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INVESTIGATIONS ON THE COPEPOD FAUNA IN EAST GREENLAND WATERS

BY

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WITH 37 FIGURES IN THE TEXT

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I. INTRODUCTION

The present investigation on the copepod fauna in the East Greenland waters is, in the first place, based upon a comprehensive material of marine copepods collected by the Three-Year-Expedition to Christian den X's Land 1931—34 (leader: Dr. LAUGE KOCH) on the cruises of the expedition vessel "Godthaab" to East Greenland in the years 1932 and 1933. The collections which in those two years were made by the zoologists Professor, Dr. phil. R. SPÄRCK and Dr. phil. G. THORSON, were more especially undertaken in the two East Greenland systems of fjords, Kejser Franz Joseph Fjord and Scoresby Sund Fjord, situated between about 70° and 74° N. lat. As to the situation of the stations within the two fjord areas, see the chart Fig. 1.

The geographical division of the fjord areas comprising Kejser Franz Joseph Fjord and Scoresby Sund Fjord is as follows:

The Kejser Franz Joseph Fjord area covers the distance from Davy Sund (c. 72° N.) to Gael Hamkes Bugt (c. 74° N.) and the various parts of fjords situated within this distance, as well as a few stations lying out at sea outside the fjord area proper. Samples of plankton have been collected in the following fjord regions: Davy Sund, Kong Oscar Fjord, Kempe Fjord, Sofia Sund, Kjerulf Fjord, Is Fjord, Kejser Franz Joseph Fjord, Nord Fjord, Moskusokse Fjord, Dusen Fjord and Gael Hamkes Bugt.

The Scoresby Sund Fjord area comprises the distance from about 70° N. to about 72° N., and besides in Scoresby Sund itself and the mouth of the latter investigations have been made in the following fjord regions: Hurry Fjord, Hall Bredning, Føhn Fjord, Røde Fjord and Nordvest Fjord.

In these investigations of fjords Hensen and Nansen nets have been used for vertical hauls and 1 m stramin nets for horizontal hauls, the implements having been hauled at different lengths of wire. In order to give an idea of the extent to which collections of plankton have been

Fig. 1. Map showing the positions of stations in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas, where pelagic hauls were made in 1932 and 1933.

made in the two fjord areas a summary is given of the number of hauls made at different depths.

	Kejser Franz Joseph Fjord	Scoresby Sund Fjord
Nansen net 100—0 m and 50—0 m	12	5
Hensen net 100—0 m.....	16	4
— — 200—0 -	..	3
Stramin net 50 m.w.	2	1
— — 75 —	..	1
— — 100 —	3	3

	Kejser Franz Joseph Fjord	Scoresby Sund Fjord
Stramin net 150 m. w.	1	..
— — 200 —	7	4
— — 300 —	13	1
— — 400 —	5	..
— — 500 —	2	..
— — 600 —	2	1
— — 650 —	1	..
— — 700 —	7	1
— — 800 —	3	..

Thus, whereas the material mentioned from the two East Greenland fjords is the chief source of the present paper, examinations have further been made of a number of plankton samples, collected by other expeditions in more southerly latitudes along the coast of East Greenland.

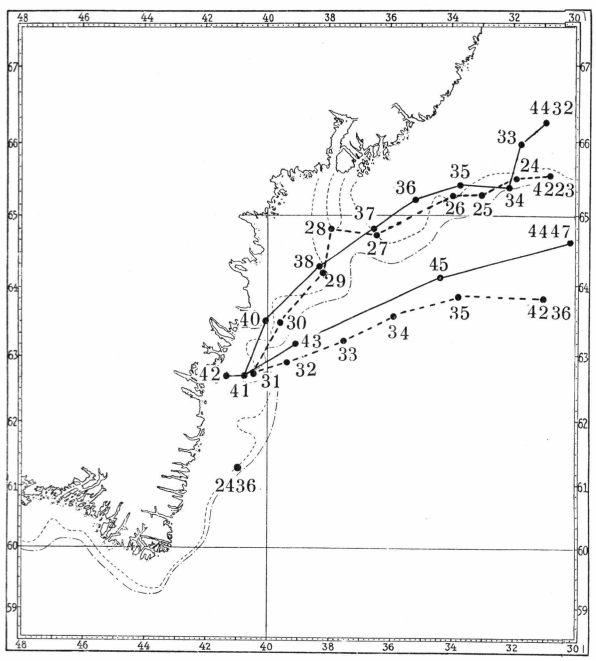

Fig. 2. The "Dana"'s pelagic stations in 1931 (St. 4223—36) and in 1932 (St. 4432—47), and also St. 2436 ("Dana" 1925) in the western part of the Danmarksstræde.

A valuable supplement to the other material is thus the great amount of plankton samples which were collected by the Scoresby Sound Committee's 2nd East Greenland Expedition (1932) to Kong Christian IX's Land (between 68° and 69°30′ N. approx.). The samples of this

expedition were collected, partly with a Hensen net and partly with a 1 m stramin net.

In order further to illustrate the distribution of the various copepods along the southeastern coast of Greenland between 60° and 65° N. approx., the present investigation has been made to comprise a great number of plankton samples collected in the years 1931, 1932 and 1933 on the cruises of the research ship "Dana" in the Danmarksstræde and

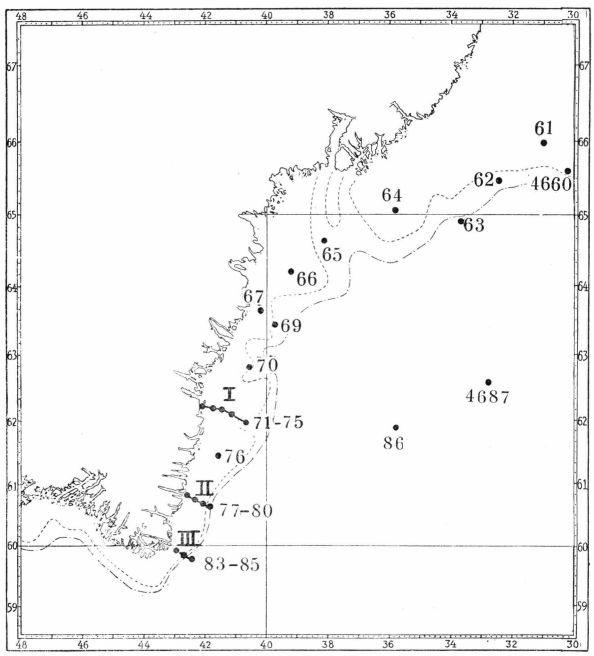

Fig. 3. The "Dana"s pelagic stations in 1933 (St. 4660—87) in the western part of the Danmarksstræde.

along the southern part of the coast of East Greenland. On those cruises the hauls made were more particularly vertical plankton hauls, in which the following implements were used at the respective depths: 1931, Hensen net, 25—0 m; 1932, Nansen net (silk no. 25), 50—0 m; 1933, $^1/_3$ m silk net (silk no. 3), 50—0 m. Further, collections have been made in all the three years by horizontal hauls with $^1/_2$ m stramin net, but the number of copepods collected in these hauls was generally so small that, only in exceptional cases, has the material been included in the present investigation. The stations on the cruises of the "Dana" have been plotted on the charts Figs. 2—3.

The first part of the report given below is a systematic account of all the species of copepods found in the material collected, with information regarding the occurrence of the latter, their distribution etc. It is

followed by a more comprehensive summary of the quantity of copepods and its composition in the various parts of the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas.

The report is concluded (pp. 96—103) by a summary of the occurrence of the various species of copepods in the different plankton samples (Tables I—XI). It has not been considered necessary to include all hauls, seeing that a number of these, particularly surface hauls, are very homogeneous in contents; but, on the other hand, all hauls which have been made with the commonly used implements and which offer points of particular interest are included in the lists. Unfortunately it has not been possible to preserve sufficiently representative samples of some of the hauls from Kejser Franz Joseph Fjord and Scoresby Sund Fjord, and consequently the latter are not included in the lists. As to the occurrence of each species the usual designations have been used to indicate their relative frequency, *viz.* rr = very few specimens, r = few, + = neither rare nor common, c = common and cc = very numerous. Further, the number of individuals have been counted in the case of a great many species, but these figures are included in the mention of the individual species.

Various investigators of copepods have been of great assistance to me in the preparation of the material at my disposal. First and foremost Dr. Karl Lang, Lund, has kindly undertaken the determination of a number of different harpacticides and Mr. Walter Klie, Bad Pyrmont, that of a smaller number of species within the same group. Further, Mr. G. P. Farran, Dublin, has verified the determination of individual species and further undertaken the description of a new species (Farran 1936a). For valuable help rendered I beg these scientists to accept my sincere thanks.

Finally, I am greatly indebted to Professor, Dr. phil. R. Spärck, for having entrusted me with the preparation of the comprehensive copepod material from the various East Greenland expeditions.

II. SYSTEMATIC ACCOUNT OF THE SPECIES

Calanus finmarchicus (Gunner).

Monoculus finmarchicus Gunnerus 1765, p. 175, figs. 20—23.
Calanus finmarchicus Sars 1903, p. 9, pls. I—III.

Material. In the following only the stages of development IV—VI have been taken into consideration for this species, seeing that it has not been possible to distinguish the youngest copepodid stages from the corresponding stages of *Calanus hyperboreus*. The species has been identified in all pelagic hauls in the fjord areas as well as in the more open waters along the coast of East Greenland.

Quantitative distribution. We will first look upon conditions in the two fjords of East Greenland, where more detailed investigations of the occurrence of the copepods have been undertaken. In hauls taken with Hensen net from 100 m to the surface there does not seem to be any pronounced distribution of the quantities at the various stations, but within the Kejser Franz Joseph Fjord area the greatest number of individuals has been taken at the innermost station in Kempe Fjord (St. 101, 1932) and in the Scoresby Sund Fjord area at the innermost station in Nordvest Fjord (St. 243, 1933). The numbers at the two stations are 1480 and 810 respectively, but seeing that such large quantities have been taken outside the fjord areas proper that they approach those of the two stations in numbers, the distribution of this species in the upper water layers is rather heterogeneous. Therefore, it has not been considered necessary to enter the numbers on a chart.

When examining the quantitative distribution of *Calanus finmarchicus* (stages IV—VI) in the deeper water layers, that is in hauls with 200—400 m.w. (stramin net) and of fifteen minutes' duration, this examination shows a distribution like the one indicated in Fig. 4.

It appears from the chart that the greatest quantities are found in the somewhat more closed areas of the Kejser Franz Joseph Fjord district, there being already a tendency in this direction in the upper water layers (100—0 m). The greatest numbers were thus found in the

interior part of Moskusokse Fjord (St. 23, 7600 specimens), in the interior part of Dusen Fjord (St. 84, 10,900 specimens) and at a few stations round Ella Ø (St. 126, 10,400 and St. 129, 7200 specimens). If we compare the numbers found at the three stations outside the fjord area (St. 114 and 116—17) with this, the figures obtained are comparatively low, *viz.*

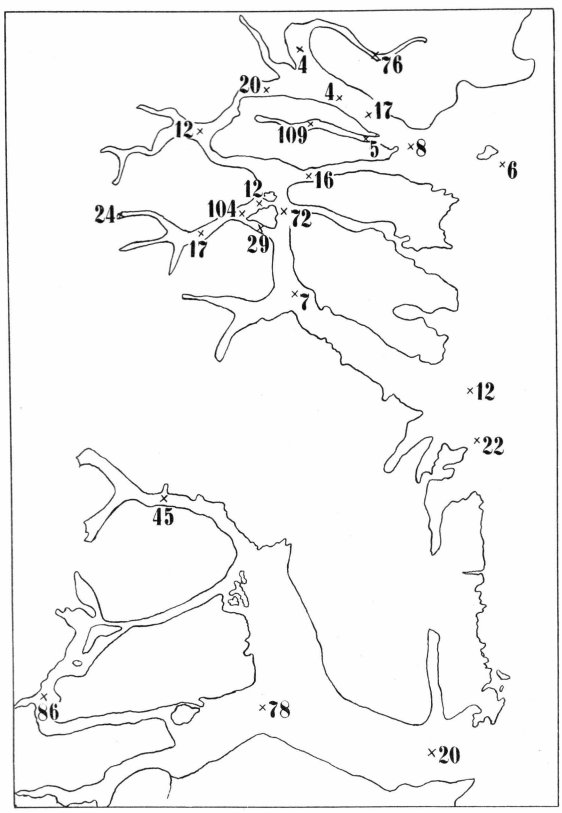

Fig. 4. *Calanus finmarchicus.* Number in hundreds at depths corresponding to hauls of 200—400 m.w. within the Kejser Franz Joseph and Scoresby Sund Fjord areas.

600, 1200 and 2200 specimens. It likewise seems to appear from the few hauls made at the mouth of Scoresby Sund Fjord that the number is here relatively smaller than farther up the fjord (see the chart Fig. 4).

While the intermediary water layers thus seem to contain the greatest numbers of *Calanus finmarchicus* (stages IV—VI) in the inner and more closed parts of the Kejser Franz Joseph Fjord area, the species in the deeper water layers, corresponding to hauls with 500—800 m.w. seems to have its maximum occurrence in the central parts of the fjord system. This f. inst. seems to be the case in the waters round Ella Ø, while the quantities decrease in the direction of the interior branches

of the fjord system and also towards the open sea. In the Scoresby Sund Fjord area there is a station at the mouth (St. 134, 1932) and one in Nordvest Fjord (St. 243, 1933) with 700 and 600 m.w. respectively. Practically the same quantities of *Calanus finmarchicus* have been taken in the two hauls, *viz.* 2340 and 2190 individuals per fifteen minutes' haul.

