

Modification by Habitat in the Portuguese Oyster *Ostrea (Gryphæa) angulata*.

By

J. H. Orton, D.Sc.

Senior Naturalist at the Plymouth Laboratory.

AND

P. R. Awati, B.A.

Professor of Zoology, Royal Institute of Science, Bombay.

With 1 Figure in the Text.

WHILE working on the beds in the River Blackwater, Essex, a collection of Portuguese oysters, which had been dredged along with native oysters (*O. edulis*) from the river and creeks, was seen at a glance to show a distinct average difference in shape from the usual type of Portuguese oyster. The ordinary Portuguese oyster as seen exposed for sale is usually imported when quite small, or occasionally well-grown, and relaid on English beds at or above low-water mark to grow and fatten. Orton* has shown by definite experiments on the same beds that the Portuguese oyster spawns and spats in English waters in favourable (hot) weather. There can be no doubt, therefore, that the Portuguese oysters dredged had grown in situ from larvæ which had developed in the waters of the river and creeks. In Portugal and France the Portuguese oyster is stated to occur at and just below low water springs (see Bashford Dean, Bull. U.S.F.C. XI, 1891 (1893), p. 368), and is apparently hand collected at the present day for export purposes.

A difference in shape in native oysters is very common, but Bell and others have so far found it a very difficult matter to correlate any particular shape with a particular environment. Indeed, Bell stated, in a letter, that each locality seems to have its own type of shell-growth in the native oyster. Such a difference as that noted above in the Portuguese oyster was therefore deemed worthy of some attempt at expression.

In the present paper, which can only be regarded as a preliminary study, the lengths of the oysters, measured to the nearest millimetre, have been collected in centimetre groups, and correlated with the corresponding shell-heights, and an average shell obtained from plotting the results to scale. (See Fig. 1, p. 229.)

* *Nature*, Vol. 110, August 12, 1922, p. 213.

Three samples of oysters were used for the diagrams given in Fig. 1.

(1) Through the courtesy of Mr. J. M. Tabor it was possible to obtain two lots, each of 100, of Portuguese oysters imported September and October, 1925, from the Tagus beds, Portugal. A glance at Fig. 1 thick-lined figure shows that the sample examined was a uniform one; the actual centimetre averages of one lot are as follows, the others being similar :—

No. of Individuals.	Length.	Height.
2	27.4 mm.	48.5 mm.
49	37.4 mm.	60.5 mm.
54	42.7 mm.	64.2 mm.
2	53.0 mm.	74.0 mm.

(2) Mr. J. M. Tabor also kindly supplied on October 28 a sample of about 100 *Gryphæa*, which had been imported from Portugal in March, 1925, and relaid at about low water neaps at Brightlingsea to grow and fatten during the summer. The measurements of this sample are as follows :—

No. of Individuals.	Average Length.	Average Height.
10	46.4 mm.	89.8 mm.
61	54.9 mm.	91.3 mm.
29	62.4 mm.	93.0 mm.

The average shape of this sample is distinctly longer than that of the usual Portuguese, therefore the difference to be observed between this sample and that dredged from deep water is the more noteworthy.

(3) The sample dredged at West Mersea, River Blackwater, gave the following averages :—

No. of Individuals.	Average Length.	Average Height.
1	26 mm.	52 mm.
2	37.5 mm.	54.5 mm.
12	46.4 mm.	61.8 mm.
28	53.0 mm.	61.7 mm.
13	63.9 mm.	76.5 mm.
4	74.5 mm.	80.25 mm.
1	80.0 mm.	80.0 mm.

It is interesting that the longer specimens in this sample approached an equal length and height, thus resembling the native oyster. The approximate average ratios of length to height in the three samples are 1 to 1.65, 1 to 1.69, and 1 to 1.17 respectively. In large *Gryphæas* from the natural habitat on the shore, the ratio as judged by existing illustrations (see Bashford Dean, Bull. U.S.F.C. X, 1890 (1892), figs. 3, 4, p. 363) is probably 1 to 2 or more. There is thus a considerable difference between the shells from above tide-mark from those dredged below tide-mark.

