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Growth Studies in Nephrops

by
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Length - Frequency Modes

In September 1969, a very distinct mode in Nephrops carapace length-frequencies at about 17 mm was first noticed at certain stations in the Irish Sea, and this led to some study of the possibilities of Petersen's method in ageing Nephrops populations, a technique mentioned briefly by Jensen (1965). In the Irish Sea, Nephrops is very heavily fished, so well represented year-classes promised to be few, thus probably simplifying the task of assigning modes to year-classes.

Figure 1 shows length-frequency distribution of male Nephrops from 11 adjoining stations sampled in September 1969, and Table 1 lists the corresponding modes. As the spread in values about the mode for a given year-class (of which the extent is unknown) must inevitably overlap and affect neighbouring modes interpretation must be cautious and tentative and rapidly becomes impracticable with increasing age of the Nephrops.

It will be seen that modes at 16-18 mm where they occur are clearly distinguishable and modes at 20-22 mm are reasonably distinct. Hereafter however the problem starts as it is very difficult to separate the modes between 25 and 32 mm which appear in the majority of cases to be two in number but are sometimes rather ambiguous.

However, the tendency of neighbouring hauls to provide mutually confirmatory evidence is helpful as the repetitive occurrence of modes at approximately the same values is easily explained only by the interpretation that each represents an age-group.

The statistical technique described by Cassie (1954) has been tried but it demonstrates modes no more clearly than a length-frequency histogram and separation of age-groups by this method is difficult due possibly to distribution of values not conforming sufficiently closely to the (statistical) normal distribution. However, investigation in this sphere is continuing.

The method of confirming the significance of modes by tracing their progress over a period presents difficulties because at one station catches can decrease enormously between cruises whilst simultaneously increasing elsewhere nearby to such an extent that large-scale movement must be postulated; if aggregated length-frequencies for a number of stations are used however, slight variations in positions of peaks and troughs very much reduce the visible modes in the resulting length-frequency distribution.

Captive Observations

In interpreting length-frequency modes, captive observations can be helpful in indicating how far apart modes of successive year-classes might be expected to fall, thus assisting interpretation in ambiguous cases. Data of Thomas (1965) provide much information based on specimens of over 20 mm carapace length. It was decided to concentrate the present studies mainly on smaller Nephrops as being easier to keep with the limited facilities available, and furthermore our research trawling surveys using small meshed covers had yielded a few Nephrops of carapace lengths 3-5 mm (post-larval) in late June, 7-9 mm in October-November 1970 and 10-14 mm

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in April 1971. Nephrops of under 15 mm carapace length have been seldom seen and the above lengths in themselves give a strong indication of the growth-rate of Nephrops during their first year of life.

Specimens collected and maintained in captivity included post-larvae metamorphosed in captivity, one specimen (thought to be rather advanced group 0) caught off Co. Cork in July and specimens caught during October-December at carapace-lengths of 7-10 mm (age-group 0), 15-17 mm (almost certainly age-group 1) and around 24 mm (probably age-group 2), all Irish Sea material other than the exception mentioned. The moults obtained from age-group 0 specimens are given in Table 2 and Figure 2 and those of age-group 1 and 2 specimens in Table 2 and Figure 3. For the sake of clarity age-group 1 specimens performing 1 moult only are omitted from Figure 3.

It will be seen that the Irish Sea age-group 0 specimens attain 8-10 mm carapace length by the end of December, while probably group 1 specimens of 15-17 mm carapace length in November reached 18-21 mm by July following: moulting in the 23-26 mm carapace Nephrops has been much slower with no specimens performing more than one moult by June 1971. This reduction may well be a growth-rate change at sexual maturity such as is known to occur in many crustacean species.

Discussion

The present investigations have shed some light on the growth of Nephrops up to the summer when they are two years old; beyond this point, Thomas (op. cit.) indicates that growth is rather variable. His data however suggest annual increments of about 6.5 mm and 5 mm for initial carapace lengths of 21 and 28 mm respectively. This supports the view that modes in the region of 22 and 28 mm belong to successive age-groups. Information in this size range is important as it more or less coincides with the first year after completion of recruitment to marketing in the Irish fishery.

