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Observations on age and growth in Nephrops norvegicus

by

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It has been shown (Hillis, 1976, in the press) that under certain circumstances, the growth rate of immature and of adult male Nephrops can be assessed by Petersen's Method with a moderate degree of accuracy. This method however only shows the modal length of an age-group, and attempts to use the method of Cassie (1954) to separate all members of age-groups where there is some overlap in length by plotting percentage length-frequency on probability paper have been unsuccessful due to length-frequency distributions of single age-groups not conforming closely to the statistical normal distribution.

It is desirable to be able to assess accurately the strength of even one or two age-groups for the purposes of total mortality (Z) calculations and year-class strength predictions, and certain work in this direction (Anon, 1976) has already been undertaken with the Dublin-Louth (Irish Sea) population. This work depended on the phenomenon of sexually mature adult females being clearly distinguishable from immatures in summer, autumn, and (on the rare occasions when encountered) winter, age-groups 1 and 2 being immature from July till December (2 and 3 from January till about March), and all older groups mature (Hillis, op. cit.). With a view to separating all individuals in these two female age-groups, and also males of the youngest age-groups in the fishery, this paper describes preliminary attempts to find biometric ratios which differ from one age-group to another. Farmer (1974) enumerated secondary sexual characters which undergo positive allometric growth changes at maturation, though he did not attempt to use a correlation between the presence/absence of the allometric changes with overall size in age assessment. In the present work, ratios of secondary sexual characters' linear dimensions to

carapace length which undergo change on maturation were plotted against carapace length. The secondary sexual characters were as follows:-

Character	Degree of change	
	Male	Female
Abdominal width	Slight	Marked
Cheliped propodus length	Marked	Slight
First pleopod length	Marked	?
Appendix masculina length	Marked	*

* Appendix masculina present only in males.

Measurements were made of the above ratios, using the third segment for abdominal width, (W3) and the ratios of the values obtained to that of carapace length (W3/CL) plotted against carapace length. In the case of the appendix masculina, the ratio plotted against carapace length was that of appendix masculina length (AM)/total length of the endopodite of the second pleopod (P2) to which it is attached. Of all ratios the only two to show evidence of clear-cut inter-year change attributable to the change in year-class were third abdominal segment width/carapace length (W3/CL) in females and appendix masculina length/second pleopod endopodite length (AM/P2) in males.

Figure 1 shows changes with length in the AM/P2 ratio in males in May and means and standard deviations of the values, by length-groups, are given in Table 1. These show a marked shift in AM/P2 mean values between 20 and 24 mm carapace length, with a slight suggestion of a bimodal distribution of values in this length-range in Figure 1 reflected as an increase in standard deviation in Table 1. This corresponds to the area between age-group 2 and 3 modes in carapace length (Hillis. op. cit.).

Figure 2 shows similar changes in the W3/CL ratio with females in August, with mean ratio values also shown in Table 1. Here the change in ratio values occurs between 19 and 23 mm carapace ratio, corresponding to the division between age-group 1 and age-group 2 modes.

Of other ratios examined, ratios based on cheliped propodus length and, in males, third abdominal segment width and first (sexually modified) prelopod length, were found to have too much variability other than that attributable to age to be

of value in this exercise. However, since all such ratios alter on maturation, best results will be obtained at a season when no maturation changes are in the course of occurrence, and repetition of the exercise at intervals during the year should indicate the best season for examining each ratio. Further, the present work is largely preliminary, and has been restricted in scale due to the labour involved in obtaining certain measurements (e.g. appendix masculina) in informative quantities. However success in this field is to be regarded as value in assisting in the hertofore difficult task of age-group strength assessment, especially in males.