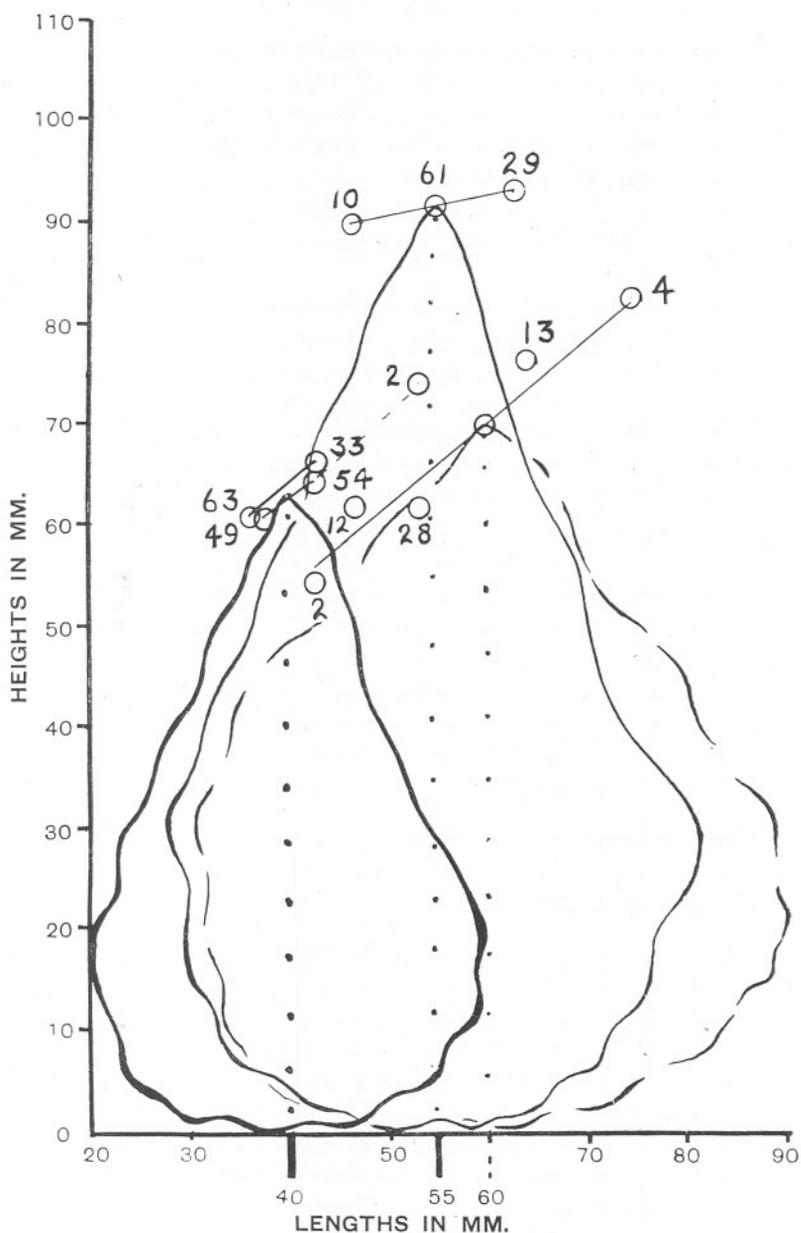


FIG. 1.—Scale-diagrams of Portuguese oysters (*G. angulata*) showing mean variation in shape with variation in habitat (above and below low-water mark).

A. Thick-lined form from Portugal.

B. Thin-lined form from Portugal, March, 1925 with English summer growth, 1925, above low-water mark.

C. Broken-lined form dredged from the Blackwater beds from below low-water mark in about 2 to 4 fathoms.

The diagrams show the average heights correlated with the average lengths in centimetre groups, and the approximate mean of all the measurements in each case.

No explanation can at present be offered for the occurrence of a broader shell in deeper water; and although cross-fertilisation between the Portuguese and native oysters is not impossible, it does not seem that the deep-water forms are hybrids, as the genital products of the two species are totally dissimilar, and those of the deep-water individuals are like the Portuguese in all respects: neither has any other character than shape of the deep-water forms been observed to be different from a normal Portuguese.

Since *G. angulata* has now been shown to exhibit a difference in the length-height ratio according to depth of habitat, it will be interesting to know whether an analysis of the measurements of other shelled forms living at different depths show a similar varying ratio.

It was possible to find the average increase in height of growth of the second sample of Gryphæas during the summer of 1925, as the Tagus oysters on arrival in this country are green and retain their greenness to a great extent, while the new English shell-growth is white with pretty patterns of blue-black and reddish-brown stripes. In this way it was found that the average increase in height of the sample relaid in March, 1925, to October 28, 1925, was 35 mm. The sizes of the shells as they were in March, 1925, were also recorded, and are plotted in Fig. 1 on the line 63-33; it is seen that the two samples of young Portuguese imported in March and October, 1925, were practically similar in mean size.

The sexes were examined in the different samples with the following results shown as percentages:—

	♀	♂	♄
Newly imported, September, 1925	11.9	18.4	69.7
Relaid March-October, 1925	60.0	36.0	3.0
Dredged Blackwater	88.3	11.6	0.0

These figures of sex percentages are perhaps worth recording, but are based on too small a number of individuals, or, in the case of the newly imported sample, examined after subjection to entirely abnormal conditions, to render it worth while discussing them. It is of interest to note that the growth of males and females in 1925 was approximately of the same average value, namely, 35 and 35.8 mm. respectively, while that of the few individuals of neuter sex was only 29.0 mm. on the average. The newly imported small Gryphæas were in poor condition, probably owing to a large proportion having recently spawned. Fattening in Gryphæa consists in this country almost entirely in development of the sex-elements in the gonad, in contradistinction to the native oyster where fattening begins by a laying down of reserve products, mainly glycogen, and is followed by development of the gonad. Thus, Portuguese oysters which had recently spawned would be mainly neuter and in poor condition, that is, not "fat."