As a means of age-assessment, marking has also been under consideration, but the Irish Sea population is so vast that it would be preferable to tag elsewhere where recoveries would form a less tiny percentage of the catch.

Another method attempted is assessment of whether a biometric ratio altering with size is age-based and can therefore be used to distinguish different age-groups at the same carapace length. The ratio of distal segment of great claw length/carapace length in males has been tried and, whilst its value varies from 1.3 at 20 mm carapace length to 1.8 at 50 mm, values are too variable and the technique too laborious - due to size of sample required - for the method to be regarded as very promising. Experiments are continuing, however, in this field also.

References

CASSIE, R. M., 1954. Some uses of probability paper in the analysis of size frequency distribution. Aus. J. Mar. Fresh. Res. 5: 513-522.

JENSEN, AA. J. C., 1965. Nephrops in the Skagerak and Kattegat (length, growth, tagging experiments and changes in stock and fishery yield). Rapp. P.-V. Cons. int. Explor. Mer,, 156: 150-154.

THOMAS, H. J., 1965. The growth of Norway lobster in aquaria. Rapp. P.-V. Cons. int. Explor. Mer,, 156: 209-216.

Table 1. Modes in carapace length (mm) frequency distributions shown in Figure 1. Indistinct modes shown in brackets.

Long.°W	5°50'	5°45'	5°40'
Lat. °N			
53°37.5'	(21)-(25)-30	16-22-27	-
53°35'	16.5-22.5-28.5	16.5-20-25-(32)	20-26.5-(34)
53°32.5'	17-(22)-(25)-30	21.5-27-30.5	17.5-(22)-27.5-(33)
53°30'	17-22-30	22-28-(33.5)	18-22-26

Table 2. Moults of Nephrops in captivity, 1970-71.

Probable age-group in 1970	Date of capture	Sex	L_c mm	Date of moult	L_c mm	Date of moult	L_c mm	Date of moult	L_c mm	Date of moult	L_c mm	Death
0	26 June	?	larval	1 July	3.7	20 July	4.6	-	-	-	-	4 Aug.
	"	?	stage	2 July	3.6	21 July	4.4	16 Aug.	-	-	-	17 Aug.
	"	?	3	3 July	3.7	18 July	4.6	5 Aug.	5.3	24 Aug.	5.8	3 Oct.
	28 July	?	7.8	23 Aug.	?	20 Sep.	8.9	23 Oct.	10.8	28 Nov.	12.5	28 Dec.
	26 Oct.	?	9.3	3 Dec.	9.9	-	-	-	-	-	-	28 Dec.
	26 Oct.	?	7.6	2 Nov.	8.7	-	-	-	-	-	-	26 Dec.
	27 Oct.	?	7.8	27 Nov.	8.6	-	-	-	-	-	-	26 Dec.
	28 Oct.	?	7.4	25 Nov.	8.3	-	-	-	-	-	-	26.Dec.
	30 Oct.	?	8.9	10 Nov.	10.1	-	-	-	-	-	-	23 Nov.
1	30 Oct.	M	17.1	11 Jan.	18.6	-	-	-	-	-	-	28 April
	"	M	16.5	12 Jan.	18.4	4 April	19.6					
	"	M	17.0	17 Jan.	18.7	26 March	18.7	16 May	19.4	9 June	21.1	
	"	M	16.7	10 Jan.	18.2	25 April	18.5					
	"	M	17.1	14 Jan.	18.1	-	-	-	-	-	-	19 April
	"	M	16.7	17 Jan.	18.0	29 March	19.2	17 May	20.6			
	"	M	15.5	14 Dec.	16.9	1 March	17.5	?	(17.5 on 26 Apr; 19.0 on 17 June)			
	"	M	15.2	16 Jan.	16.8	?	(16.8 on 26 Apr; 17.8 on 17 June)					
	"	M	15.5	30 Nov.	16.9	22 March	17.8	6 June				
	"	M	16.7	22 Jan.	18.2	-	-	-	-	-	-	3 June
	"	F	15.8	18 Dec.	16.8	1 April	17.2	22 May	18.6			
	"	F	15.2	13 Dec.	17.1	-	-	-	-	-	-	13 March
	"	F	'15'	17 Dec.	16.0	13 March	16.7	16 May				
2	13 Nov.	M	23.6	9 March	24.5	-	-	-	-	-	-	11 June
	"	M	24.6	9 April	25.1	-	-	-	-	-	-	29 June
	4 Dec.	M	26.4	26 May	27.2							
	"	F	23.6	16 April	24.6	-	-	-	-	-	-	5 July
	"	F	24.6	19 April	25.5							

