

## AGE, GROWTH AND MATURITY OF IRISH LOBSTERS

By

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A completely satisfactory method of ageing lobsters has not been developed. Gibson (1967) attempted to age lobsters using the principles of the von Bertalanffy equation as suggested by Beverton and Holt (1957). In this case the only determinable parameters were,  $L_{\infty}$ ,  $K$  and the annual growth rate was calculated from the recapture of tagged lobsters which had been at liberty for a period of one year, during which time they had or had not moulted. The smooth curve produced from these data suggested that lobsters first come into the catch, in large numbers, at the end of their fifth year and are fully recruited in the sixth year. In reaching this age, the rate at which lobsters grow does not appear to be consistent, and does not appear to be so throughout the life span. Observations of moulting rates in young lobsters, under natural conditions, are not known, because it has not been possible, so far, to catch lobsters under 6.0 cm carapace length in quantity enough to obtain results from tagging. There is a number of records of moult rates in young captive lobsters and these suggest that moulting is very frequent in the early stages and in adolescence, slowing down as they become older. Records of moult rates for medium-sized lobsters (7.0 to 11.0 cm carapace range) are fairly common from the tagging material. Above this size (i.e. over 35 cm in total length) data again are scarce.

In Figs. 1 and 2 the increments of growth made by male and female tagged lobsters in the sea, have been plotted on the basis of  $I_t$  against  $I_t + 1$ , for those which could reasonably have moulted once during liberty, and those which had been at liberty for one year. Also included in these figures are details of lobsters which had been at liberty for 2 years, most of which it will be noted had made considerably more growth than those at liberty for shorter intervals of time.

Gibson (1967) surmised that, because the co-efficient in the regression equation for small male and female lobsters exceeded unity, the growth rate per moult up to a size somewhere in the region of 83 mm carapace length, is progressive, i.e. increasing with each moult. The majority of records were made of lobsters from 8.4 to 11.0 cm carapace length and in their case, the coefficient was over 0.95 and less than 1.00, which implies that at each moult the amount of increment is approximately the same, within this size range at least. Further data are essential before it can be said that these observations are typical. In the meantime, the present data have been applied to the method for assessing age from length groups, as described by Cassie (1954). Cumulative frequency percentage occurrence of 692 male lobsters has been plotted on arithmetical probability paper in Fig 3. This produced a series of apparently definable inflections and straight

line plots have been drawn through the calculated points. As would be expected, there is considerable overlap of the "year-classes". The means for the year-classes and their standard deviations according to the Cassie method and the back-calculated mean lengths for age from the von Bertalanffy equation are given in Table 1. These mean lengths have been converted to total length according to the regression:

$$\text{Total length (mm)} = 2.483C + 32.66 \quad (C = \text{Carapace length in mm}).$$

The calculated smooth curve estimate of the total length in each year from 1 to 10 appears in the second column of Table 1. At the 4th year this estimate coincides and overlaps until the 6th year with those found by the Cassie method in column three. It will be seen that for ages 4 to 6 inclusive, there is a close agreement between these two methods, which though it does not prove that the ageing techniques used in both cases are valid, does point to an area which would repay further study in the determination of the age of the larger decapods. Accurate estimates of age are essential to the proper management of the stocks of crustacea.

TABLE 1. Age and length of Irish male lobsters are estimated from recapture of tagged lobsters at liberty for one year and cumulative length frequency percentage occurrence.

Estimated year-class	Calculated* mean size (total in cm)	Plotted mean** size (total in cm)	S
1	6.2		
2	12.6		
3	16.5		
4	19.9	20.6	0.22
5	22.9	23.0	0.55
6	25.5	25.2	0.62
7	27.6	27.0	0.46
8	29.4	28.4	0.65
9	31.3	30.6	0.57
10	33.2	32.9	0.62

\* Data from tag returns

\*\* Data from length frequencies.

