rapid than that of males. This indicates that the spawning in females may be more rapid than in males. It is interesting to point out here that Durve and Bal (1961) observed a marked decrease in the glycogen and fat content of the oyster *C. gryphoides* during its spawning season. This suggests a close relationship between the percentage edibility and the chemical composition of this oyster and consequently the quality of its meat.

Figs. 3 & 4 show the monthly variations in the index of condition in the oysters taken as a whole and also in different sexes. The index of condition shows the same

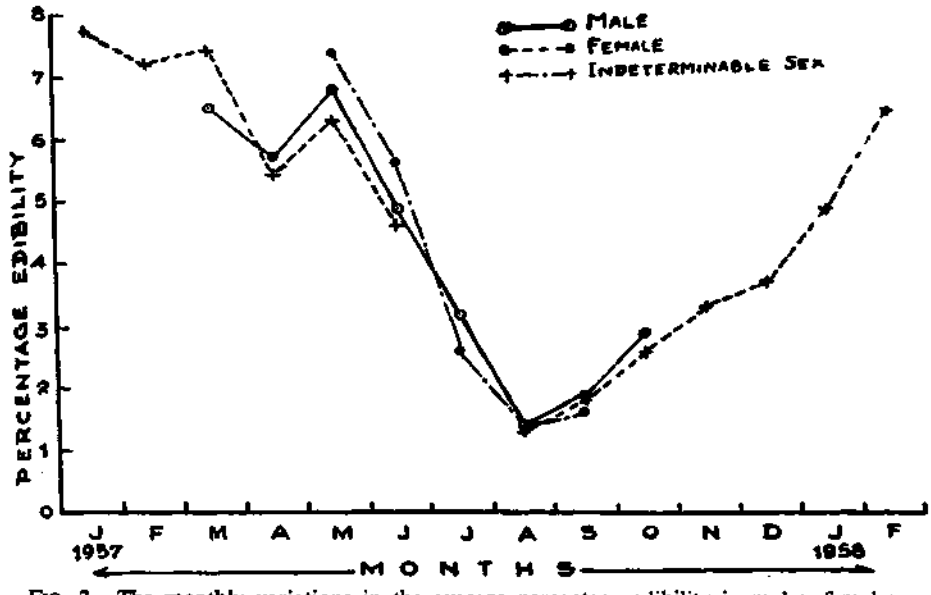

FIG. 2. The monthly variations in the average percentage edibility in males, females and those of indeterminable sex of *C. gryphoides* during the period January 1957 to February 1958.

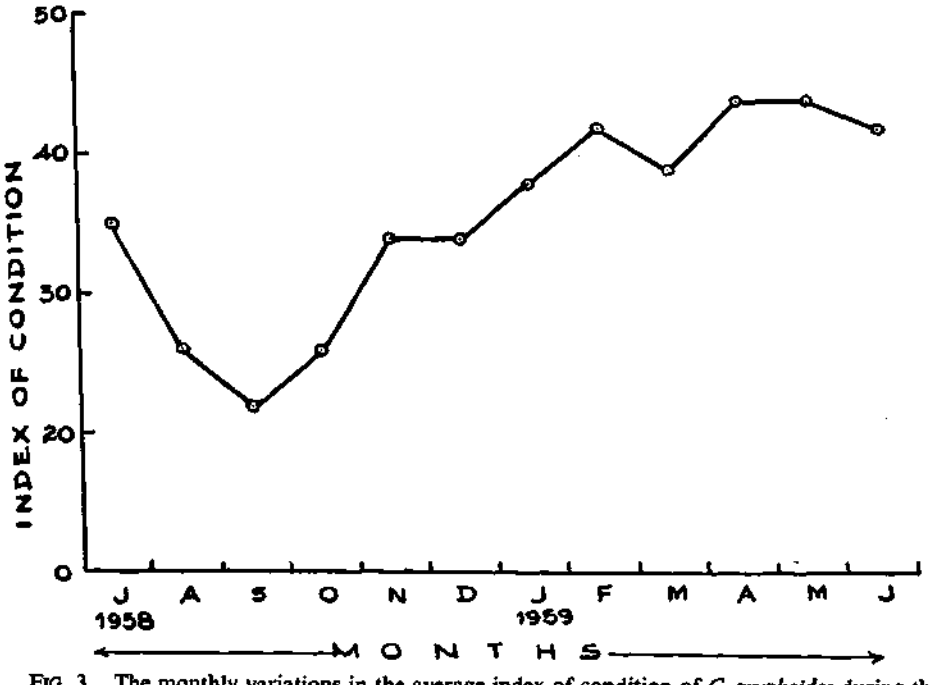

FIG. 3. The monthly variations in the average index of condition of *C. gryphoides* during the period, July 1958 to June 1959.

pattern of changes as that of percentage edibility. These two aspects studied in two successive years, lend support to each other in their inference. Fig. 4 reveals once again the rapidity of spawning in females. Further, the values for female fall rapidly and reach the minimum earlier than the values for male. The higher index values of both males and females reappear along with the proliferation of gonads during summer.