As regards the relative quantity of the species in a vertical direction it should be mentioned that *C. finmarchicus* (stages IV—VI) seems to occur in greatest numbers in the intermediary water layers corresponding

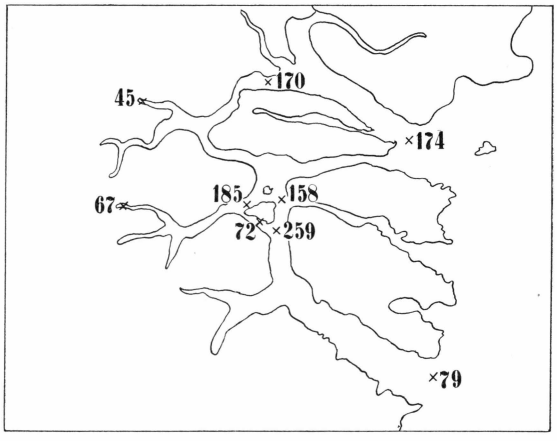

Fig. 5. *Calanus finmarchicus.* Number in tens at depths corresponding to hauls with 500—800 m.w. within the Kejser Franz Joseph Fjord area.

to hauls with 200—400 m.w. and is on an average found in somewhat smaller quantities in the deepest water layers (500—800 m.w.). At five stations in the Kejser Franz Joseph Fjord area hauls have been made, both in the intermediary and in the deeper water layers, and the figures given below show the numbers of *C. finmarchicus* in the respective hauls.

	St. 95	St. 97	St. 101	St. 107	St. 121	St. 129
500—400 m.w.	800	*2000*	*2400*	*2900*	*10400*	*7200*
200—800 —	*1700*	1700	700	700	1800	1600

The quantity of *C. finmarchicus* is, as it appears, on an average considerably greater in the intermediary (200—400 m.w.) than in the deep water layers (500—800 m.w.). An exception is St. 95 in the table above, but this station, as contrasted with the others given in the table, lies outside the fjord area proper, and so it is possible that it is only in the fjord area that *C. finmarchicus* has its maximum occurrence in the intermediary water layers. It is, however, of interest in this connection to call attention to the fact that *C. finmarchicus* in West Green-

land waters (see JESPERSEN 1934, p. 13) also seems to have its maximum occurrence in the upper and intermediary water layers and decreases in quantity in deeper water layers. In Baffin Bugt f. inst. this copepod on an average makes 60 per cent of all copepods in hauls with 200—350 m.w., whereas it only makes 21 per cent of the total number of copepods in water layers corresponding to hauls with 400—800 m.w.

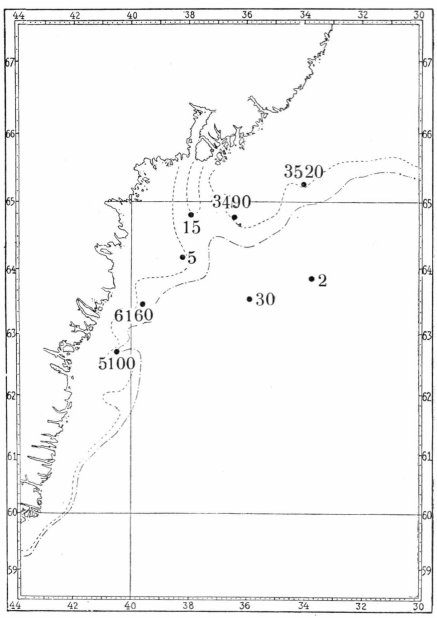

Fig. 6. Number of *Calanus finmarchicus*, taken at the various stations in 1931 with Hensen net (25—0 m).

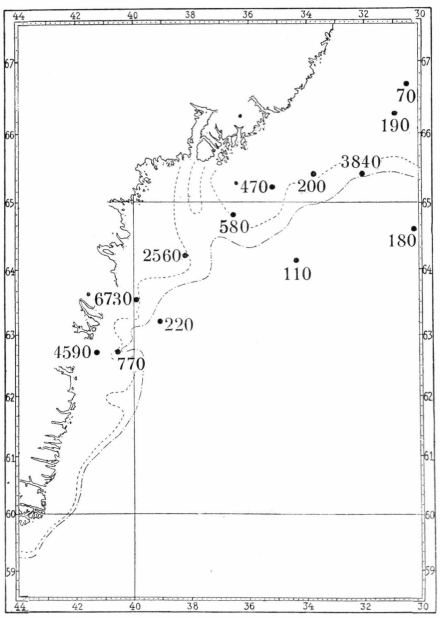

Fig. 7. Number of *Calanus finmarchicus*, taken at the various stations in 1932 with Nansen net (50—0 m).

As to the vertical distribution of the species throughout the year see otherwise USSING (1938, p. 16).

If we then examine the quantitative distribution of *C. finmarchicus* in the more open waters along the coast of East Greenland and the western part of the Danmarksstræde, this investigation reveals various points of interest. As a basis for this investigation we use plankton hauls carried out from the research ship "Dana" during the years 1931, 1932 and 1933. The numbers of *C. finmarchicus* in the respective hauls have been counted, but as the implements used vary somewhat in the different years, it is necessary to deal separately with the material from each year.

The charts of Figs. 6 and 7 give the number of *C. finmarchicus* taken in 1931 and 1932 in plankton hauls with the Hensen net 25—0 m and the Nansen net 50—0 m respectively.

The quantity of *C. finmarchicus* is thus, as it appears, extremely varying at the various stations; still, it must be mentioned that the

greatest number is to be found comparatively close to the coast of East Greenland, and that small numbers of this copepod species have been met with at all the stations situated outside the 1000 m curve. A somewhat similar fact results from the investigations in 1933, when hauls have been made with $^1/_3$ m silk net (silk no. 3) from 50 m to the surface.

The implement used in 1933 was comparatively small, so that the quantity caught of this copepod was on an average rather small, but

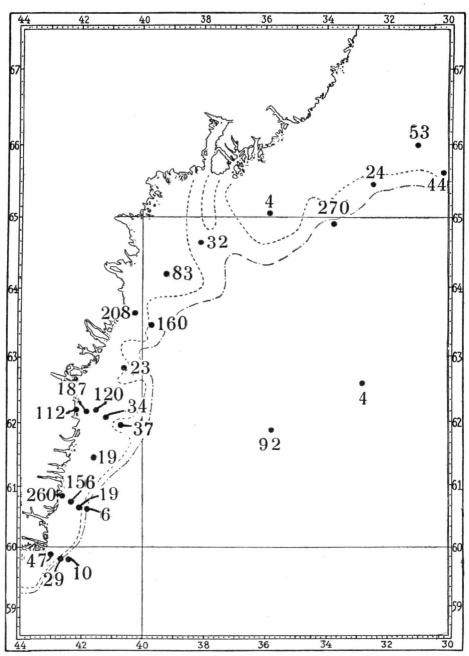

Fig. 8. Number of *Calanus finmarchicus* taken at the various stations in 1933 with $^1/_3$ m silk net (50—0 m).

still the numbers seem sufficient to show a gradual distribution of the quantity from the pronounced coast water and out towards the more open sea. On the cruises of 1933, as distinguished from those of preceding years, regular sections were made from off the coast. It is a question of three sections which have been indicated in Fig. 3 (see p. 6). The first section (I) lies partly off Tingmiarmiut, the second (II) off Kap Herluf Trolle and the third (III) on the east side slightly north of Kap Farvel. The station numbers of the three sections are the following: Section I, Sts. 4671—75; Section II, Sts. 4677—80 and Section III, Sts. 4683—85. The chart of Fig. 8 shows the numbers of *C. finmarchicus* in the different sections, but in order to make this still more clear these figures are further graphically represented in Fig. 9, together with curves of the mean temperature in 50—0 m of the different sections.

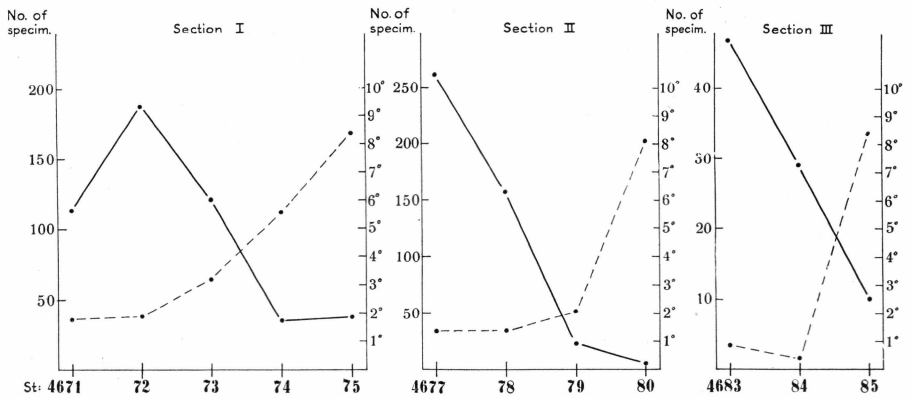

Fig. 9. Number of *Calanus finmarchicus* and mean temperature in 3 sections taken in 1933 from off the coast of East Greenland.

——— Number *Cal. finm.* ---------- Mean temperature 50—0 m.

It is quite evident that the number of *C. finmarchicus* is greatest immediately off the coast, and that it is smallest at the stations farthest from land. A comparison of the copepod numbers with the temperature at the various stations further shows quite clearly that the quantity of *Calanus finmarchicus* in the waters along the coast of East Greenland is greatest in water with a low temperature (0.5°—2° approx.). The mean temperatures given are calculated from the temperatures in 50 m, 25 m, 10 m and 0 m at the respective stations, as appears from the summary given below, which further shows the calculated mean figures.

Table 1. Temperatures in 3 sections taken along the coast of East Greenland, medio August 1933.

	Section I					Section II				Section III		
St:	4671	4672	4673	4674	4675	4677	4678	4679	4680	4683	4684	4685
0 m...	2.96	3.30	3.80	5.84	8.82	2.12	2.97	3.90	8.23	2.90	2.68	9.34
10 - ...	2.47	1.96	3.10	5.98	8.82	1.81	1.92	1.96	8.07	1.16	—0.94	9.14
25 - ...	1.06	1.83	2.74	5.14	8.54	2.27	1.92	1.29	8.05	0.15	—0.58	8.13
50 - ...	0.78	0.45	3.00	5.14	7.41	—0.39	—1.06	0.91	8.02	—0.64	0.71	7.00
Mean...	1.82	1.88	3.16	5.52	8.40	1.45	1.44	2.01	8.09	0.89	0.47	8.40

The low temperatures nearest the coast are due to the Polar Current, which from the Arctic passes in a southerly direction along the coast of East Greenland and in the summer carries ice round Kap Farvel, and it is therefore in this East Greenland Polar Current that the greatest number of *C. finmarchicus* occur. The water areas with the large number of *C. finmarchicus* are, however, not only characterized

by the low temperatures, but also by a relatively low degree of salinity which is caused by the superincumbent layer of melting water. A calculation of the mean salinity for the depths 50 m, 25 m, 10 m and 0 m in the various sections consequently shows that there is a low mean salinity at the innermost stations, but that the salinity—in accordance with the mean temperature—increases towards the more open sea. The salinity in the various depths and the calculated mean salinities for the various stations appear from Table 2 given below.

Table 2. Salinities in 3 sections taken along the coast of East Greenland, medio August 1933.

	Section I					Section II				Section III		
St:	4671	4672	4673	4674	4675	4677	4678	4679	4680	4683	4684	4685
0 m...	27.52	28.31	32.37	33.91	34.98	26.92	29.22	32.91	34.70	29.88	32.70	34.95
10 - ...	28.17	29.90	32.50	34.09	34.98	28.89	32.20	33.01	34.74	31.17	33.13	34.95
25 - ...	30.70	31.29	33.17	34.07	34.99	30.94	32.39	33.50	34.87	32.29	33.52	34.96
50 - ...	31.94	32.17	33.42	34.52	35.05	32.53	33.04	33.91	34.88	32.84	33.90	35.08
Mean...	29.58	30.42	32.86	34.15	35.00	29.82	31.71	33.33	34.80	31.54	33.31	34.98

The various sections along East Greenland have already been subjected to a detailed investigation from a hydrographical point of view (THOMSEN 1934, pp. 12—13), and so the reader is referred to this work.

When summing up what has been said above it thus proves that off East Greenland the greatest quantities of *C. finmarchicus* are found in the cold Polar Current immediately along the coast, whereas the number is relatively much smaller in the warm Atlantic water outside the Polar Current.

Occurrence of the various stages of development. When examining the relative quantity of the three oldest stages of development of *Calanus finmarchicus* (stages IV—VI) at various depths and in various parts of the Kejser Franz Joseph area use is made of a number of stations within the following three different areas: 1. The interior part of the fjord area, 2. The waters round Ella Ø, and 3. Outside the fjord area. The table given below shows the relative quantities of the three stages of development in the various hauls.

In the interior parts of the fjord area stage V is numerically predominant in all hauls, with the exception of a single one in the intermediary water layers (St. 84), where the greater part of the specimens consisted of adult individuals (stage VI). In the waters round Ella Ø the frequency of the various stages of development corresponded very

Table 3. Relative quantity of stages IV—VI of *Calanus finmarchicus* within three different parts of the Kejser Franz Joseph Fjord area.

