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THE FOOD OF GADUS ESMARKII NILSSON AND A COMPARISON WITH ITS PLANKTONIC ENVIRONMENT

by

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Summary

A detailed analysis is given of the stomach contents of *Gadus esmarkii* sampled in the North Sea in March/April 1961. Copepods and euphausids were the dominant food types. A comparison between the relative abundance of species in the stomachs and in Gulf III plankton samples from the same location shows that they are similar. The difficulties of this sort of work are discussed.

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Introduction

In a previous report, Raitt (1961), the food and feeding of Gadus esmarkii Nilsson, was described and compared with that of 0 group haddock and whiting. G. esmarkii was shown, like young whiting, to be principally a planktonic feeder with a diet consisting mainly of pelagic crustacea. Young haddock, on the other hand, were found to be omnivorous bottom feeders with a wide variety of species in the stomach contents. In the present paper a more comprehensive analysis of G. esmarkii stomachs has been made and the quantities of the various food species found are compared with the fish's planktonic environment as sampled with the Gulf III high speed tow net.

Material and Methods

The samples were collected during a routine trawling survey in the northern North Sea in March-April 1961. For purposes of comparison the results from two areas have been treated separately - a northern area extending from 58°30'N to 61°01'N and from 01°00'W to 03°00'E and a southern area extending from 57°00'N to 58°30'N and 04°00'W to 01°00'E. The northern area lay east of Orkney and Shetland and the southern area lay within the Moray Firth - Buchan fishing area. All sampling was done during the hours of daylight, Gulf III and trawl hauls being made in the same position on 15 occasions in the Northern area and on 13 occasions in the Southern area.

Details of the Gulf III high speed plankton sampler and the methods of analysis used are as given by Adams (1962). From 10-15 stomachs of G. esmarkii were collected from each trawl haul and all the stomachs containing food were combined from each sample. The numbers of individuals of each species found were raised to a common factor of numbers per 10 stomachs. All of the fish sampled were 1 year or older, the length distribution being 12-19 cm.

Detailed Analysis of Stomach Contents

The numbers of each species occurring in the stomachs in each haul are shown, separately for the two different areas, in Tables 1 and 2. As in previous investigations, Raitt (loc.cit.), copepods and euphausids formed the bulk of the diet. In the Southern samples Pseudo/Paracalanus, Temora longicornis and Metridia lucens were the dominant copepods in the stomachs and Thysanoessa inermis, Meganyctiphanes norvegica and Nyctiphanes couchii the commonest euphausids. The only other food types occurring in a significant volume were crangonids and Oikopleura sp. although decapod larvae and cirripede nauplii did occur at greater densities than one per 10 stomachs.

The relative importance of food types in the stomachs from the Northern area was similar to that in the Southern area except that Calanus finmarchicus was by far the most abundant copepod.

Stomach contents of G. esmarkii compared with planktonic environment

For this comparison food and plankton species were grouped into two types

for the two areas of the investigation: a) Small organisms which included copepods, calyptopis larvae and Spiratella retroversa and, b) Large organisms which included euphausids, Sagitta sp., Tomopteris sp., and Oikopleura sp. The results can be seen in Figures 1 and 2. On the left hand side of each figure the species are arranged in decreasing order of abundance in the plankton samples expressed as numbers per cubic metre for the small organisms, and numbers per $100m^3$ for the large organisms. On the right hand side their corresponding abundance in the stomach samples is shown as numbers per 10 stomachs. No species of the appropriate size range occurring in the plankton samples in numbers less than 0.3 per m^3 or 0.3 per $100m^3$ were included. Only once was a species occurring at below this level present in the stomachs - Centropages typicus occurring in the Southern area at numbers of 0.4 per 10 stomachs. Invertebrate larval forms were unfortunately not counted in the Gulf III samples but decapod, cirripede and lamellibranch larvae did occur in small numbers in the stomachs in both areas.

From Figures 1 and 2 it can be seen that although not in complete agreement the general picture of abundance of organisms in the plankton and in the stomachs is similar. The correlation is good when one considers the difficulties inherent in research of this nature.