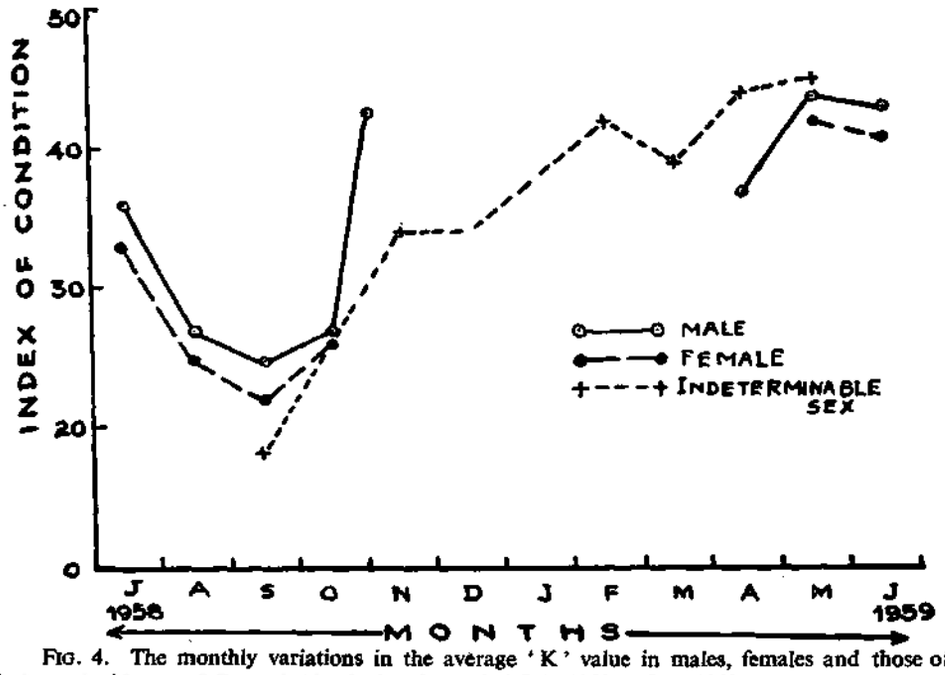

FIG. 4. The monthly variations in the average 'K' value in males, females and those of indeterminable sex of *C. gryphoides* during the period July 1958 to June 1959.

Fig. 5 shows the percentage distribution of oysters in different 'K' (index of condition) value classes during the period of observation. The mode at the class 36-40 in July, gradually shifts to lower values as the spawning progresses. A small mode at the class 61-65 in August, may be due to the presence of a few unspawned oysters in the samples. In October, the majority of oysters are in the index classes of 16-20 and 21-25. In the second half of October, with the conclusion of spawning and recovery of oysters, the mode shifts to the higher values. Hereafter, the majority of oysters show higher values of index of condition. The lower modal values in March, May and late June may perhaps be due to less feeding or other environmental factors or may even be accidental.

The foregoing account indicates that the quality of meat of the oyster *C. gryphoides* shows a definite seasonal variation. The oysters are fatty and cream-coloured from late October or November to June, and lose their vigour and quality with the onset of monsoon and consequently the spawning. They are thus unfit for human consumption during this period. Analysis of the chemical composition of this oyster supports the above observation (Durve and Bal, 1961). Ingle (1949) has shown a correlation between the index of condition and the glycogen content and also the calorific value in the case of American oysters.