		Farthest in the fjord			The waters round Ella Ø				Outside the fjord area			
	St:	101	102	103	107	121	126	129	114	115	116	117
100—0 m	VI....	10.3	12.6	13.6	22.2	16.4	26.5	17.2	23.5	6.4	2.9	12.5
	V.....	*55.5*	*65.3*	*77.3*	*72.2*	*73.1*	*58.8*	*70.7*	*64.7*	14.9	9.5	40.6
	IV....	34.2	22.1	9.1	5.6	10.5	14.7	12.1	11.8	*78.7*	*87.6*	*46.9*
	St:	101	23	84	107	—	126	129	114	—	116	117
200—400 m.w.	VI....	24.5	6.3	*70.4*	42.3	—	*74.9*	33.4	45.7	—	21.5	33.0
	V.....	*73.3*	*85.6*	29.6	*51.2*	—	23.3	*66.3*	*51.4*	—	*60.0*	*60.0*
	IV....	2.2	8.1	0.0	6.5	—	1.8	0.3	2.9	—	18.5	7.0
	St:	101	58	—	107	121	126	129	95	118	—	—
500—800 m.w.	VI....	12.8	14.5	—	44.7	27.5	43.9	38.1	23.9	36.2	—	—
	V.....	*85.1*	*85.5*	—	*55.3*	*69.7*	*56.1*	*60.4*	*74.8*	*61.6*	—	—
	IV....	2.1	0.0	—	0.0	2.8	0.0	1.5	1.3	2.2	—	—

nearly to conditions in the innermost parts of the fjord area. Thus stage V was everywhere predominant, apart from a single haul in the intermediary water layers (St. 126), where adult individuals occurred in greatest numbers. Outside the fjord area it is more particularly stage IV which predominates in numbers, but this only applies to the upper water layers; deeper down, as in by far the greater number of hauls in the fjord area itself, it is stage V which occurs in greatest quantities.

It is thus characteristic of the occurrence of the three stages of development that whereas stage V dominates in by far the greater number of cases, it is more particularly stage IV which occurs in greatest numbers in the surface layers outside the fjord area. As to the vertical distribution of *Calanus finmarchicus* it may be said that the youngest copepodid stage (stage IV) occurs in greatest numbers in the upper water layers, whereas adult individuals (stage VI) by preference occur in greatest numbers somewhat deeper down in the water.

The distribution of the three stages of development in the Scoresby Sund Fjord area rather corresponds with that of Kejser Franz Joseph Fjord (see Table 4). Exactly as in the latter fjord, it is stage V which dominates in by far the greater number of hauls from Scoresby Sund, both in the upper water layers and deeper down. The only exception is, as a matter of fact, a haul with 200 m.w., where adult individuals (stage VI) have been found in relatively greater numbers than stage V.

This station (St. 243) is situated farthest in Nordvest Fjord. In this connection it is worthy of mention that adult individuals likewise predominate in a couple of hauls from intermediary water layers (200—400 m.w.) in the Kejser Franz Joseph Fjord area.

As already mentioned, it was a characteristic feature of the occurrence of the three stages of development in the Kejser Franz Joseph Fjord area that stage IV predominated in the upper water layers outside the fjord area proper. In the Scoresby Sund Fjord area there are no

Table 4. Relative quantity of stages IV—VI of *Calanus finmarchicus* within three different parts of the Scoresby Sund Fjord area.

		Farthest in the fjord			In the middle of the fjord		At the mouth of the fjord			
St:		207	243	327	299	333	11	134	141	142
100—0 m	VI.....	26.0	22.5	—	10.8	—	—	—	19.1	22.5
	V.....	*72.3*	*76.9*	—	*89.2*	—	—	—	*78.3*	*75.3*
	IV.....	1.7	0.6	—	0.0	—	—	—	2.6	2.2
200 m.w.	VI.....	—	*59.8*	48.4	—	26.1	25.0	—	—	—
	V.....	—	39.1	*50.4*	—	*73.9*	*69.0*	—	—	—
	IV.....	—	1.1	1.2	—	0.0	6.0	—	—	—
600—700 m.w.	VI.....	—	41.3	—	—	—	—	33.6	—	—
	V.....	—	*57.3*	—	—	—	—	*63.9*	—	—
	IV.....	—	1.4	—	—	—	—	2.5	—	—

stations outside the fjord district, so that it is impossible to say whether stage IV is also predominant in the surface layers off the open coast in these latitudes. At the stations at the mouth of the Scoresby Sund Fjord area stage IV, at any rate, only occurs in small numbers (2—3 per cent), and upon the whole it is characteristic of the upper water layers in the Scoresby Sund Fjord area that the youngest of the three stages of development (stage IV) occurs in relatively far smaller numbers than in the corresponding water layers in the Kejser Franz Joseph Fjord area.

In the year 1933, as already mentioned, some sections were taken with pelagic hauls from 50—0 m from off the coast of East Greenland, the stations extending from the cold coast water out into the Atlantic water. The number of *C. finmarchicus* at these stations was unfortunately so small that it is difficult to examine the relative frequency of the various stages of development. In one section (Section I, see the chart Fig. 3, p. 6) it is, however, possible with tolerable accuracy to calculate the relative frequency of the various stages of development. A calculation of this kind yields the following picture:

	St. 4671	St. 4672	St. 4673	St. 4674	St. 4675
Stage VI.....	—	—	—	6.9	*48.0*
Stage V.....	18.7	33.3	25.8	*75.9*	44.0
Stage IV.....	*81.3*	*67.7*	*74.2*	17.2	8.0

It appears from these calculations that whereas stage IV is numerically predominant at the three innermost stations in the East Greenland Polar Current, stages V and VI have been found in by far the greatest number at the two outermost stations, situated in the waters of the Atlantic. Thus, it seems to appear from an investigation of corresponding conditions at other stations that adult individuals of *C. finmarchicus* (stage VI) practically do not occur at stations situated in the cold coast water, but that they are found in greater or smaller numbers at most stations in the warmer Atlantic water farther out to sea.

Finally, as regards the vertical distribution of this species it should be mentioned that the males of *C. finmarchicus* by preference occur in the deeper water layers. The males as a rule only make a small percentage of the adult individuals, the females being by far numerically predominant. In the upper water layers practically no males have been found, whereas in the deeper water layers they may occur in considerably greater numbers. In order to obtain an impression of the relative quantity of males in the various depths, a great number of adult individuals have been counted from a number of hauls made in the Kejser Franz Joseph Fjord area with 300 and 700 m.w., the percentage of males being afterwards calculated in the case of each haul. In 8 hauls with 300 m.w. the males make 1—7 per cent of the total number of adult individuals (average: 3.1 per cent), whereas 5 hauls with 700 m.w. yielded 5—14 per cent (average: 9.6 per cent). It appears from these investigations that there are about three times as many males of *C. finmarchicus* in depths corresponding to hauls with 700 m.w. as in water layers corresponding to hauls with 300 m.w.

Variation in the size of *Calanus finmarchicus*. STÖRMER (1929) proved that in the waters west of Greenland *C. finmarchicus* occurs in two size groups. By measuring the length of cephalothorax in a great number of specimens belonging to this copepod species, a more thorough investigation was made of the geographical distribution of the two size groups. The material was collected by the "Godthaab" Expedition 1928 in West Greenland waters, and by means of this examination it was proved that the large form of *C. finmarchicus* occurred in greatest numbers in the central and western parts of Baffin Bugt, and that the large individuals were more particularly found in water layers of a low temperature, whereas the small individuals by preference

Table 5. *Calanus finmarchicus*, stage VI, ♀. Length measurement

	100—0 m							50—200 m.w.												
St:	97	101	102	110	114	121	Total	84	114	124	124	126	129	Total	73	94	95	97	98	10
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
8	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	.
7	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	1	..	..	..	.
6	..	..	..	..	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	.
55	..	..	..	..	1	..	1	1	4	..	..	1	..	6	1	..	1	..	..	1
4	..	..	..	..	..	..	..	2	8	1	..	4	1	16	2	..	..	..	1	1
3	..	..	1	..	..	..	1	5	10	3	..	9	5	32	1	..	1	..	..	4
2	..	..	..	1	..	1	2	11	9	2	..	7	8	37	3	..	4	1	2	4
1	..	..	..	2	1	1	4	12	11	2	2	14	7	48	2	2	3	2	3	6
50	..	..	..	..	1	2	3	11	16	1	3	20	10	61	4	7	7	3	5	1
9	2	..	1	2	..	..	5	15	12	2	2	19	12	62	4	9	12	6	5	6
8	1	..	..	1	1	..	3	12	7	..	4	16	15	54	1	9	8	6	6	8
7	..	..	..	..	..	1	1	10	6	2	5	5	11	39	3	8	3	7	4	9
6	..	..	..	..	1	1	2	9	8	4	1	2	6	30	..	1	8	3	2	4
45	..	..	..	..	1	..	1	5	6	2	6	4	5	28	1	4	2	3	2	.
4	..	1	..	..	..	..	1	4	1	2	2	2	5	16	..	3	1	..	4	2
3	..	..	1	..	1	..	2	2	1	2	3	1	1	10	..	1	1	2	2	.
2	..	..	..	..	..	..	..	..	2	..	..	1	1	4	..	..	..	1	..	.
1	..	1	..	..	..	..	1	..	1	..	..	..	1	2	..	..	..	1	..	.
40	..	..	..	1	..	..	1	1	2	..	..	..	3	6	..	..	..	..	..	.
9	1	..	..	..	1	1	3	..	2	..	1	..	1	4	..	..	..	1	..	3
8	..	2	..	3	2	..	7	..	1	..	..	1	3	5	..	..	..	..	..	5
7	1	1	4	1	2	2	11	..	1	..	1	..	..	2	..	..	..	1	1	3
6	4	3	2	2	..	1	12	..	..	..	..	..	1	1	1	..	..	4	..	.
35	2	..	..	2	2	..	6	..	..	1	..	1	..	2	1	1	..	3	..	.
4	..	1	1	2	4	1	9	..	..	2	..	..	1	3	..	1	..	1	1	
3	1	..	1	1	..	..	3	..	..	..	..	..	..	..	1	..	1	..	..	.
2	..	1	1	..	2	..	4	..	..	..	1	..	..	1	1	..	..	1	..	.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.

occurred in the warmer surface layers or pronouncedly Atlantic waters (JESPERSEN 1934).

Measurings of the length of cephalothorax have likewise been made in a great number of adult individuals (♀) of *C. finmarchicus* from East Greenland waters, and so it is possible to make a comparison of this material with that from the waters west of Greenland.

When looking over Table 5 it immediately appears that there are two size groups of *C. finmarchicus* in the waters along the east coast of Greenland, as is also the case in the West Greenland waters.

The material which is given in the table and exclusively dates from

)f cephalothorax (measurement scale: 1 division line = 0.077 mm).

)0—500 m.w.											650—800 m.w.									Total no. of measured specimens
07	110	110	116	117	118	124	126	129	129	Total	58	95	97	105	107	121	126	134	Total	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
..	..	..	..	..	1	..	..	..	..	2	..	..	..	..	..	..	..	1	1	4
..	1	..	..	1	1	..	..	..	..	3	..	1	..	..	..	..	2	2	5	9
1	2	2	..	..	..	..	1	..		9	..	1	..	..	..	1	..	6	8	24
..	1	2	1	..	..	..	4	..	2	14	..	1	..	..	1	3	3	..	8	38
3	3	3	1	2	2	1	9	3	1	34	..	2	..	..	1	1	..	7	11	78
7	4	6	..	2	5	1	7	7	2	55	..	5	3	3	..	..	5	3	19	113
8	8	15	2	1	3	2	14	9	4	84	..	6	3	2	1	4	7	5	28	164
16	8	18	1	1	2	4	20	14	6	127	1	5	6	2	1	4	11	3	33	224
7	8	21	1	2	4	2	19	19	8	133	1	6	7	2	2	5	12	10	45	245
8	11	11	..	..	3	2	16	12	4	105	2	7	13	1	1	4	6	5	39	201
8	7	15	3	3	3	2	5	15	6	101	1	6	9	3	2	3	9	5	38	179
5	3	15	1	3	4	1	2	8	3	64	4	7	4	..	..	3	8	6	32	128
4	4	12	1	2	3	1	4	4	2	53	5	7	4	..	1	2	2	4	25	107
2	9	7	1	..	1	..	2	3	4	39	2	1	3	..	..	4	4	3	17	73
3	1	3	2	2	2	1	1	2	..	27	..	1	2	1	1	..	2	3	10	49
1	2	3	1	1	..	..	1	2	..	13	..	1	2	..	..	1	1	3	8	25
1	1	1	1	2	..	..	..	1	3	11	..	..	1	..	..	2	1	1	5	19
1	1	3	1	2	2	..	..	..	2	13	..	2	..	..	..	..	1	7	10	30
2	2	3	3	1	1	2	..	..	1	19	..	4	4	..	..	1	..	5	14	40
3	4	2	2	1	1	1	1	..	3	20	..	3	3	..	1	1	1	6	15	47
3	2	5	2	1	2	1	..	4	2	26	1	5	5	..	2	5	3	10	31	70
3	3	6	2	1	4	3	..	1	4	33	..	..	2	..	1	3	5	8	19	65
3	4	2	..	..	..	..	1	..	1	18	1	1	7	..	..	1	1	3	14	40
1	2	4	..	..	..	..	..	1	1	13	..	2	3	..	..	..	..	3	8	33
..	..	1	..	1	..	..	..	..	2	6	..	1	6	..	..	..	1	2	10	19
..	..	1	..	1	..	1	..	..	..	5	..	1	1	..	..	..	..	..	2	12
..	..	..	1	..	..	..	..	..	..	1	..	..	1	..	..	..	..	..	1	2
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

the Kejser Franz Joseph Fjord area consists of 2040 specimens, and the measures show the length of cephalothorax measured with a Winkel microscope, objective 00 without front lens, ocular 2 with measurement scale: 1 division line = 0.077 mm. The same microscope and the same enlargements were used in measuring the material from the "Godthaab" Expedition 1928 (Jespersen 1934, p. 21), so that it can be directly compared with the material mentioned above.