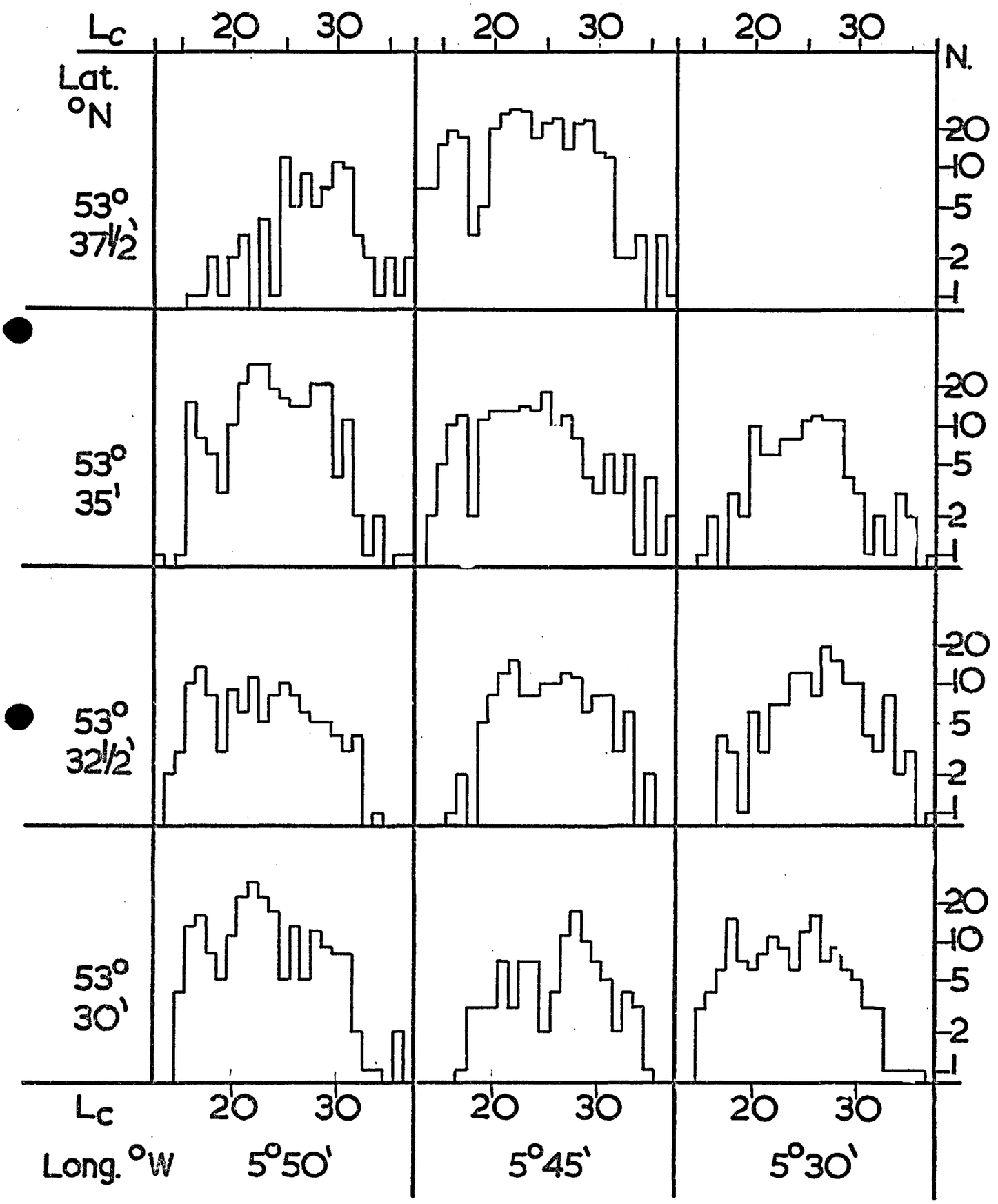

Figure 1. Carapace length (mm) frequency distribution histograms for male Nephrops from eleven adjoining stations in the Irish Sea, September 1969.