(I) Stomach contents as a method of assessing food eaten must be treated with some caution. The length of time since feeding is not known and different digestion rates might well eliminate some species very quickly. This in fact might explain the comparative absence of the soft bodied Sagitta from the stomachs in spite of the fact that in both areas it was common in the plankton. (The irregular occurrence of Appendicularia in both stomach and plankton samples is rather more difficult to explain).

(II) The fish may have moved in the period between active feeding and capture i.e. they may not have been feeding where they and the plankton were sampled.

(III) The fish examined were all caught with the Bottom Trawl. The Gulf III does not effectively sample the extreme bottom layers of plankton as the risk of losing the gear is too great. If the fish were only feeding on the bottom layers of plankton this would undoubtedly introduce a bias into the results.

Figures 1 and 2, although demonstrating that the most abundant planktonic species were also generally best represented in the stomach contents, by no means prove conclusively that G. esmarkii is a non selective feeder.

In both areas euphausids were well represented in the stomach contents although not always occurring in large numbers in the plankton. The absence of Sagitta from the stomachs has already been noted.

It is hoped to continue this work and include some research into the feeding depth of G. esmarkii and the associated depth distribution of plankton species.

References

Adams, J. A. 1962. "Zooplankton surveys in the northern North Sea with the Gulf III sampler". I.C.E.S., C.M. 1962, Plankton Comm., Paper No.

Raitt, D. F. S. 1961. "The food and feeding of Gadus esmarkii Nilsson compared with O-group haddock and whiting". I.C.E.S., C.M. 1961, Gadoid Fish Comm., Paper No. 101.

Table 1

G. esmarkii Stomach Contents Southern Area

	Trawl S61/													Total 13	Average/ Sample
	15	16	17	18	19	21	24	25	27	28	35	36	37		
Calanus finmarchicus						2		1		15		6	20	44	3.38
Pseudo/Paracalanus		3014			426	29	1			11	48	103	982	4614	355
Temora longicornis		301		3			22	1066	523	15		10	20	1960	151
Centropages hamatus				1			22	2	8	9		16		58	4.5
C. typicus		4												4	0.3
Metridia lucens		24			589	147				2		7	380	1149	88.4
Caligus	2							1			2	1		6	0.5
Meganyctiphanes norvegica	5									49	3	26		83	6.4
Thysanoessa inermis	13	1				47						6		68	5.2
Nyctiphanes couchii					5	62						2		69	5.3
Euphausid fragments					36	38		11				17		102	7.8
Cumacea		1							5					6	0.5
Mysids	2		1	2		1								6	0.5
Amphipods		1	1						3					5	0.4
Isopods			2						3					5	0.4
Crangon allmani	5			3				2		5				15	1.12
Spirontocaris sp.															
Other natant decapods			9			1	6					1		17	1.3
Appendicularia						3						82		85	6.5
Sagitta sp.	2												3	5	0.4
Tomopteris						1								1	.08
Decapod larvae		48										1		49	3.7
Calyptopis													7	7	0.5
Cirripede nauplii							1	10	3					14	1.1
Lamellibranch larvae								1						1	.08
Annelid fragments			+											+	+
Fish				1	1			1				1		4	0.3

Table 2

G. esmarkii Stomach Contents Northern Area

	Trawl S61/															Total 15	Average/ Sample
	31	32	33	34	40	41	42	45	47	48	50	51	53	54	55		
Calanus finmarchicus	10	35	13			2	121	89	30		930	173	2	226	1693	3324	222
Pseudo/Paracalanus	1		610	882	77	2	8	6			3	8		2	17	1616	108
Temora longicornis									2		15	18	6			41	2.7
Centropages hamatus		1					1									2	0.13
Metridia lucens	2	11	30	147	7	5	18	19	16		6	13	8	6		288	19.2
Caligus						2										2	0.13
Meganyctiphanes norvegica	15	+	10	24					16							65	4.3
Thysanoessa inermis			57	1			23	7	15							103	6.8
T. raschii									1							1	.06
Nyctiphanes couchii							3	4	102						1	110	7.3
Euphausid fragments	12		24					6								42	2.8
Amphipods			1					4							1	6	0.4
Isopods							1									1	.06
Crangon allmani						10				+						10	0.7
Spirontocaris sp.				1												1	.06
Other natant decapods																-	-
Spiratella retroversa		1					4				1					6	0.4
Appendicularia																	
Sagitta sp.																	
Decapod larvae						2		3								5	0.3
Calyptopis							1	7								8	0.5
Cirripede nauplii												3				3	0.2
Furcilia								1	2			3				6	0.4
Annelid fragments						+										+	+
Fish							7	7	1							15	1.0