Such a comparison appears from the graphic representation in Fig. 10, where the measurings are indicated for the material from East Greenland and West Greenland waters respectively, the length of cephalothorax

(1 division line = 0.077 mm) being indicated on the abscissa and the number of specimens on the ordinate. For comparison the number of the respective lengths in the material from West Greenland has been reduced to about two thirds, thus yielding about equal numbers from the two localities *viz.* 2040 individuals from East Greenland and about 2230 individuals from West Greenland (i. e. two thirds of the number

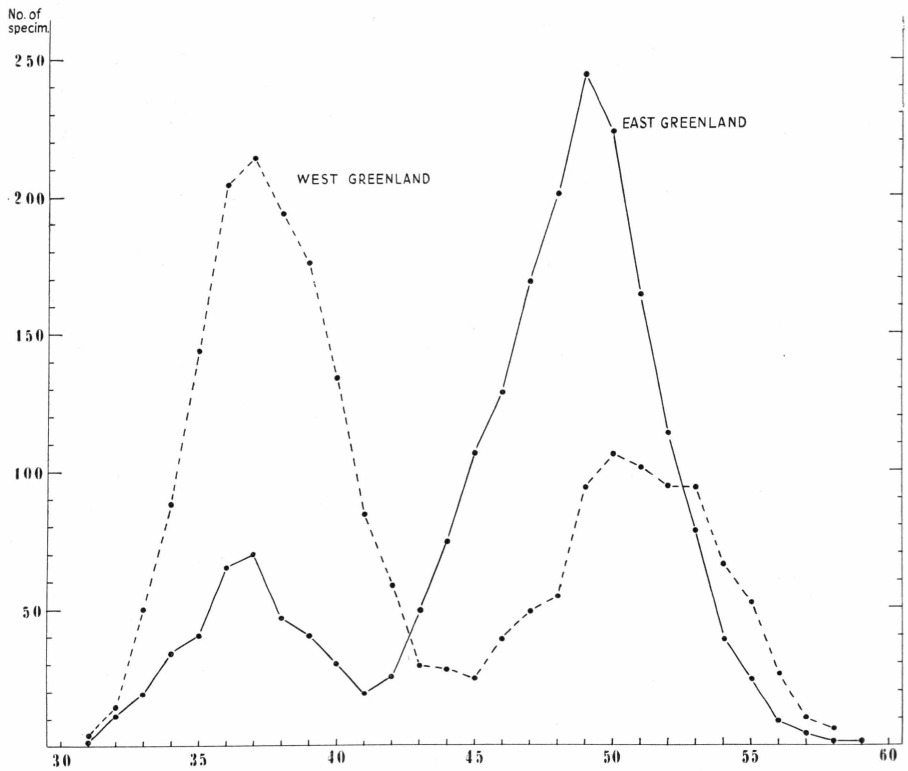

Fig. 10. *Calanus finmarchicus*, stage VI ♀. Length measurements of cephalothorax in specimens from East Greenland and West Greenland waters (see the text).

given in Table 3, JESPERSEN 1934, pp. 22—23). The selection of the number of individuals measured being dependent upon chance, no importance should be attached to the relative quantities of large individuals and small individuals, but it appears clearly from both curves that there are two size groups of this copepod species in both waters. Generally speaking, the two size groups from the two waters are identical, although the average length both for the small and the large size group is somewhat greater in the West Greenland than in East Greenland waters. This appears both from the position of the vertices of the two curves and from their general course. The variation in length of the two groups must approximately be estimated as follows:

Number of division lines.

	Small individuals	Large individuals
West Greenland	31—c. 44	c. 45—58
East Greenland	31—c. 40	c. 41—59

In the following description of the material from East Greenland specimens of a length of 31—40 division lines will thus be called small

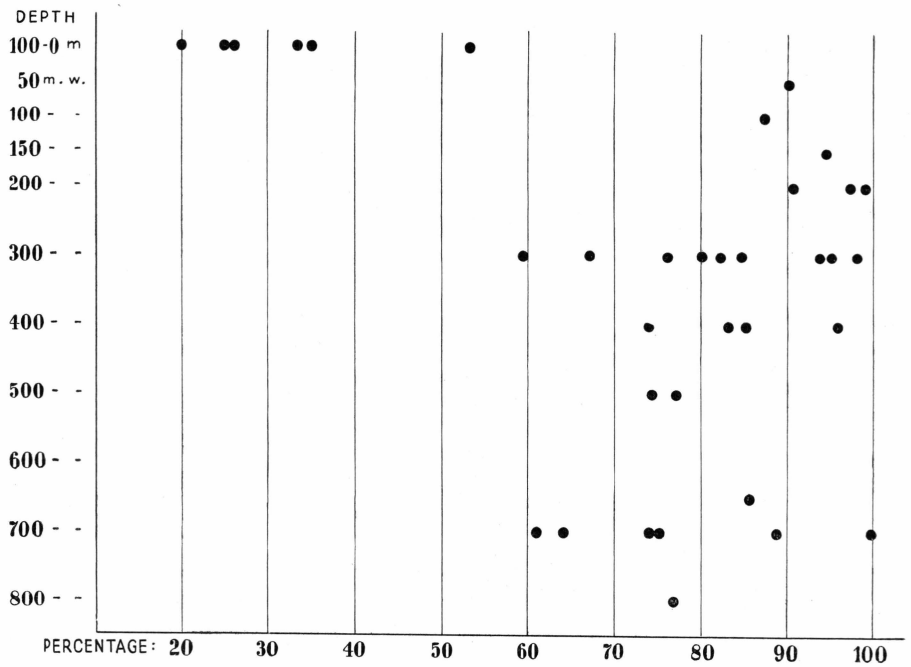

Fig. 11. Percentage of large individuals of *Calanus finmarchicus* in the various pelagic hauls.

individuals (2.3—3.1 mm approx.), whereas specimens of 41—59 division lines (3.1—4.5 mm approx.) will be called large individuals.

A more detailed investigation of the occurrence of the two size groups reveals various points of interest. Whereas the relative quantity of large and small individuals shows no pronounced distribution in a horizontal direction within the various parts of the Kejser Franz Joseph area, conditions are somewhat different regarding the vertical distribution.

The relative quantity of large individuals in the various pelagic hauls are given in Fig. 11, and it clearly appears that the large individuals, from a purely quantitative point of view, play a far greater part in the deeper water layers than immediately at the surface. Thus, in vertical hauls from 100 m to the surface only relatively few large individuals have been taken, *viz.* 20—52 per cent, whereas in the deeper water layers

they amount to from about 60—100 per cent of the number of *C. finmarchicus* ♀ collected. The vertical hauls, it is true, were made with the Hensen net, whereas a 1 m stramin net was used for the deeper hauls, but adult individuals of this copepod are of such an order of size that they can hardly escape through the open meshes of the stramin net. Therefore, the captures made by both implements may presumably for this species be regarded as representative of adult individuals.

If the whole material for all the respective hauls is put together, and the relative number of large and small individuals is calculated on the strength of it, the quantities given in Table 6 are obtained.

Table 6. Number and relative quantities of large and small *Calanus finmarchicus* ♀ at various depths.

	Number of individuals		Percentage	
	Small	Large	Small	Large
100—0 m	56	27	67.5	32.5
50—200 m.w.	24	448	5.1	94.9
300 —	85	467	15.4	84.6
400 —	41	224	15.5	84.5
500 —	26	79	24.8	75.2
650—800 —	124	332	27.2	72.8

The large individuals amount, in all, only to 32.5 per cent in vertical hauls from 100 m to the surface, whereas in the deeper water layers they amount to 72.8—94.5 per cent of the total number of individuals. It is, however, worthy of mention that the large individuals have their maximum occurrence at depths corresponding to hauls with 50—400 m.w., whereas they again seem to decrease in relative quantities in still deeper water layers (500—800 m.w.).

As to an explanation of this difference in the relative quantity of the vertical distribution those interested in the problem must look for it in the hydrographical conditions in the Kejser Franz Joseph Fjord area (cf. SPÄRCK 1933, THORSON and USSING 1934).

During the summer the main features of the hydrographical conditions in the Kejser Franz Joseph Fjord area are as follows: Uppermost there is a surface layer 10—25 m deep with a positive temperature and a relatively low salinity. At the actual surface the temperature may rise to about 12° C, and at a depth of 10 m temperatures of 5°—6° may be measured, but in this depth the temperature is on an average about 2.5°. The salinity in this surface layer is on an average about 30 ‰. Immediately below this surface layer and down to a depth of 300—400 m there is a water layer with a negative temperature, the so-called "Polar

Current water". In this the temperature fluctuates from 0° to ÷1.6° C, and the salinity varies between 32.3 and 34.8 ‰. Finally, there is another water layer below this one with a positive temperature and a rather constant high salinity, the latter being about 34.6—34.9 ‰ and the temperature between 0° and 1.7° C.

If we now compare the relative quantities of large and small *C. finmarchicus* with the hydrographic conditions mentioned above, it appears that the predominant number of small individuals in the surface hauls (100—0 m) must, to a certain extent, have been caught in the surface layer with a positive temperature, whereas the hauls with a predominant number of large individuals (50—400 m.w.) must undoubtedly have been made in the intermediary water layer with a negative temperature. The fact that the deepest hauls (500—800 m.w.) show a relatively larger number of small animals than those from the Polar Current water is undoubtedly due to the occurrence of the latter in a relatively greater number in the lowest water layer with a positive temperature than in the cold intermediary water layer.

To sum up, the small individuals of *C. finmarchicus* occur in greatest numbers in the warm surface layers in the fjords of East Greenland, whereas the large individuals dominate in water layers with a negative temperature; further, the small individuals again seem to occur in somewhat greater numbers in the lower water layers, where the temperature is positive. In accordance with conditions in the West Greenland waters, where large individuals of *C. finmarchicus* predominated in water with a low temperature, the temperature also along the east coast of Greenland seems to be the decisive factor for the frequency of the two size groups.

Ussing (1938) who has studied in detail the variation in the size of *C. finmarchicus* throughout the year in East Greenland fjords, points at the great difference in food conditions in summer and winter, respectively, as the real cause of the two size groups.

The facts given above as to size conditions of *C. finmarchicus* ♀ in East Greenland waters are exclusively based upon material collected in East Greenland fjords and the waters immediately outside the latter, and it is now of interest to regard the conditions of the material collected farther out to sea, outside the East Greenland Polar Current, or in the western part of the Danmarksstræde.

Measurements of the length of cephalothorax in a large number of *C. finmarchicus* ♀ have been made on material collected in 1931 at the "Dana" Sts. 4226, 4230 and 4231 and St. 4686 in 1933 (se Figs. 2 and 3, pp. 5—6). The material examined from 1931 dates from vertical hauls in 25—0 m, that of 1933 from vertical hauls in 50—0 m, but at none of the stations has a single specimen been found which can be classed with the group of large individuals. It thus proves that in the

surface layers in the western part of the Danmarksstræde, but outside the East Greenland Polar Current, only small individuals of *Calanus finmarchicus* are to be found.

The following is a summary of the number of individuals measured, their variation in length (1 division line = 0.077 mm) and the mean length for the various stations.

	Number of individuals measured	Variation in length	Mean length
St. 4226	105	31—40	35.82
- 4230	102	32—41	35.89
- 4231	81	31—41	35.91
- 4686	100	29—39	34.41

At St. 4686 which is situated farthest south and farthest out to sea, the mean length is somewhat less than at the other stations; however, the difference is so slight that the whole of the present material in all probability belongs to the same size group; therefore, the material examined from all the four stations will be dealt with under one.

It appears from a comparison between the material at hand from the Danmarksstræde and length measurements of the material from the fjords of East Greenland that there is little difference in the size of individuals from the western part of the Danmarksstræde and the group of small individuals from East Greenland fjords. The measurements given below apply to all individuals from the western part of the Danmarksstræde and to small individuals (less than 42 division lines) from East Greenland fjords.

Number of division lines (1 division line = 0.077 mm)		29	30	31	32	33	34	35	36	37	38	39	40	41
Number of individuals measured	The Danmarksstræde	1	4	10	18	33	58	63	73	65	34	17	9	3
	East Greenland fjords	—	—	2	12	19	33	39	66	70	46	40	32	17

In order further to illustrate conditions the measurements given have been graphically rendered in Fig. 12, and it clearly appears from the two curves that they are essentially identical, but that the individuals from the Danmarksstræde are on an average somewhat smaller than the specimens from the fjords of East Greenland.