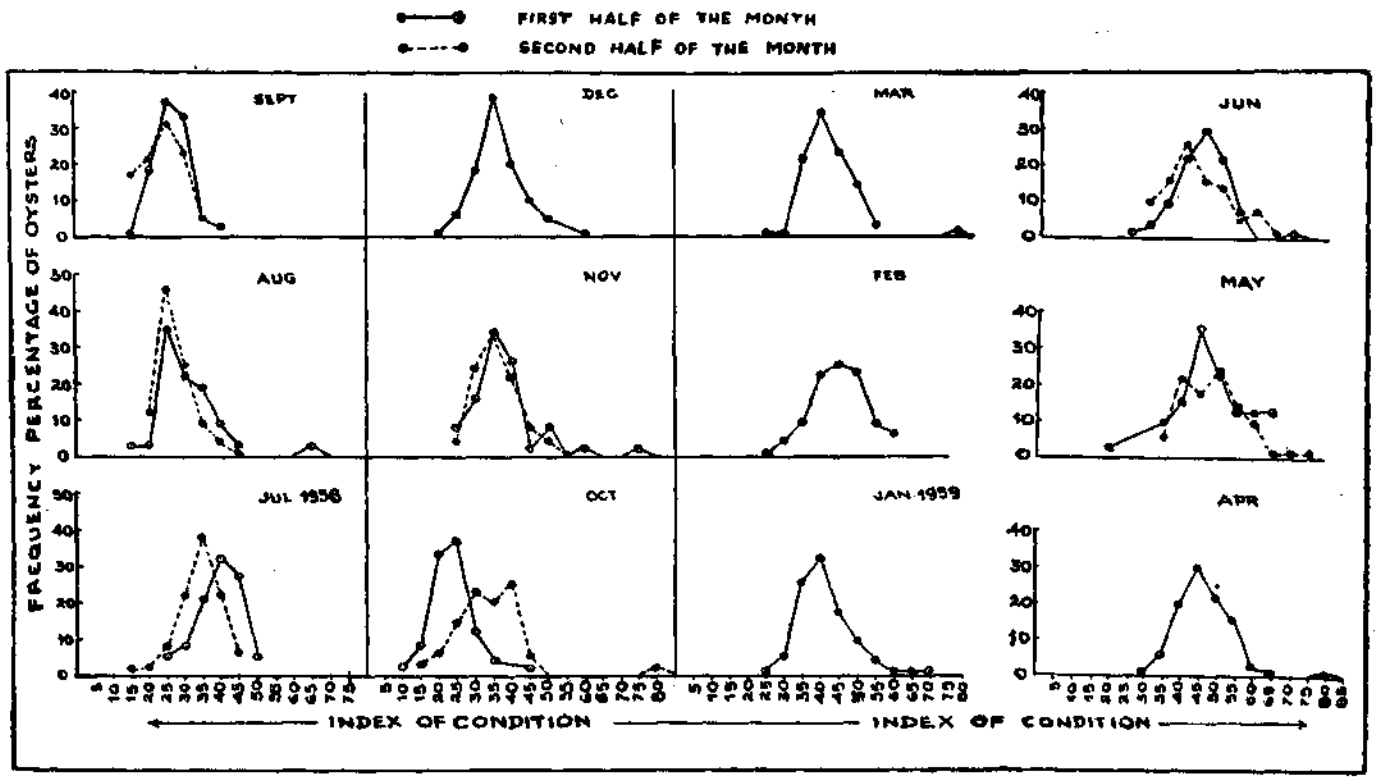

FIG. 5. The monthly variations in the frequency distribution of *C. gryphoides* in different 'K' value (index of condition) classes during the period July 1958 to June 1959. From December 1958 to April 1959, the two samples of every month are grouped together and represented by a single graph.

On comparing the methods of percentage edibility and the index of condition, it may be suggested that although both the methods show the quality of meat in a fair manner, the method of percentage edibility has certain disadvantages. It depends considerably on the absolute size of the oyster and the shell thickness, and does not take into account the shell cavity. In the case of thick-shelled oysters, the real value of percentage edibility will be considerably disturbed due to their heavy weights.

The index of condition also depends upon the water content which varies from oyster to oyster. Accordingly, there may perhaps be the corresponding change in the volume of the meat. Any amount of standardization, in the procedure of blotting the oyster meat, may not remove this drawback completely. However, despite this drawback this method is widely accepted because of its quickness in assessing the quality of oyster meat. Thus, in this method, the degree of fatness of the meat is objectively assessed irrespective of shell thickness.

The data on the index of condition and the shell dimensions of the oyster were subjected to statistical treatment. Shell dimensions used were depth and height. Depth denotes the maximum distance between the upper and the lower valves, while the height, maximum distance between hinge and the opposite end. These observations were restricted to oyster samples collected during the period of resting phase, as during this period, all oysters are in the same physiological state and the average index of condition is high.

The coefficient of correlation between depth(d) and the index of condition (K) calculated from the sample of 380 oysters, was found to be 0.025 which is not significant at the 5% level. The regression is given by the equation $K=0.05d+39.87$. In order to test whether the value of 'K' differs for different depth classes, the total variance was analysed into two components one due to the differences between depth classes and the other due to the differences within. The observed value of the variance ratio was 1.918 which is not significant. This indicates that the depth has no effect on the index of condition.

The relation between the index of condition and height was determined by the analysis of the data of the samples of 40 oysters collected during the month of January. The regression of the index 'K' on height 'h' found by the method of least squares, gave the equation $K=-2.529h+60.444$. The variance ratio of 4.31 is significant at 5% level indicating thereby linear dependence of the index of condition on the height.

The observations on the relation between the meat volume and the cavity volume were also based on the sample of 40 oysters referred to above. The linear regression of meat volume (M) on the cavity volume (C) was found to be $M=0.2063C+2.8789$. The observed value 24.70, of the variance ratio is highly significant. The fitting of higher degree orthogonal polynomials does not improve the fit thus suggesting that the relation between the meat and cavity is linear. However, it may be added that the constants of the relation are likely to change from month to month depending on the gonadial cycle, and hence may be thought of as parameters depending on the time of the year.

This observation supports the earlier inference on the suitability of the method of index of condition in assessing the quality of oyster. The meat volume being dependent upon the cavity of the oyster, the more the cavity the more will be the meat. The method of the index of condition takes into account these two main factors

viz. cavity and the meat and hence it seems to be more reliable than the method of percentage edibility.

Summary

Percentage edibility and the index of condition were determined in the oyster *Crassostrea gryphoides* (Schlotheim). Both the factors show seasonal variation depending upon the spawning cycle of the oyster.

The statistical treatment of the data suggests that the method of the index of condition is more dependable than that of the percentage edibility.

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