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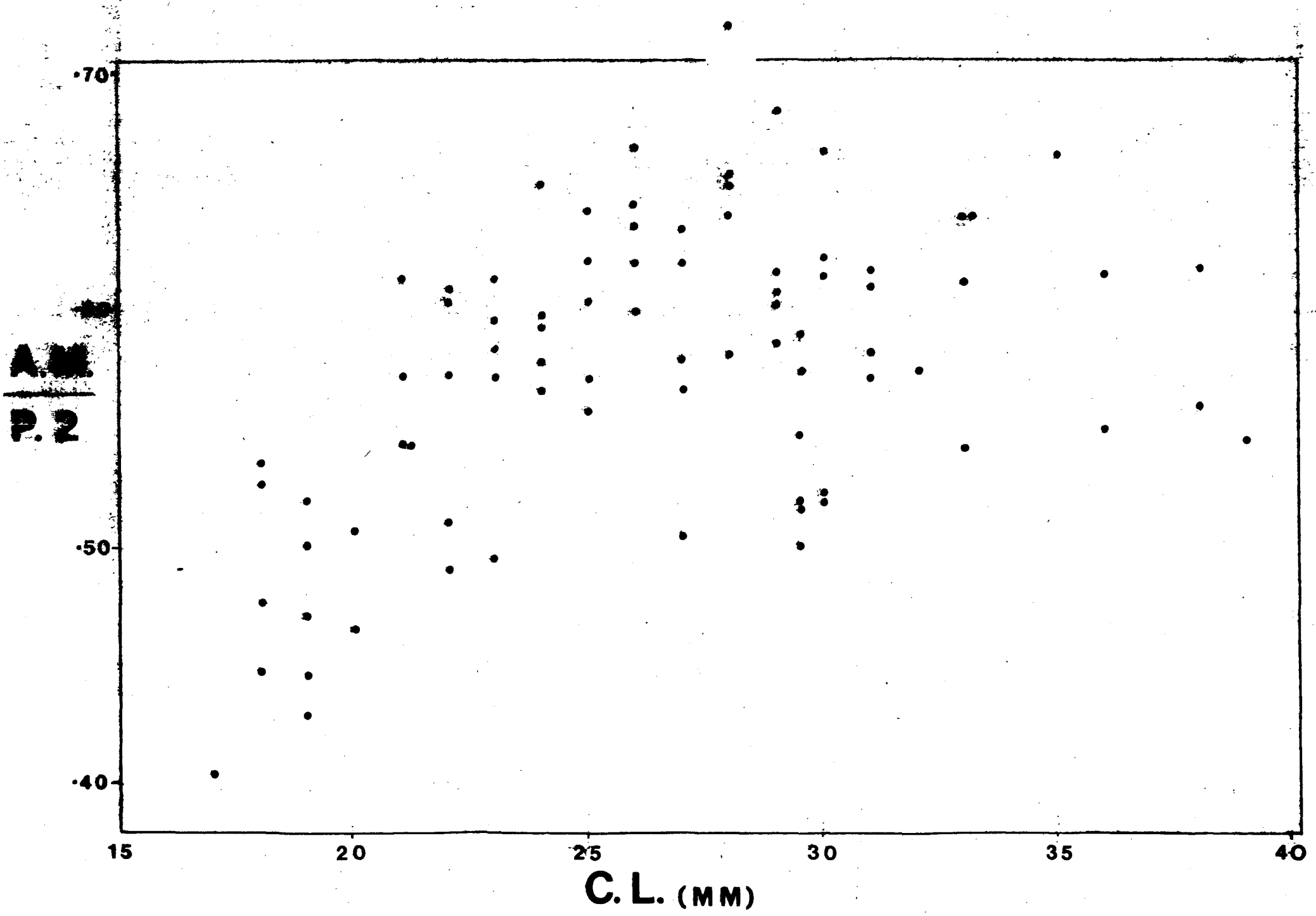

Figure 1. Male ratio of appendix masculina length to second pleopod endopodite length (AM/P2) plotted against carapace length. Sample, May 1977.