The means for 388 specimens from the Danmarksstræde are thus 35.49 and for 376 specimens from East Greenland fjords 36.73, but it

should be borne in mind that it is not possible with certainty to fix the boundary between the group of large and small individuals for specimens from the East Greenland fjords. In broad features the individuals from the Danmarksstræde may, however, beyond a doubt,

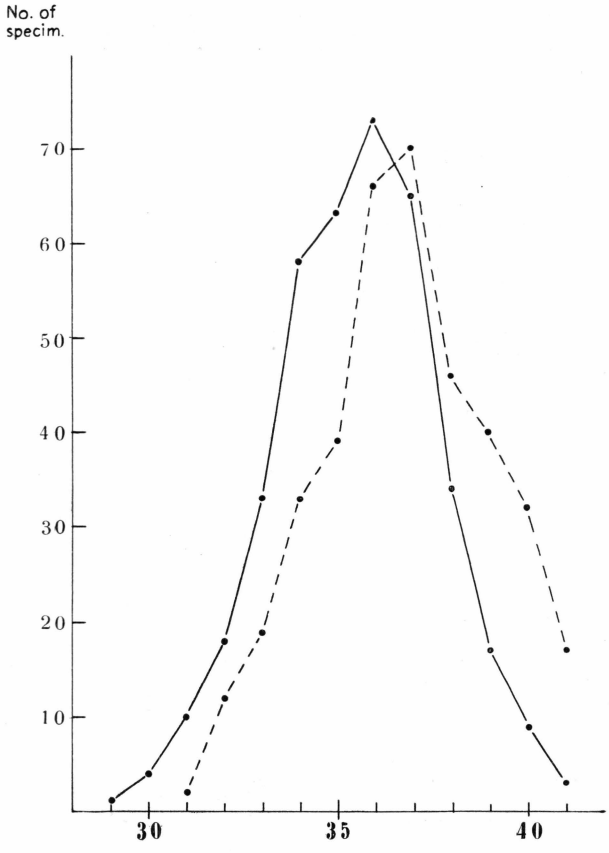

Fig. 12. *Calanus finmarchicus* ♀. Graphical representation of the length of cephalothorax in individuals from the Danmarksstræde (————) and small individuals from East Greenland fjords (----------).

be established to be of the same order of size as the small individuals from the East Greenland fjords. The fact that small individuals only have been found in the material examined from surface hauls in the Danmarksstræde undoubtedly has some bearing upon the relatively high temperature (3.5°—9.5° approx.) which here prevails in the surface layers.

As already mentioned, only a small number of adult males of *C. finmarchicus* have been found among the material collected in East Greenland waters. However, it is of interest to examine whether, as in the

case of the females, two size groups can be identified for adult males of this copepod species, and therefore a number of males have been separated from the remainder of the material.

Fig. 13 shows the result of measurements of the total length as well as the length of cephalothorax in *C. finmarchicus* ♂ from the Kejser Franz Joseph Fjord area, and it appears quite clearly that the measurements made fall into two distinct size groups. Even though the material

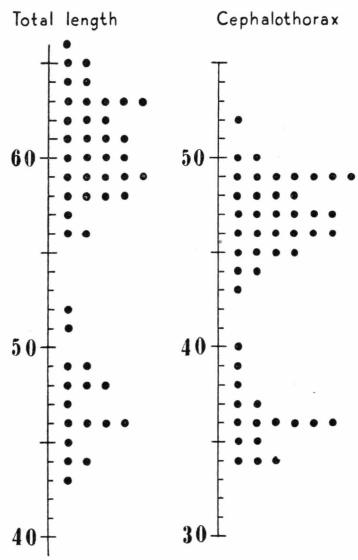

Fig. 13. Total length and length of cephalothorax in *Calanus finmarchicus* ♂ from East Greenland waters. (Measurement scale: 1 division line = 0.077 mm).

at our disposal is in itself very small, it seems, however, sufficient to prove that the males as well as the females of *C. finmarchicus* in East Greenland waters are represented by two size groups.

Calanus hyperboreus Krøyer.

Calanus hyperboreus Krøyer 1838, p. 84, pl. IV; Sars 1903, p. 12, pl. V.

Material. Like the preceding species *Calanus hyperboreus* (stages IV—VI) has been met with in all the pelagic hauls, both in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas, and it is chiefly the material from these two fjords which is treated in the following.

Quantitative Distribution. The frequency of this species is on an average considerably less than that of *C. finmarchicus* in the East Greenland fjords, and more particularly in the upper water layers. Thus,

in the Kejser Franz Joseph Fjord area the upper water layers (100—0 m) are represented by 13 hauls, yielding 7190 specimens of *C. finmarchicus* and 3070 of *C. hyperboreus*, i. e. 70.1 per cent and 29.8 per cent, respectively. In the Scoresby Sund Fjord area the difference is even greater, 1880 specimens of *C. finmarchicus* and 335 specimens of *C. hyper-*

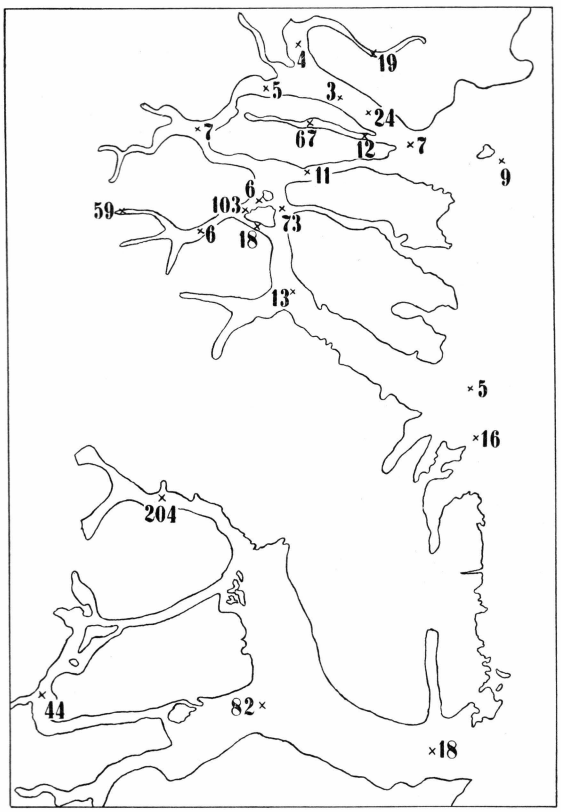

Fig. 14. *Calanus hyperboreus*. Number in hundreds at depths corresponding to hauls with 200—400 m.w. in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas.

boreus having been taken in 5 hauls with 100—0 m, or a percentage of 84.9 and 15.1 respectively.

In the upper water layers (100—0 m) *C. hyperboreus*, as mentioned above, has generally been met with in rather small numbers, and the quantitative distribution of the species in the various areas is on the whole rather heterogeneous in character.

In the intermediary water layers (200—400 m.w.) the special features of the distribution are on the other hand more pronounced. This appears from the chart Fig. 14. In the Kejser Franz Joseph Fjord area the species is represented by the greatest quantities (>5000

specimens) farthest in Dusen Fjord (St. 84: 6730 specimens), farthest in Kempe Fjord (St. 101: 5920 specimens) and at some of the stations round Ella Ø (St. 126: 10,260 specimens and St. 129: 7330 specimens). In comparison it may be mentioned that at the Sts. 114, 116 and 117, which are situated outside the fjord area proper, the numbers are considerably smaller, *viz.* 910, 520 and 1580, respectively. At the above-mentioned stations in the interior parts of the Kejser Franz Joseph Fjord area the plankton thus contains 5—10 times as many specimens of *Calanus hyperboreus* as in the waters outside the fjord area proper.

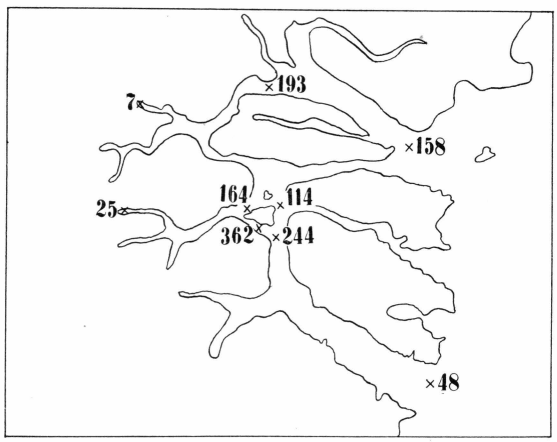

Fig. 15. *Calanus hyperboreus*. Number in tens at depths corresponding to hauls with 500—800 m.w. in the Kejser Franz Joseph Fjord area.

In the Scoresby Sund Fjord area the quantity of *C. hyperboreus* also in a rather marked degree tends to being greatest in the interior parts of the fjord system. As appears from the chart Fig. 14, only 1800 specimens of *C. hyperboreus* have been identified at the mouth of the fjord per 15 minutes' haul, whereas at St. 243, which is situated far up in Nordvest Fjord the number of specimens identified per 15 minutes' haul is very considerable, *viz.* 20,400. This very high number of *C. hyperboreus* must, however, presumably be regarded as something quite exceptional.

In broad features it may thus be said that in the intermediary water layers *C. hyperboreus*, like *C. finmarchicus*, occurs in far greater numbers in the interior parts of the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas than at the mouth of and outside these fjord systems.

In still deeper water layers, i. e. at depths corresponding to hauls with 500—800 m.w. *C. hyperboreus* occurs in greatest number in the middle part of the fjord system, whereas the species seems to decrease

in numbers, both at the mouth and in the direction of the interior parts of the fjord area, which corresponds entirely with the facts regarding *C. finmarchicus*. On the chart of Fig. 15 the number of *C. hyperboreus* is indicated in tens, and it appears i. a. from this fact that in the deeper water layers of the Kejser Franz Joseph Fjord area the species seems to occur in particularly great numbers in the waters round Ella Ø.

The Scoresby Sund Fjord area is further represented by a couple of hauls with 600—700 m.w. At St. 134 (1932) at the mouth of the fjord 1180 specimens of *C. hyperboreus* were caught in a 15 minutes' haul, whereas at St. 243 (1933) in Nordvest Fjord 2210 specimens were taken. It seems to appear from this that also in the deeper water layers of this fjord area the species occurs in considerably smaller numbers at the mouth of the fjord than farther into the interior of the fjord system.

If we then consider the quantitative occurrence of *C. hyperboreus* (stages IV—VI) in intermediary (200—400 m.w.) and deep (500—800 m.w.) water layers, respectively, it will be noticed, as appears from the table given below that the greatest numbers are found, now in the intermediary and now in the deeper water layers.

	St. 95	St. 97	St. 101	St. 107	St. 126	St. 129
200—400 m.w.	660	530	*5920*	1810	*10,260*	*7330*
500—800 —	*1580*	*1930*	250	*3620*	1640	1140

As to the vertical distribution of the species throughout the year see USSING (1938, p. 21).

Only small numbers of *C. hyperboreus* occur in the surface hauls taken at the stations in the 3 above-mentioned sections from off the coast of East Greenland in 1933, and this material is therefore unfortunately insufficient to undertake an investigation corresponding to the one carried out for *C. finmarchicus*.

Relative quantity of *C. finmarchicus* and *C. hyperboreus* in the different water layers. The upper water layers (100—0 m) of the Kejser Franz Joseph Fjord area contains a relatively larger number of calanids than the corresponding water layers in the Scoresby Sund Fjord area. The former fjord area thus yields an average of 553 specimens of *C. finmarchicus* and 236 specimens of *C. hyperboreus*, whereas the respective number in the Scoresby Sund Fjord area amounts to 376 and 67 specimens, *C. finmarchicus* being by far the dominating species in the upper water layers in both localities.

In the intermediary water layers (horizontal hauls with 200—400 m.w.) the number of calanids is, on the other hand, considerably greater in the Scoresby Sund than in the Kejser Franz Joseph Fjord

area. In the former the average number of *C. finmarchicus* is 5737 as against 8712 *C. hyperboreus*, while the numbers for the Kejser Franz Joseph Fjord area are 2900 and 2407 specimens, respectively.

Finally, there are the deepest water layers (500—800 m.w.), where in the Kejser Franz Joseph Fjord area the average figures per haul are as follows: *C. finmarchicus* 1343 and *C. hyperboreus* 1461 specimens, and in the Scoresby Sund Fjord area 2265 and 1697 specimens, respectively.

Whereas the number of calanids is usually smaller in the deepest (500—800 m.w.) than in the intermediary (200—400 m.w.) water layers, the relative quantity of *C. hyperboreus* undoubtedly increases with the increasing depth.

The occurrence of the various stages of development. In the Kejser Franz Joseph Fjord area the material, like that of *C. finmarchicus*, is divided into three groups according to the positions of the stations. The relative numbers of the three oldest stages of development are given in Table 7.

Table 7. Relative quantity of stages IV—VI of *Calanus hyperboreus* within three various parts of the Kejser Franz Joseph Fjord area.

		Farthest in the fjord			The waters round Ella Ø				Outside the fjord area			
	St:	101	102	103	107	121	126	129	114	115	116	117
100—0 m	VI....	*67.9*	17.6	*62.3*	17.6	18.2	(20.0)	(20.0)	12.2	0.0	0.0	0
	V	32.1	*76.5*	35.8	*64.7*	*75.7*	(*40.0*)	(*60.0*)	42.9	0.0	5.3	0
	IV....	0.0	5.9	1.9	17.7	6.1	(40.0)	(20.0)	*44.9*	*100.0*	*94.7*	*100.0*
	St:	101	23	84	107	—	126	129	114	—	116	117
200—400 m.w.	VI....	*76.8*	14.5	*53.1*	27.3	—	*48.5*	24.7	*50.9*	—	36.8	25.0
	V	22.3	39.1	42.8	*60.4*	—	43.5	*40.6*	38.2	—	19.3	26.4
	IV....	0.9	*46.4*	4.1	12.3	—	8.0	34.7	10.9	—	*43.9*	*48.6*
	St:	101	58	102	107	121	126	129	95	118	—	—
500—800 m.w.	VI....	*52.9*	40.0	*54.5*	*48.1*	*64.1*	*42.6*	39.9	21.5	0.0	—	—
	V	47.1	*55.0*	45.5	42.7	34.1	35.2	*44.0*	*43.8*	14.5	—	—
	IV....	0.0	5.0	—	9.2	1.8	22.2	16.1	34.7	*85.5*	—	—

In contradistinction to *C. finmarchicus* where a single stage of development (stage V) was by far the predominant one, it will be noticed that in the case of *C. hyperboreus* it is now stage IV, now stage V and then again stage VI which predominates. Upon closer examination, however, it appears that the youngest stage of development (stage IV), as in the case of *C. finmarchicus*, is by far numerically predominant

outside the fjord area. Whereas stage IV of *C. finmarchicus* only predominated in numbers in the upper water layers, stage IV of *C. hyperboreus* seems to occur in greatest numbers, not only in the upper water layers, but also in part in the intermediary and deep water layers outside

Table 8. Relative quantity of stages IV—VI of *Calanus hyperboreus* within 3 different parts of the Scoresby Sund Fjord area.