#### Moulting and Ovigerous Females

The system of tagging Irish lobsters was such that releases were made every month from February to August inclusive in 1965. All

subsequent recaptures were again released, and many of these were captured for a second time and in some instances re-entered the traps from three to five times. The time over which tagging was carried out together with the release of recaptures in a fishery which is actively pursued in all months except January afforded a very good opportunity to study the ovigerous habit and one or two surprising observations were made.

At release females were recorded as either ovigerous or not. At recapture, in the following year, many of these females were ovigerous which had been non-ovigerous in the previous year and vice versa. At first glance this would suggest the carrying of ova in alternate years. However, this could only be concluded if each female were kept under observation throughout her full period of liberation, which, of course, is impossible. A number of other observations were made which showed that certain females at least do not become ovigerous in alternate years.

From Table 2 it may be seen that where records are available of ovigerous and moulting females at liberty during a period of two years, valuable information has been obtained. For example, lobsters bearing tags 175 and 327 were hatching their ova in February and March, which is somewhat early in the year. Lobster 175 was recaptured on 31.12.65, having moulted, and was then ovigerous. Thus she carried her ova twice during one year. Lobster 260 was non-ovigerous on 18.3.65 but had moulted upon first recapture on 2.9.65, carrying recently emerged ova at that time. She was recaptured for a second time on 12.11.65 when her ova had reached the eyed stage and recaptured a third time on 8.9.66 carrying ova of recent emergence. She not only carried ova in consecutive years but moulted each year also. Lobster 371 was ovigerous when tagged on 1.4.65. She had moulted at the second recapture on 2.9.65 and was again ovigerous. She was recaptured for a third time on 23.9.66 carrying ova and having moulted once more. This female moulted in each year and carried ova in three consecutive years.

Lobsters 327, 367, 370, 375, 542, 633, 662, 760 and 805, all carried ova in consecutive years.

There are only two Irish records of female lobsters moulting in each of the three years that they were at liberty. The details are as follows:—

Lobster 236 was first released on 5/8/65 at a carapace length of 9.5 cm and was recaptured on 13/5/66, when her carapace measured 10.4. She was recaptured for the third time on 19/5/67 when she measured 11.0 cm.

Lobster 266 was first liberated on 9/8/65 at a carapace length of 7.7 cm and was recaptured on 2/9/66 when her carapace measured 8.8 cm. She was recaptured a third time on 31/1/67 when she measured 9.4 cm. These two females, together with the details given for Nos. 260 and 371 above, are the only recorded evidence of annual moulting, in this experiment.

TABLE 2. Details of female lobsters which moulted and carried ova in successive years.

Tag No.	Date of 1st liberation	Condition of ova	L <sub>1</sub> (cm)	Date of 1st recapture and liberation	Condition	L <sub>2</sub> (cm)	Date of 2nd recapture and liberation	Condition	L <sub>3</sub> (cm)
175	25.2.65	Hatching	9.2	31.12.65	Recent Ova	10.6			
260	18.3.65	—	7.9	2.9.65	do.	8.6	8.9.66	Recent Ova	9.3
327	25.3.65	Hatching	7.2	23.6.66	do.	8.4			
367	24.6.65	Eyed	9.4	22.9.65	do.	10.5			
370	1.4.65	Recent Ova	8.5	12.9.65	do.	10.5			
371	1.4.65	do.	10.9	2.9.65	do.	12.0	23.9.66	Recent Ova	12.5
375	1.4.65	do.	9.6	15.8.65	do.	10.3			
542	22.4.65	do.	10.6	21.10.66	do.	12.1		do.	
633	20.5.65	?	11.5	23.9.65	do.	11.5	18.11.66	do.	12.7
662	20.5.65	Recent Ova	11.6	22.10.66	do.	12.4			
760	20.5.65	Eyed	9.3	8.9.66	do.	10.2			
805	3.6.65	do.	7.9	15.8.66	do.	8.8			

Only two females which were recaptured in the two years following first release did not moult whilst at liberty. On the other hand, 45 females were recorded as having moulted the year after they had been liberated.