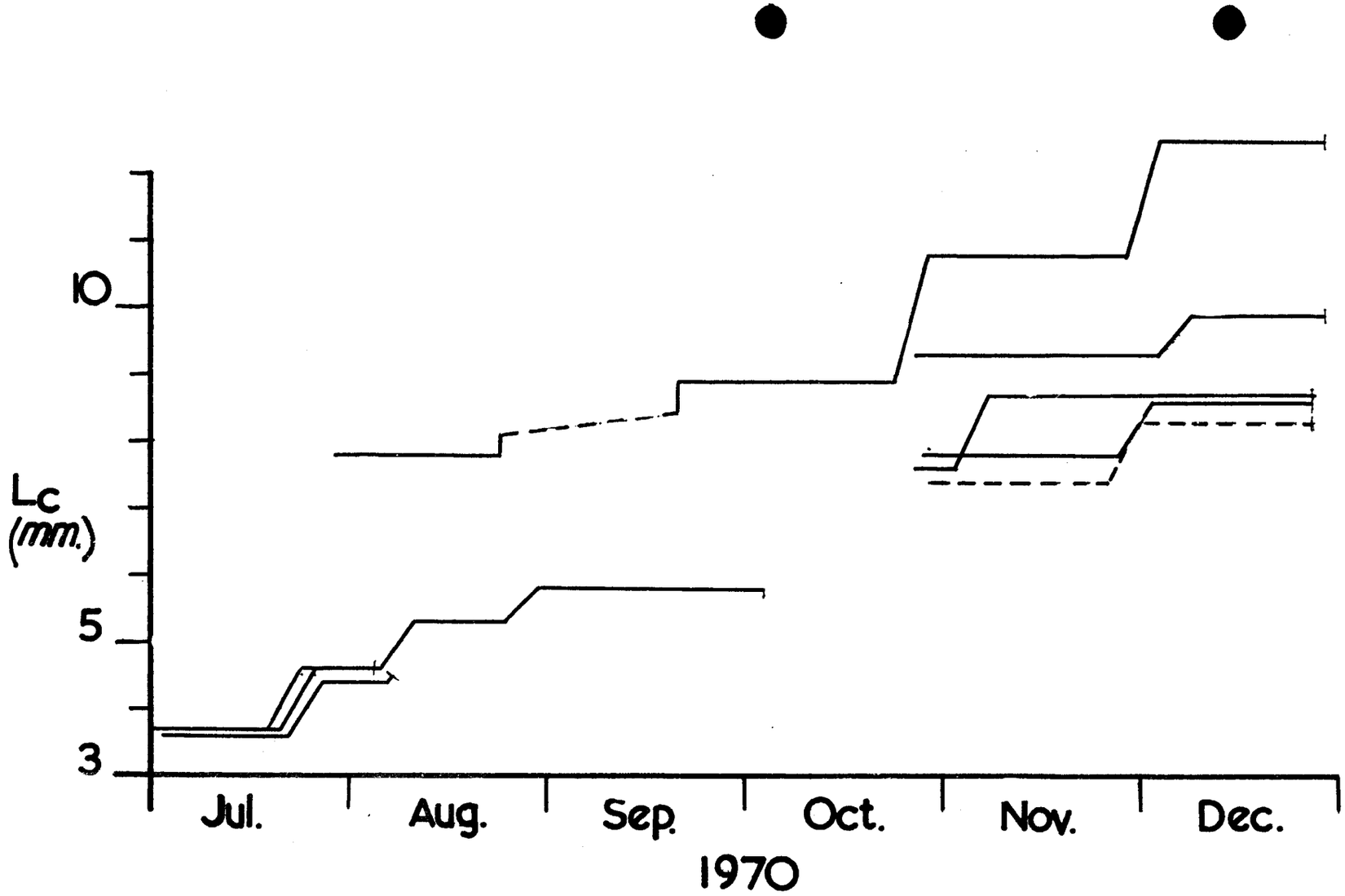

Figure 2. Moults of 0-group Nephrops, 1970.