		Farthest in the fjord			In the middle of the fjord		At the mouth of the fjord			
	St.	207	243	327	299	333	11	134	141	142
100—0 m	VI.....	23.7	*53.8*	—	11.8	—	—	—	(—)	16.6
	V	*42.1*	38.5	—	29.4	—	—	—	(50.0)	*66.7*
	IV.....	34.2	7.7	—	*58.8*	—	—	—	(50.0)	16.7
200 m.w.	VI.....	—	*57.1*	39.8	—	26.6	42.1	—	—	—
	V	—	37.0	*50.0*	—	*53.3*	*48.7*	—	—	—
	IV.....	—	5.9	10.2	—	20.1	9.2	—	—	—
600—700 m.w.	VI.....	—	39.5	—	—	—	—	7.3	—	—
	V	—	*42.3*	—	—	—	—	13.3	—	—
	IV.....	—	18.2	—	—	—	—	*79.4*	—	—

the fjord area proper. In the interior parts of the fjord system and in the waters round Ella Ø it is now stage V and now stage VI which predominates in numbers. As a rule it may be said that stage V predominates in most hauls from the surface layers and stage VI in those from the deepest water layers, and the intermediary water layers occupy an intermediate position, stages V and VI predominating in about an equal number of hauls. When looking upon conditions in the upper water layers only, stage VI seems to predominate in the interior parts of the fjords, stage V in the waters round Ella Ø and stage IV in the sea outside the fjord area.

The relatively small number of hauls from the Scoresby Sund Fjord area reveal no points of interest, but as it appears from Table 8, the youngest stage of development (stage IV) most frequently occurs at the mouth of the fjord (St. 134, 700 m.w.) *viz.* in the same proportion as in the Kejser Franz Joseph Fjord area.

A further point to be noticed in Table 8 is that the only station where adult individuals predominate in numbers is in the interior part of Nordvest Fjord (St. 243).

Variation in the size of *Calanus hyperboreus*. Measurements of the length of cephalothorax have been made in a considerable material

Table 9. *Calanus hyperboreus* ♀. Measurements of the length c
in material from the Kejse

	50—200 m.w.								300—500 m.v				
St:	84	86	103	114	124	126	129	Total	94	98	101	105	107
96	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	1	1	..	..	..	..	..
3	1	..	..	..	..	..	..	1	..	1	2	..	..
2	1	..	..	..	..	..	..	1	1	..	..	..	1
1	1	..	..	2	1	..	..	4	1	..	1	1	1
90	3	..	1	..	..	1	..	5	1	1	2	..	..
9	2	..	..	2	..	7	1	12	1	2	2	..	..
8	4	3	..	2	4	6	3	22	3	1	2	2	1
7	5	3	2	4	4	8	4	30	2	4	4	3	..
6	6	4	..	2	2	8	3	25	3	1	3	2	2
85	6	5	1	2	5	13	7	39	4	6	9	..	3
4	12	5	..	5	3	11	5	41	4	6	5	2	4
3	7	8	3	5	3	15	1	42	7	4	3	3	2
2	6	8	3	5	2	16	2	42	5	2	6	1	2
1	9	4	..	3	2	12	2	32	4	3	6	1	4
80	3	3	3	5	2	13	2	31	6	4	6	1	3
9	11	4	2	3	2	10	3	35	4	4	7	..	1
8	3	5	2	3	5	10	3	31	1	..	3	1	3
7	4	4	1	..	4	11	2	26	3	1	6	..	2
6	4	1	1	..	2	5	1	14	2	..	2	..	2
75	2	3	..	..	4	2	1	12	1	..	2	1	1
4	2	2	2	2	1	4	1	14	..	..	2	..	1
3	1	2	1	..	..	1	..	5	..	..	1	1	1
2	1	1	1	1	1	1	..	6	..	1	..	..	1
1	..	..	..	..	1	..	..	1	..	..	..	..	1
70	..	..	..	..	1	..	..	1	..	..	..	..	..

of *C. hyperboreus* ♀ from the Kejser Franz Joseph Fjord area. The same enlargements have been used for these as for *C. finmarchicus* (measurement scale: 1 division line = 0.077 mm). The number of individuals measured is in all 1395, and a summary of the measurements is given in Table 9, where the material is divided according to the various water layers, where hauls have been made with 50—200, 300—500 and 650—800 m.w., respectively.

When regarding the column which shows the total numbers of individuals measured it appears that when the whole of the material is treated under one, there is only one size group of *C. hyperboreus* in East Greenland waters, and very nearly the same holds good of the species in West Greenland waters (see JESPERSEN 1934, Fig. 10, p. 43). A later and more detailed investigation (JESPERSEN 1937) of the sizes

phalothorax (measurement scale: 1 division line = 0.077 mm)
ranz Joseph Fjord area.

				650—800 m.w.										Total no. of measured specimens
14	117	129	Total	95	97	100	105	107	116	121	126	134	Total	
..	..	1	1	..	..	..	..	..	..	..	..	..	..	1
..	1	1	2	..	..	..	..	..	..	..	1	..	1	3
..	..	5	5	..	1	..	..	1	..	..	..	..	2	8
..	1	3	7	1	1	..	..	..	1	..	1	..	4	12
1	..	3	6	1	2	..	..	1	1	1	2	1	9	16
..	1	2	7	5	2	..	1	1	..	3	3	2	17	28
2	1	6	13	..	3	..	1	1	..	2	8	..	15	33
3	..	12	20	..	4	..	..	2	1	3	5	1	16	48
2	2	8	21	1	7	1	..	4	1	7	8	1	30	73
4	1	15	33	5	5	..	1	8	3	5	7	4	38	101
2	2	14	29	4	8	1	1	11	4	5	5	2	41	95
1	1	15	39	3	6	2	..	8	1	9	5	5	39	117
1	2	14	38	3	7	1	2	8	1	7	7	1	37	116
1	3	12	35	2	4	2	1	10	1	11	5	1	37	114
..	2	11	29	4	5	2	1	10	2	10	5	..	39	110
3	..	9	30	1	10	3	4	5	2	7	4	2	38	100
1	..	9	30	3	8	5	1	5	..	8	2	..	32	93
1	1	8	26	4	7	3	1	5	1	8	3	..	32	93
2	..	4	14	1	3	1	1	3	..	3	..	..	12	57
1	..	4	17	4	2	2	..	..	..	1	..	..	9	52
..	..	5	11	2	6	1	..	2	..	3	..	..	14	39
1	..	1	7	1	3	2	1	3	..	3	..	1	14	33
1	..	..	4	..	2	1	..	1	..	1	..	..	5	23
2	..	1	6	1	..	1	1	..	..	1	..	1	5	16
..	..	..	2	..	..	..	..	..	..	1	..	..	1	9
..	..	1	2	..	..	..	..	..	..	..	..	..	..	3
..	..	..	..	..	1	..	..	..	..	..	..	..	1	2

of individuals from the waters of West Greenland, however, prove that even though there is only one size group in these waters, the mean size varies in the various areas of Davis Stræde and Baffin Bugt. It is consequently of interest to investigate, whether similar facts can be proved as regards the present material from the Kejser Franz Joseph Fjord area.

For this purpose an investigation has first been made as to whether it is possible to prove differences in the average sizes of individuals caught in different water layers. Table 10 gives both the absolute and the relative number of measured individuals in hauls with 50—200, 300—500 and 650—800 m.w., the material being divided into groups of 5 division lines (which corresponds to a range of variation of about 0.38 mm).

Table 10. *Calanus hyperboreus* ♀. Absolute number and relative quantities of the various size groups in hauls with 50—200, 300—500 and 650—800 m.w.

No. of division lines	No. of measured specimens			Percentage		
	50—200 m.w.	300—500 m.w.	650—800 m.w.	50—200 m.w.	300—500 m.w.	650—800 m.w.
90—96	12	41	48	2.5	9.5	9.8
85—89	128	142	164	27.1	32.7	33.6
80—84	188	162	183	39.7	37.3	37.5
75—79	118	75	81	25.0	17.3	16.6
70—74	27	14	12	5.7	3.2	2.5

The variation of the average size in the various water layers is, as it appears, not very great, but it should be borne in mind that the largest individuals increase, while the smallest decrease in relative numbers with the increasing depth. If the average length of *C. hyperboreus* is calculated from hauls with the lengths of wire required, it also appears that the mean length is somewhat smaller in the upper layers than deeper down in the water, as appears from the following:

	50—200 m.w.	300—500 m.w.	650—800 m.w.
Range of variation	80.2—83.0	80.9—86.1	80.1—86.1
Mean length	81.9	83.5	83.6

The differences which can be identified in the material from the various depths are thus rather insignificant, nor does it seem possible to demonstrate essential differences in the material from the Kejser Franz Joseph Fjord area and the waters immediately outside this system of fjords, for which reason it is presumably justifiable to regard the whole of the material at hand as belonging to the same population.

We next proceed to a comparison between the size of *Calanus hyperboreus* ♀ in East Greenland and West Greenland waters. Fig. 16 shows, by means of curves, the measurements of the whole of the material from East Greenland (Kejser Franz Joseph Fjord area) and West Greenland (Baffin Bugt and Davis Stræde). The latter material which dates from the "Godthaab" Expedition 1928 is dealt with graphically (see JESPERSEN 1937, p. 104).

When comparing the two curves it distinctly appears that the length of *C. hyperboreus* is on an average considerably greater in the West Greenland than in the East Greenland waters, the approximate mean length making 90 and 84 division lines respectively. As already mentioned, it has however for this species been possible to prove that

the mean length is considerably smaller in the central and eastern part of the waters south of Davis Stræde than in the western part of these waters and Baffin Bugt (JESPERSEN 1937, Fig. 2, p. 105). It is therefore of interest to compare the measurements of the length of

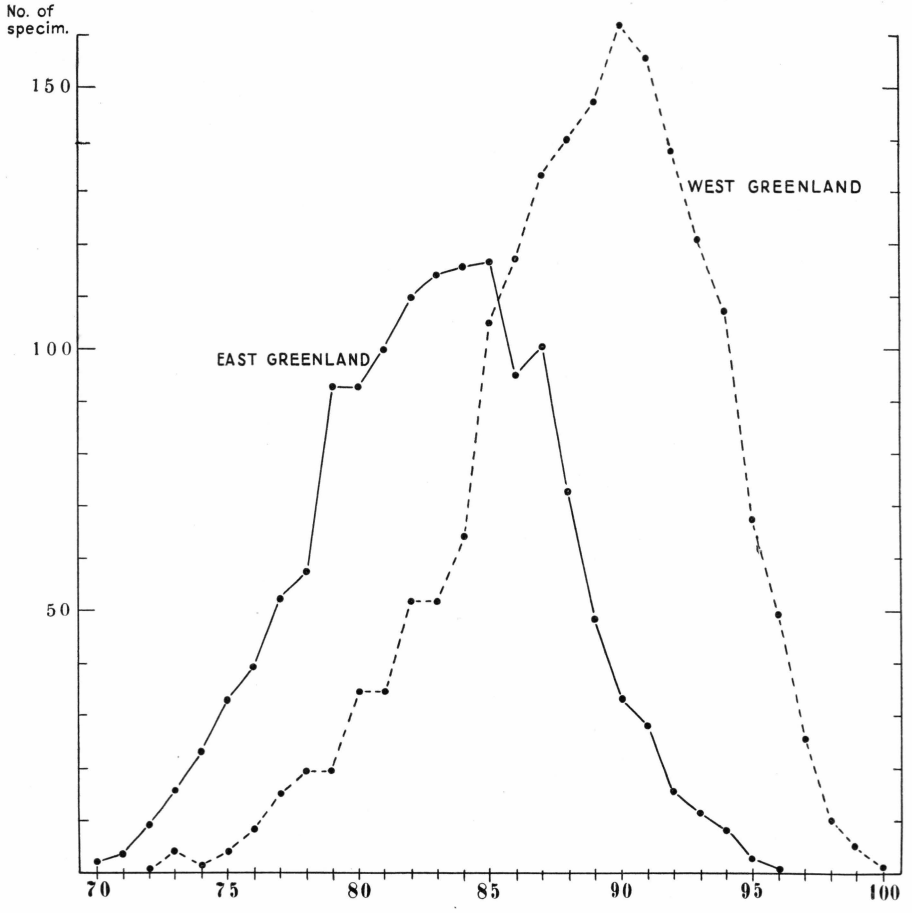

Fig. 16. *Calanus hyperboreus* ♀. Measurements of length of cephalothorax (measurement scale: 1 division line = 0.077 mm) in the whole of the material investigated from East Greenland and West Greenland waters.

cephalothorax in the material from East Greenland with those of the material from the central and eastern part of the waters south of Davis Stræde. The latter in Fig. 17 is called South Greenland. For comparison the numbers from East Greenland have everywhere been reduced to about a fourth.