The above examples may not prove that females are ovigerous and moult annually, nevertheless they provide evidence that this may be more common than had been thought. The carapace size range of these females was from 7.8 to 11.0 cm. It may be during this middle part of the female life that moulting and ova production are annual. However, later when moulting becomes less than annual, then, of course, ova bearing would also occur, at most, each alternate year.

It is difficult to obtain large numbers of records of moultings at sea because the number of recaptures decreases rapidly with the increased period of liberty. Clearly it would be advantageous to collect more data of this kind. The results so far suggest that the most information will emerge from tagging carried out during the early part of the year, especially from February to April. Supplies of lobsters are meagre at this time and, therefore, it might be equally useful to tag in October when lobsters are more plentiful.

Amongst the other features of interest arising from the tagging material is the evidence that hatching does take place over a long period. For example, in February, 10% of female lobsters, in March, 10%, in April 3% and in May 16% carried ova which were in the eyed or hatching condition. Furthermore, in February 10% of female lobsters, 3% in March, 17% in April and 13% in May all carried ova of recent emergence. The majority of non-ovigerous females were recorded in May and August, and therefore the foregoing records of hatching ova and freshly emerged ova would suggest that there are concentrations of hatching early and late in every year.

Very much more information is, however, needed before the questions as to when and how often female lobsters are ovigerous and moult can be fully settled.

#### REFERENCES

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- Gibson, F. A. (1967). "Irish Investigation on the lobster (*Homarus vulgaris* Edw.)" *Irish Fish Invest. Series B (Marine)*, No. 1.