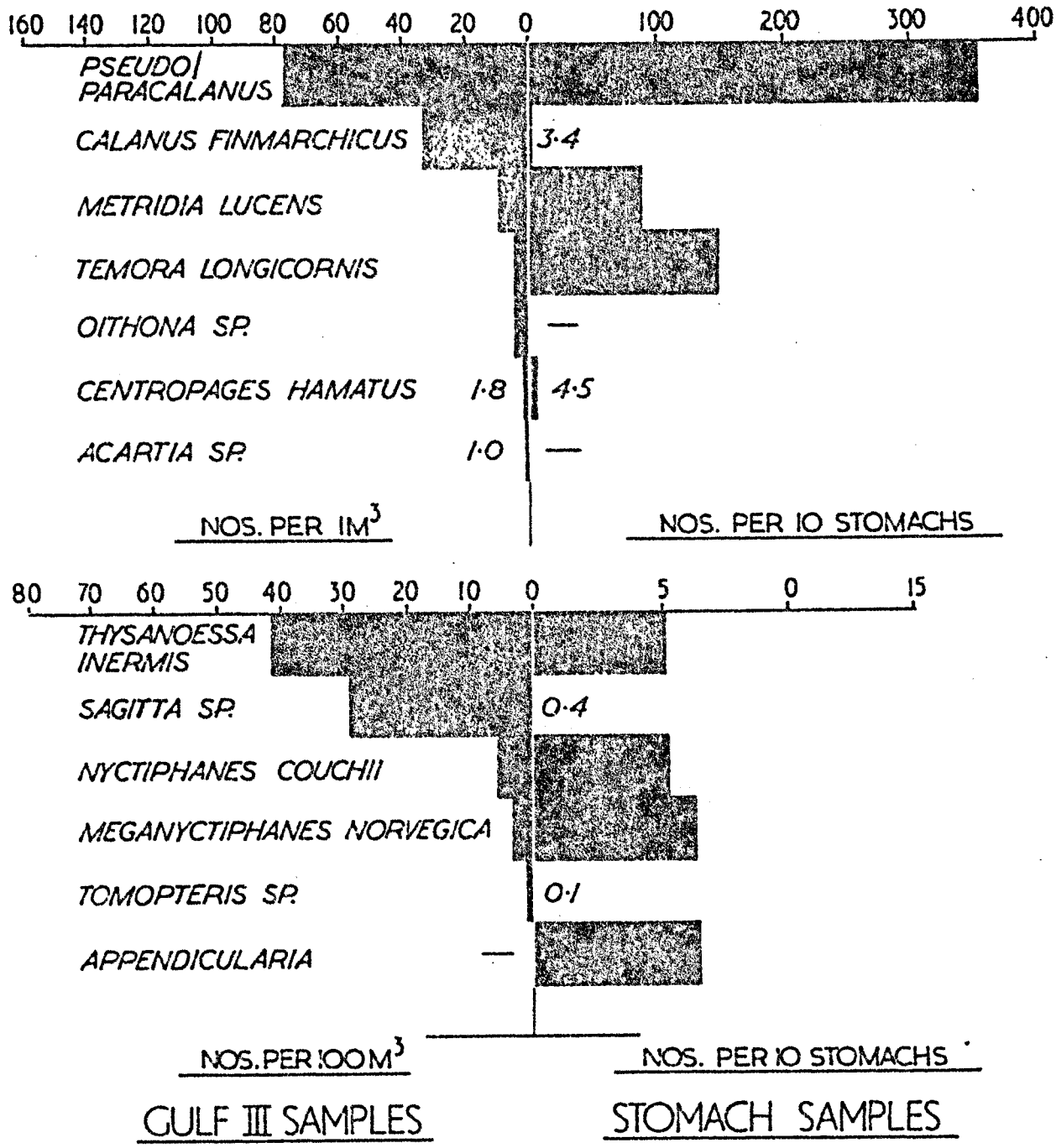

FIG.I. SOUTHERN AREA