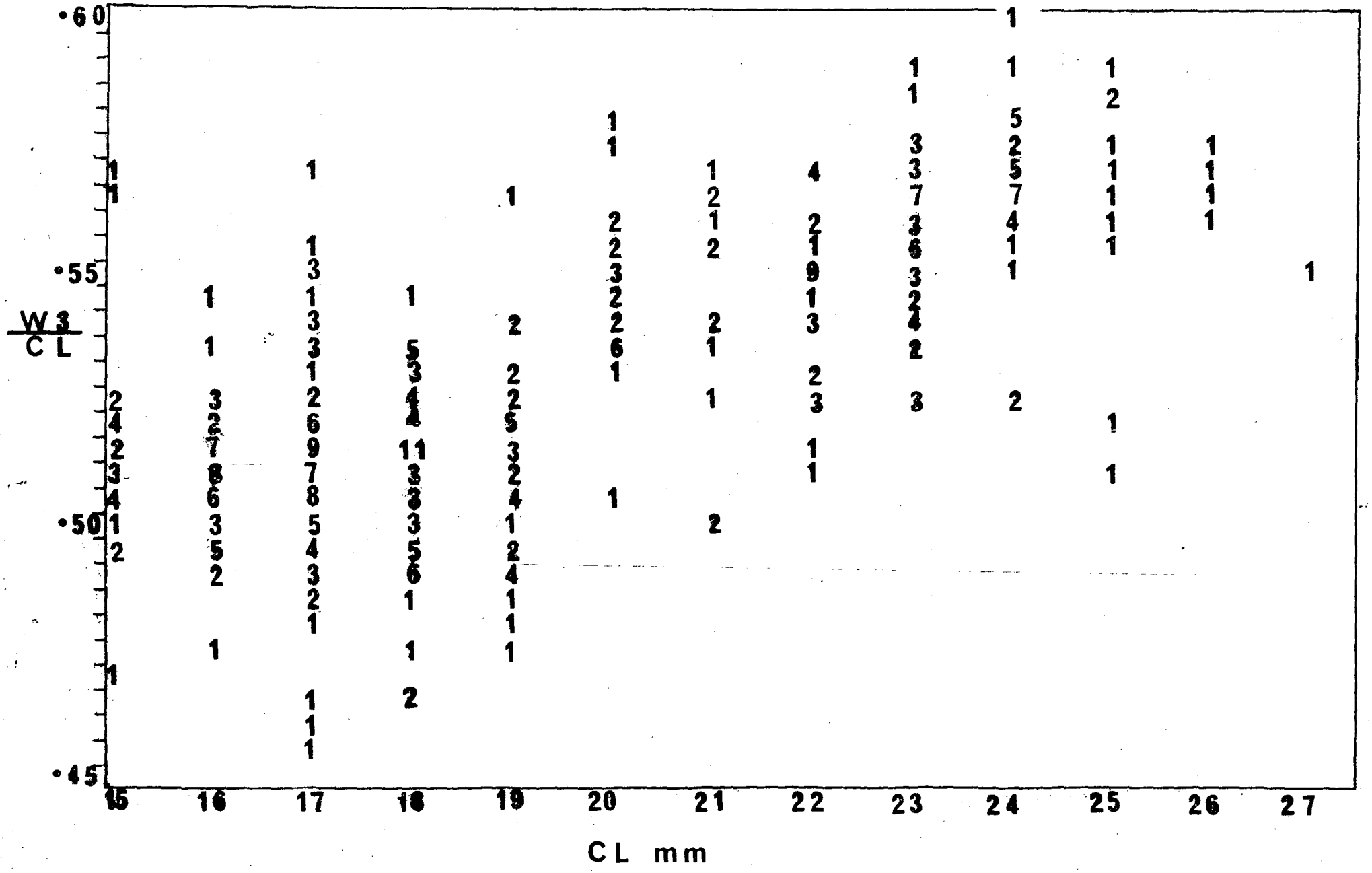

Figure 2. Female ratio of third abdominal segment width to carapace length (W3/CL) plotted against carapace length. Sample, August 1977.

Table 1. Means and standard deviations of biometric ratios of *Nephrops* at different carapace length groups

Carapace length group (lower margin)	Appendix masculina length / 2nd pleopod endopodite length (AM/P2) MALE (May)			3rd abdominal segment width / carapace length (W3/CL) FEMALE (August)		
	Mean	S.D.	N	Mean	S.D.	N
15	-	-	-	0.515	0.0216	21
16	-	-	-	0.509	0.0130	39
17	0.377	0.0389	2	0.512	0.0220	63
18	0.496	0.0412	4	0.510	0.0182	52
19	0.473	0.0371	5	0.511	0.0202	31
20	0.457	0.0534	3	0.538	0.0181	22
21	0.531	0.0862	5	0.546	0.0210	11
22	0.556	0.0534	5	0.546	0.0165	27
23	0.571	0.0452	5	0.556	0.0160	38
24	0.596	0.0331	4	0.567	0.0156	29
25	0.598	0.0339	5	0.561	0.0271	10
26	0.632	0.0259	5	0.567	0.0065	4
27	0.580	0.0506	5	0.550	-	1
28	0.649	0.0492	5	-	-	-
29	0.618	0.0375	5	-	-	-
30	0.588	0.0653	5	-	-	-
31	0.593	0.0217	5	-	-	-
32	0.573	-	1	-	-	-
33	0.607	0.0456	4	-	-	-
34	-	-	-	-	-	-
35	0.664	-	1	-	-	-
36	0.581	0.0460	2	-	-	-
37	-	-	-	-	-	-
38	0.587	0.0403	2	-	-	-
39	0.545	-	1	-	-	-