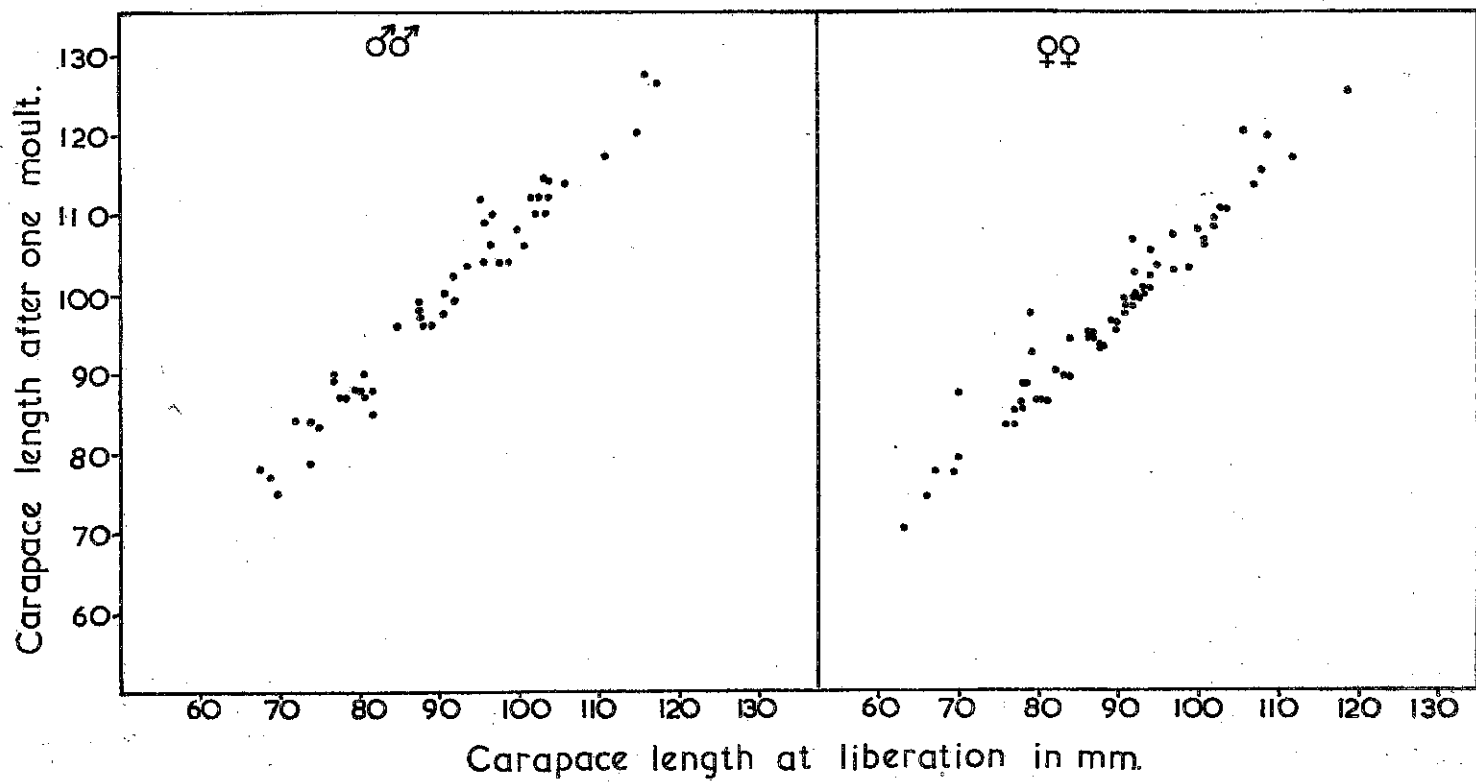


Fig. 1. Length of male and female lobsters at liberation compared with growth increment due to one moult.