It appears from the two curves that the lengths are essentially identical in the two areas, and it therefore seems beyond doubt that *C. hyperboreus* from East and South Greenland (i. e. the central and

eastern part of the waters south of Davis Stræde) belong to the same order of size. In the paper quoted above (1937) I have attempted to explain the occurrence of smaller specimens of *C. hyperboreus* off South Greenland, by the fact that the prevailing temperature is higher there than in the cold water along the coast of Labrador and in Baffin Bugt. The validity of this theory, however, cannot be maintained in the face

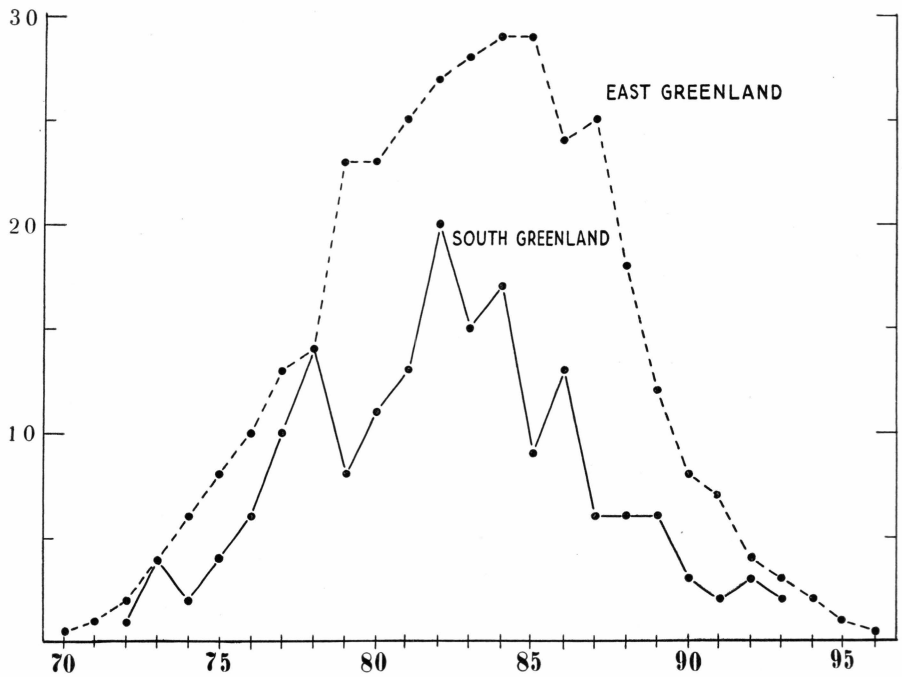

Fig. 17. *Calanus hyperboreus* ♀. Measurements of the length of cephalothorax in material from East Greenland and South Greenland (see the text).

of the discovery now made that *C. hyperboreus* in the cold water of the East Greenland fjords only attains a relatively smaller size, and this being so, it seems difficult to give a plausible explanation of the variation in size of this species. The reason why it attains a comparatively smaller size in the fjords of East Greenland has possibly some bearing upon the small amount of plankton produced in the waters along the coast of East Greenland, and the small individuals in the central and eastern parts of the waters south of Davis Stræde should in that case originate from the East Greenland waters and have been carried south and round Kap Farvel with the East Greenland current. However, we know as yet too little of the conditions of production within the various districts of these northern waters to be able to draw reliable conclusions. In connection with the above-mentioned facts relating to *C. hyperboreus* it

should, however, be borne in mind that *C. finmarchicus*, both as regards the group of small and large individuals, attains a somewhat greater average length in West Greenland waters than along the east coast of Greenland (see Fig. 10, p. 20).

Young copepodid stages of *Calanus finmarchicus* and *C. hyperboreus*.

As it is rather difficult to distinguish between the youngest copepodid stages (stages I—III) of the species mentioned above (see SÖMME 1934), no such attempt has been made as regards the material at hand from East Greenland. Even though it has not been possible to carry out a determination of species for the youngest copepodid stages, the quantitative distribution of these young calanids reveals several points of interest.

In the fjord areas investigated in East Greenland young calanids occur in rather considerable numbers during the summer. Vertically they

Table 11. Number in tens of young calanids (stage I—III) taken in hauls with different lengths of wire.

	Kejser Franz Joseph Fjord															Scoresby Sund Fjord			
St:	23	29	95	97	107	110	114	116	117	118	120	121	124	126	129	134	141	142	328
50 m.w. . . .	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	3
100 — . . .	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	18	8	..
150 — . . .	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..
200 — . . .	110	19	..	..	..	..	..	..	..	..	..	..	..	43	40	..	..	..	..
300 — . . .	..	..	4	..	16	15	..	6	..	..	44	..	18	..	275	..	..	..	..
400 — . . .	..	..	..	..	..	14	3	..	2	..	..	..	..	..	..	..	..	..	..
500 — . . .	..	..	..	..	..	..	..	..	..	1	..	..	..	..	9	..	..	..	..
650 — . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..
700 — . . .	..	..	8	5	5	..	..	..	..	..	..	..	..	..	..	9	..	..	..
800 — . . .	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..

are of most frequent occurrence in the uppermost 100—200 m. Table 11 shows the numbers taken in horizontal hauls with various lengths of wire, and from this it appears that most of them seem to be caught in hauls with 200—300 m.w. which presumably corresponds to a depth of about 100—150 m.

The instrument used in the above mentioned horizontal hauls is the stramin net, and so there is a possibility that at any rate a number of the smallest specimens may have escaped through its comparatively open meshes. On the other hand the Hensen net (silk no. 3) has been used in vertical hauls from 100 m to the surface, and the material yielded

by these hauls is therefore probably more representative. The following summary shows the number of young calanids occurring at the stations where vertical hauls have been made.

Table 12. Number in tens of young calanids taken in vertical hauls 100—0 m with the Hensen net.

	Kejser Franz Joseph Fjord													Scoresby Sund Fjord				
St:	95	97	98	101	102	103	107	110	114	115	116	117	121	141	142	207	243	299
Number of specimens.....	234	28	27	24	25	15	11	152	28	38	126	34	98	62	59	3	1	23

The number of young calanids is, as it appears, very varying at the various stations, and in order to get an impression of the quantitative distribution the numbers are indicated on the chart of Fig. 18.

It is a striking fact that the greatest numbers of young calanids in Kejser Franz Joseph Fjord have been taken in the outer part of the fjord area, while the numbers in the inner parts of the fjord system are relatively small. This quantitative distribution is still more pronounced in the inner parts of the Scoresby Sund Fjord area, where each haul only yields about 10—30 specimens, whereas the number of individuals identified nearer the mouth of the fjord is about 590—620 per haul.

Neocalanus gracilis (Dana).

Calanus gracilis Dana 1855, p. 1078, pl. 74, fig. 10.
Cetochilus longiremis Claus 1863, p. 171, pl. 26, fig. 1.
Calanus gracilis Brady 1883, p. 35, pl. V; Giesbrecht 1892, p. 90.

Material. A single specimen (♀) has been taken in a haul with 1000 m.w. at the "Dana" Station 2436 ($^{25}/_{7}$ 1925) off the east coast of South Greenland (61°13′ N.—40°57′ W.). Mr. G. P. FARRAN, Dublin, has kindly verified the determination of the species.

Geographical distribution. This species is widely distributed in the northern Atlantic as in most other oceans, and it is undoubtedly a rather pronouncedly warm water species. As far as is known, it is not previously known from such northerly latitudes.

Eucalanus elongatus (Dana).

Calanus elongatus Dana 1849, p. 18.
Eucalanus elongatus Giesbrecht 1892, p. 131.

Material. In the material of the "Godthaab" Expedition 1932 a rather surprising find was made, *viz.* a single individual of this species. It was taken on August 12th, 1932 at St. 95 in a horizontal haul with

700 m.w. The station is situated at the mouth of Kejser Franz Joseph Fjord between Kap Franklin and Broch Islands. As the specimen was taken in a haul with 700 m.w., it has probably been living in the bottom water with a positive temperature. In various depths the temperature at the said station was the following: surface 5.21°, 200 m +1.67°, 300 m

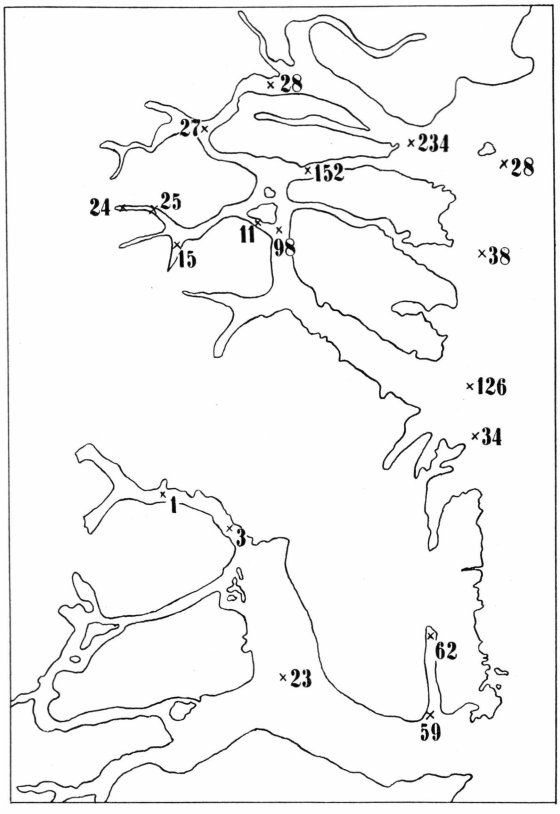

Fig. 18. Number in tens of young copepodid stages (I—III) of calanids in the upper water layers (100—0 m) in the Kejser Franz Joseph and Scoresby Sund Fjord areas.

1.42° and 400 m 1.64°. The fact that the species has probably been met with at a considerable depth (presumably 300—400 m) agrees very well with earlier finds from the more northerly areas of its distribution. Thus, on the "Godthaab" Expedition 1928 (Jespersen 1934) it was only taken in hauls with 1000—3000 m.w. in the waters south of Davis Stræde, and in the northern Atlantic between the west coast of Ireland and the southern point of Greenland it was taken only in hauls with 400—1000 m.w. (Lysholm and Nordgaard 1921).

Geographical distribution. The species is spread over large parts of the northern Atlantic, but it is not previously known from such

northerly latitudes. The hitherto known most northerly finds nearest the coast of East Greenland originate from the "Ingolf" Expedition St. 95, which is situated in Danmarksstræde in 65°14′ N.—30°39′ W. (WITH 1915).

Rhincalanus nasutus Giesbrecht.

Rhincalanus nasutus Giesbrecht 1892, p. 152; Sars 1903, pp. 15—16, pls. VI—VII.

Material. The species has not been met with immediately off the coast of East Greenland, but on the slope towards the deep water, *viz.* at the "Dana" Station 2436 ($^{25}/_{7}$ 1925), situated in 61°13′ N.—40°57′ W. At the said station a few specimens were caught in a haul with 1000 m.w.

Geographical distribution. This pronouncedly Atlantic form has undoubtedly its northern boundary of common occurrence in the southern part of the Danmarksstræde, and also in the waters south of Davis Stræde (JESPERSEN 1934). In the former area it is previously identified as far north as off the western corner of Iceland, *viz.* in 65°50′ N.—26°53′ W. (WITH 1915).

Pseudocalanus minutus (Krøyer).

Calanus minutus Krøyer 1849, p. 543.
Pseudocalanus elongatus Sars 1903, p. 20, pls. X—XI.

Material. This species is of common occurrence in the waters immediately off the coast of East Greenland.

Table 13. *Pseudocalanus minutus.* Number of individuals taken in vertical hauls (100—0 m) with Hensen net.

	Kejser Franz Joseph Fjord													Scoresby Sund Fjord				
St:	95	97	98	101	102	103	107	110	114	115	116	117	121	141	142	207	243	299
No. of specimens..	1450	770	1350	8260	6580	12130	1010	7750	50	110	150	50	2560	50	80	400	260	330

Quantitative distribution. To examine the frequency of this copepod we first make use of the material collected in the Kejser Franz Joseph Fjord area and in Scoresby Sund Fjord, where hauls have been made at various depths. It appears from Table 13 which shows the number of individuals at various stations with vertical hauls in 100—0 m that this copepod sometimes occurs in very great numbers in the upper water layers. In comparison it may be stated that 120 individuals is the highest number of *Pseudocalanus minutus* taken in 15 minutes' horizontal hauls with 1 m stramin net and wire lengths from 50 to 800 m, the figures not exceeding 5—40 in by far the greater number of the

hauls in which it is represented. In the following we will consequently only consider the material from the above-mentioned vertical hauls with Hensen net from 100 m to the surface.