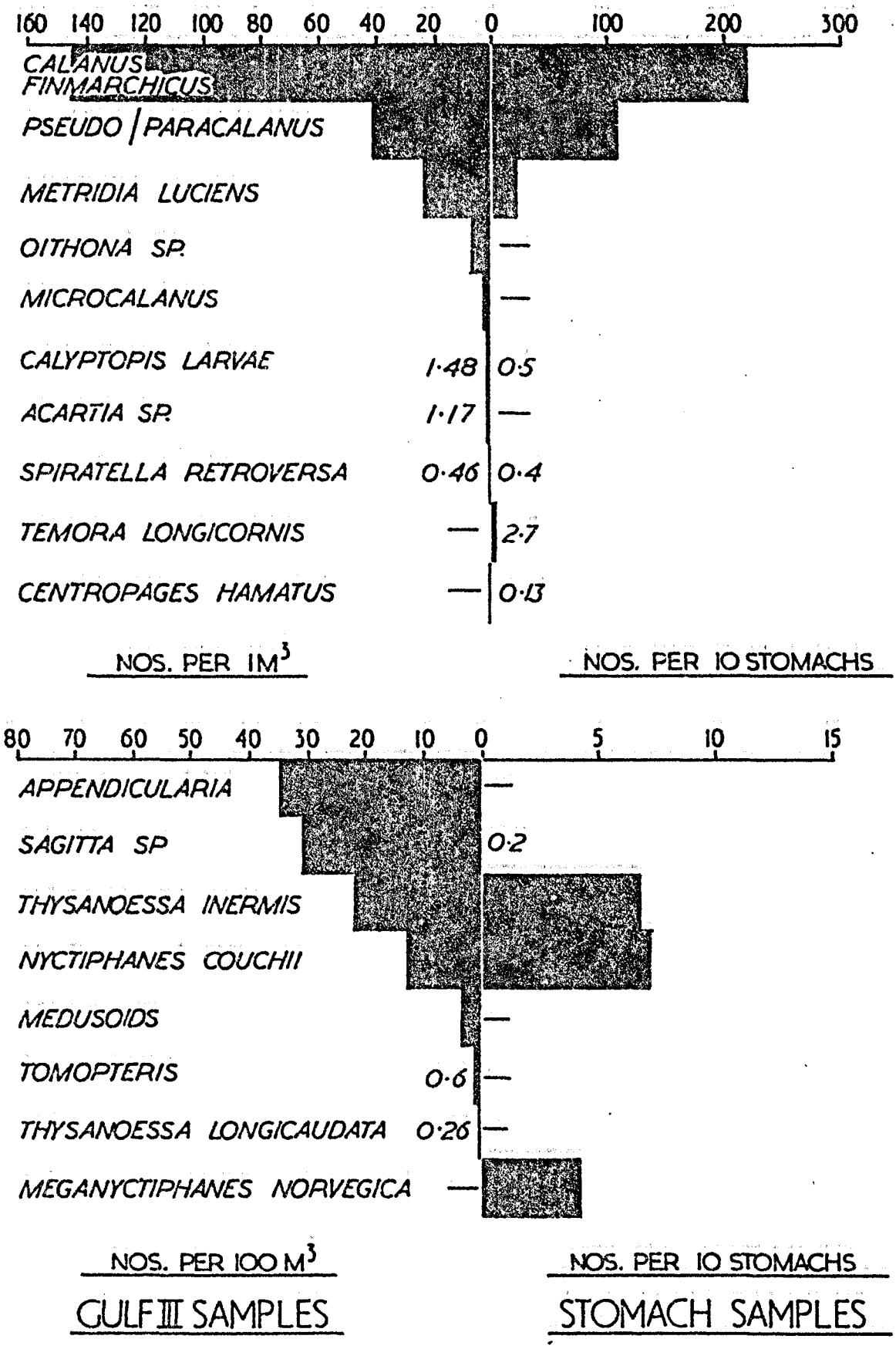

FIG. 2. NORTHERN AREA