Period of post-moult expansion arbitrarily taken as 5 days. Where two lines coincide, one of them is shown dotted before convergence and after separation.

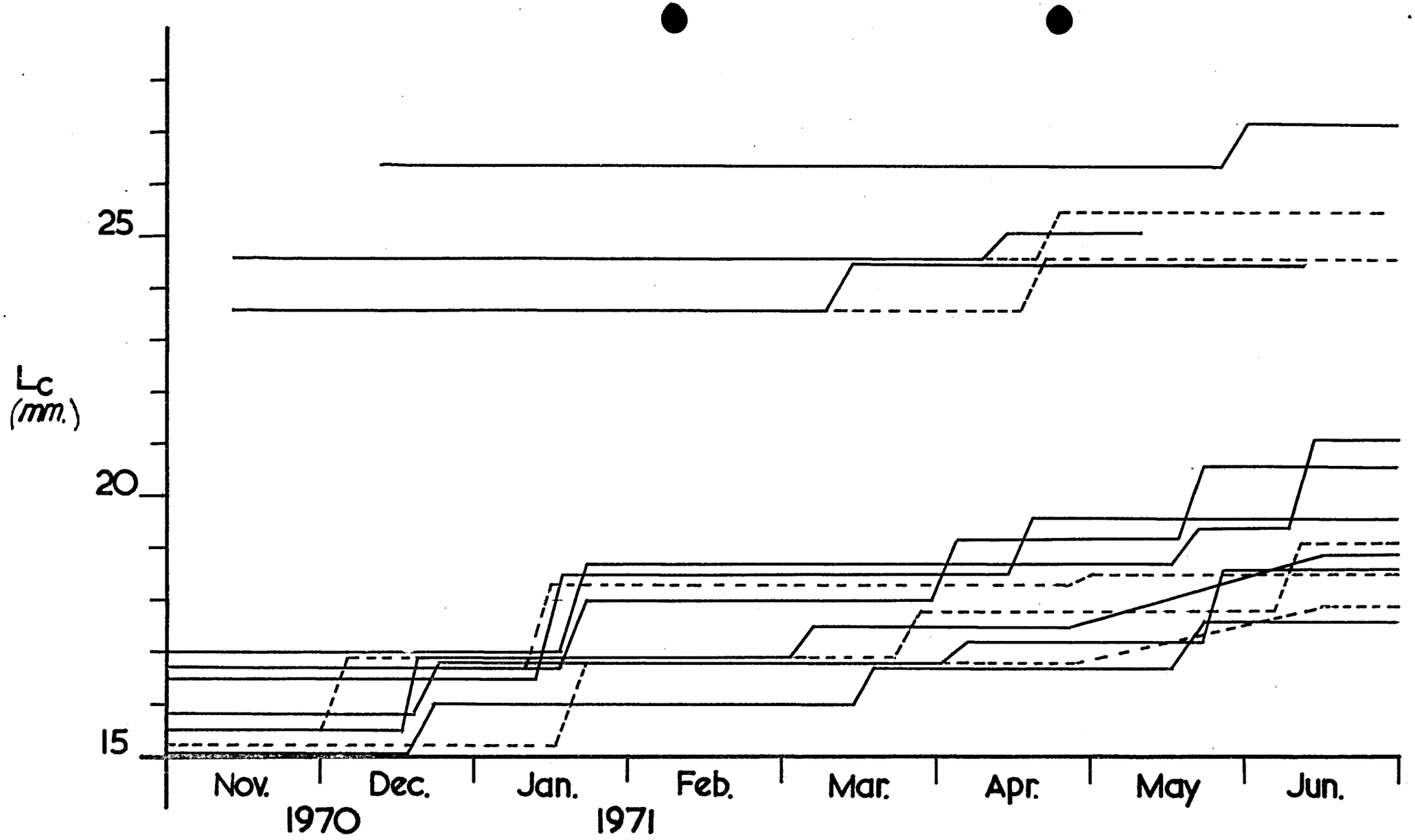

Figure 3. Moults in Nephrops probably of age groups 1 and 2 caught October-December 1970.

Conventions as in Figure 2.