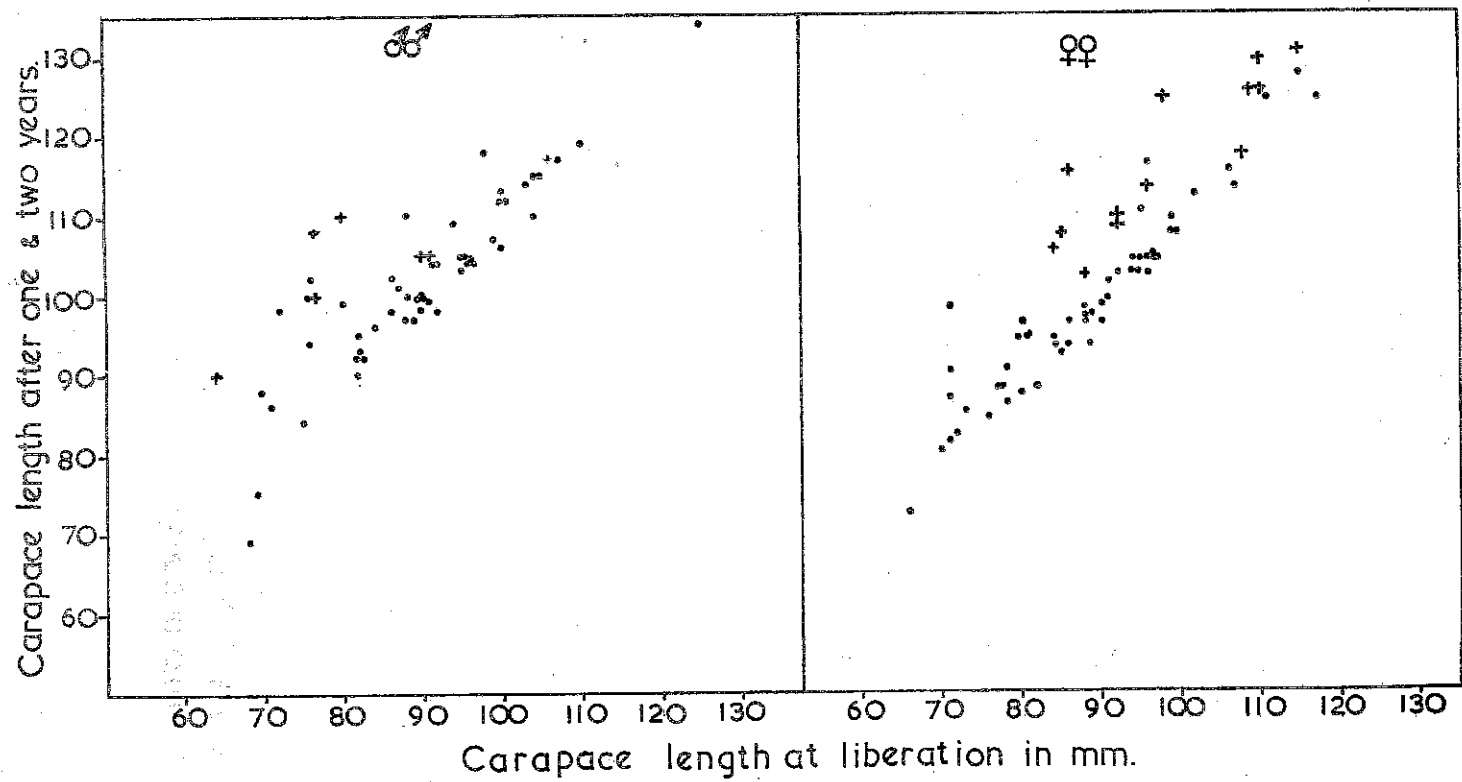


Fig. 2. Length increments made by male and female lobsters at liberty for one or two full years.  
 (0 = one full year at liberty  
 + = two full years at liberty).

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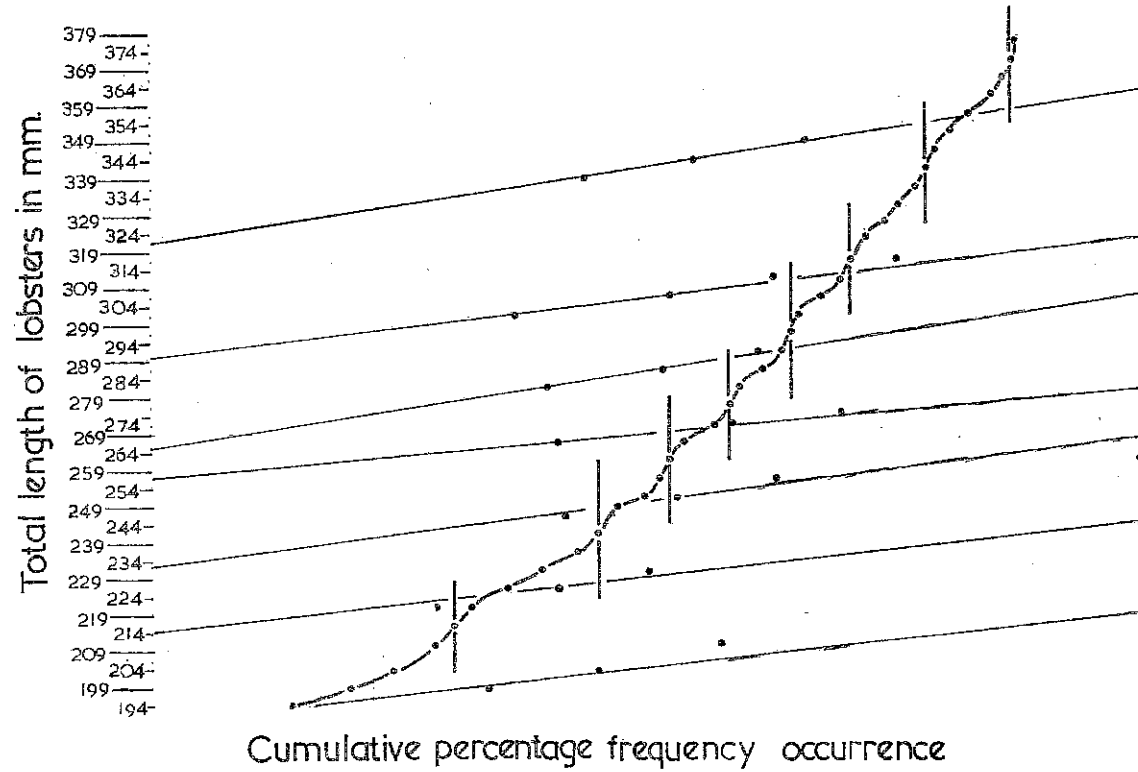


Fig. 3. Cumulative percentage frequency occurrence of 692 male lobsters from the Wexford coast plotted on arithmetical probability paper.