In order to obtain a better view of the numbers of individuals at the various stations the latter have been indicated on the chart Fig. 19,

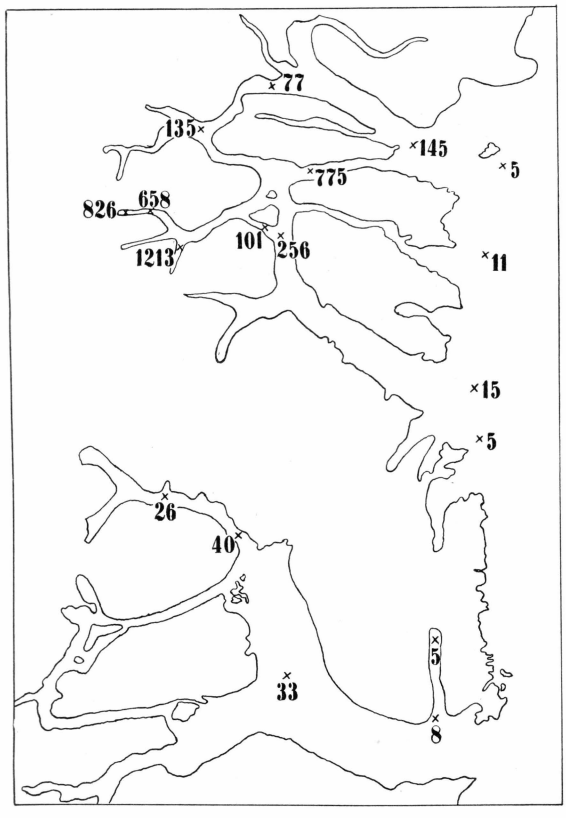

Fig. 19. *Pseudocalanus minutus.* Number in tens, taken in vertical hauls 100—0 m in the Kejser Franz Joseph Fjord area and in Scoresby Sund Fjord.

the numbers, however, only being given in tens. As already appears from Table 13, this copepod has on an average been met with in far greater quantities in the Kejser Franz Joseph Fjord area than in Scoresby Sund Fjord.

A closer examination at the chart shows that both in the Kejser Franz Joseph Fjord area and in Scoresby Sund Fjord the greatest numbers occur in the innermost parts of the two fjord systems, whereas at the mouths of the fjords and in the waters immediately outside them the numbers are relatively very small. At three stations in the interior parts of Kempe Fjord the number of the species taken thus amounts to

6000—12000, while at four stations outside the coast along the distance from Bontekoe Ø to Davy Sund it has only been caught in numbers varying from 50 to 150 specimens, in other words a striking difference in frequency. The collections made within the Scoresby Sund Fjord area suggest, as already mentioned, a far smaller frequency as compared with the Kejser Franz Joseph Fjord area proper, but on the other hand the investigations at our disposal show a considerable decrease in numbers from the inner parts of the fjord system and out towards the mouth of the fjord.

As to the vertical distribution of the species throughout the year see USSING (1938, p. 23).

When after this we proceed to an investigation of the frequency of this species in the waters along the coast of East Greenland and in the western part of the Danmarksstræde, we will first of all look upon the quantitative occurrence in the three sections, which as previously mentioned were made on the cruise of the "Dana" in 1933, from off the coast of East Greenland (see the chart, Fig. 3, p. 6). The designations of frequency for this species were as follows at the various stations, where vertical hauls of 50—0 m were taken with $^1/_3$ m silk net:

Section	I.....	St.	4671	4672	4673	4674	4675
			+	r	rr	o	o
—	II.....	-	4677	4678	4679	4680	
			r	r	rr	o	
—	III.....	-	4683	4684	4685		
			rr	r	o		

It is quite obvious that the numbers of individuals decrease from the coast in the direction of the more open water. Thus, the species has not been identified at the outermost stations in all three sections.

As appears from an investigation of the occurrence of the species at the many stations taken by the research ship "Dana" (1931—33) in the western part of the Danmarksstræde, from Angmagssalik to Kap Farvel, *Pseudocalanus minutus*, as represented on the chart of Fig. 20, has more particularly been taken immediately along the coast, and during these years it has not been taken at stations situated far out to sea in the southerly part of the area investigated. Conditions, however, are somewhat different in the northernmost part of the area investigated, *viz.* between 65° and 66° N. lat. approx., the species here being of frequent occurrence at practically all stations across the Danmarksstræde.

The whole occurrence of *Pseudocalanus minutus* along the coast of East Greenland thus proves it to be a pronounced coast form which more particularly occurs in great numbers within the fjords, but across the northern part of the Danmarksstræde there is

undoubtedly a connection with the stock in Icelandic waters. The species is of common occurrence along the coasts of Iceland, and it seems an obvious supposition that it is the west-going branch of the Irminger Current which carries the species from Iceland across the Danmarksstræde towards the coast of East Greenland.

Propagation. At a few stations in the Kejser Franz Joseph Fjord area a number of egg-bearing females of this species were found at the

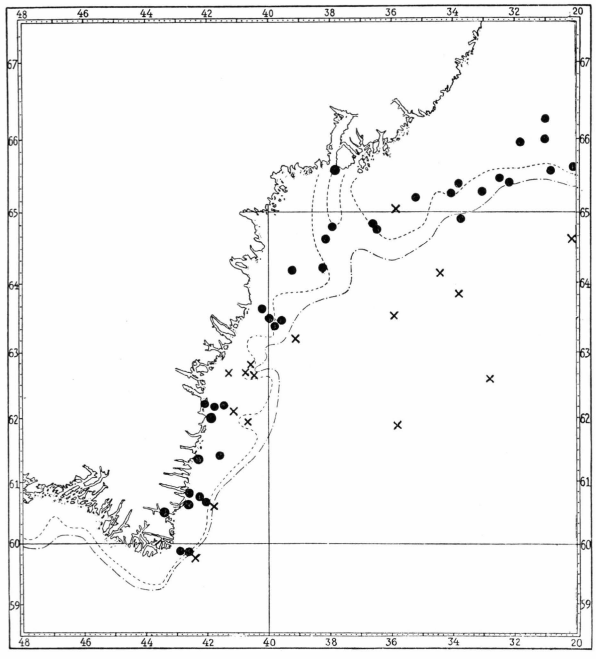

Fig. 20. *Pseudocalanus minutus*. The occurrence of the species in the western part of the Danmarksstræde. ● positive stations × negative stations.

beginning of August, and at Eskimonæs in Gael Hamkes Bugt (74° N. lat. approx.) a rather considerable number of egg-bearing females were already identified in a haul from May 18th (1933). Consequently, there can be no doubt that the spawning of this species in East Greenland waters takes place in the summer (May—August).

Microcalanus pygmæus G. O. Sars.

Pseudocalanus pygmæus (♀) Sars 1900, p. 73, pl. XXI.
Spinocalanus longicornis (♂) Sars 1900, p. 77, pl. XII.
Microcalanus pusillus Sars 1903, p. 157, Suppl. II—III; v. Breemen 1908, p. 27, fig. 2.
— *pygmæus* v. Breemen 1908, p. 27, fig. 24; With 1915, p. 66.

Material. In examining the material at hand no distinction—like the one made e. g. by Farran (1936) for the material from the

waters round Spitsbergen—has been attempted between the two very closely related species, *viz. Microcalanus pygmæus* G. O. Sars and *Microcalanus pusillus* (G. O. Sars), but the whole of the material has been entered under the former name. By far the greater part of the material at hand originates from the East Greenland fjords, where collections have been made.

Quantitative distribution. An examination of the quantitative distribution of this species in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas reveals various points of interest. *Microcalanus pygmæus* is a rather pronounced surface form, and when occasional individuals have been taken in hauls from greater depths, this is probably due to their having been caught in higher water layers, while the nets were being hauled on board. In our investigations of the said fjords we will consequently in the following confine ourselves to the material collected in vertical hauls with Hensen net from 100 m to the surface. Table 14 shows the numbers of this copepod collected at the various stations within the two fjord areas.

Table 14. *Microcalanus pygmæus.* Number of individuals taken in vertical hauls 100—0 m.

	Kejser Franz Joseph Fjord													Scoresby Sund Fjord				
St:	95	97	98	101	102	103	107	110	114	115	116	117	121	141	142	207	243	299
Number of specimens.....	170	200	10	650	1320	590	30	370	10	10	20	0	120	5	5	20	0	70

From the chart of Fig. 21 which shows the quantitative distribution of the species at the various stations it appears very clearly that there are considerable numbers of this copepod in the interior parts of the Kejser Franz Joseph Fjord area, whereas the numbers outside the fjord area are relatively much smaller. Thus 590—1320 specimens have been found at three stations in Kempe Fjord, whereas 4 stations outside the fjord area proper show numbers from 0—20 specimens. In the Scoresby Sund Fjord area where the species upon the whole has been found in much smaller numbers, conditions are less pronounced, but the numbers found in the middle parts of the fjord system are considerably greater than those found nearer the mouth of the fjord.

When comparing the appended map with the chart of Fig. 19 (p. 41), which shows the quantitative distribution of *Pseudocalanus minutus*, it will be noticed that there is an uncommonly good agreement between the quantitative distribution of the two species in the fjord areas

investigated, both of them appearing in relatively far greater numbers in the interior parts of the East Greenland fjords than in the waters immediately outside the latter.

As to the vertical distribution of the species throughout the year see Ussing (1938, p. 24).

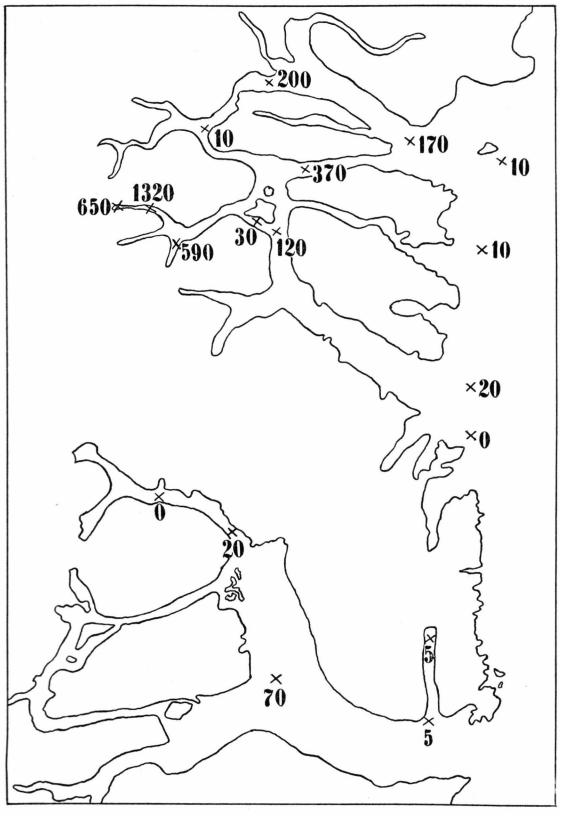

Fig. 21. *Microcalanus pygmæus*. Number taken in vertical hauls 100—0 m in the Kejser Franz Joseph Fjord and in Scoresby Sund Fjord areas.

Geographical distribution. As to the distribution of this species elsewhere in the East Greenland waters it may undoubtedly be said to occur along the whole of the coast of East Greenland. Thus, the Scoresby Sound Committee's 2nd East Greenland Expedition to Kong Christian IX's Land identified the species at Kap Stephensen (68°23′ N.—28°33′ W.) and in Ravns Fjord (68°30′ N.—28°15′ W.); likewise, it was found in 1933 at the "Dana" Stations 4664, 4674 and 4675, which are situated on the stretch from off Angmagssalik as far as off Tingmiarmiut.

The species must, however, more particularly be regarded as an arctic form, though it is found, especially in greater depths, rather far south in the northern Atlantic.

Spinocalanus abyssalis Giesbrecht.

Spinocalanus abyssalis Giesbrecht 1892, p. 209.
— *longicornis* Sars 1903, p. 22, pl. XII.

Material. Only a few individuals (3 ♀♀) of this species have been met with at a single station in the Kejser Franz Joseph Fjord area (St. 101, $^{19}/_{8}$ 1932, 100—0 m).

Geographical distribution. Whereas the species is not previously known from East Greenland waters it has, besides in several places in arctic seas, been identified both in Davis Stræde and in Baffin Bugt (JESPERSEN 1934). Its chief area of distribution is presumably in arctic seas, but like the preceding species it penetrates far south in the northern Atlantic.

Bradyetes brevis G. P. Farran.

Bradyetes brevis Farran 1936a, pp. 238—41, figs. 1—12.

A specimen of this species (♀, 2.31 mm in length) was taken on October 30th, 1932 in a vertical haul from 50 m to the surface at Ella Ø (72°55′ N.—25°00′ W.). As the instrument touched the bottom when hauled in, it is probable that the specimen has been taken immediately at or close to the bottom. When I sent the specimen to Mr. G. P. FARRAN for closer examination, it proved to be a new species of the family *Bradyetes*, which Mr. FARRAN has kindly described under the above name in Annals and Magazine of Natural History, Ser. 10, Vol. XVIII.

Chiridius armatus (Boeck).

Euchaeta armata Boeck 1872, p. 39.
Chiridius armatus Sars 1903, p. 27, pls. XV—XVI.

Material. The species has been identified in inconsiderable numbers at a couple of stations with deep hauls, *viz.* with 700 m.w. in the Kejser Franz Joseph Fjord area (St. 58, 3 ♀♀, 1 ♂ and St. 101, 3 ♀♀). One specimen from the latter station contained the remains of an egg sac, and from this it may presumably be concluded that the species breeds in these northern latitudes. As the specimens caught have all been taken in hauls with a great length of wire, it is probable that they have lived in the deep water layer with a positive temperature which lies under the Polar water.

Geographical distribution. This rather pronouncedly Atlantic species has previously been identified in the Danmarksstræde (WITH 1915), but not immediately off the coast of East Greenland. It is true that CLEVE (1900) mentions the species *Chiridius armatus* Boeck from a couple of stations between 71°30′ and 74°15′ N. along the coast of

East Greenland, but it is possible that this is in reality the following species. In the waters west of Greenland it is known both from Davis Stræde and from Baffin Bugt.

Chiridius obtusifrons G. O. Sars.

Chiridius armatus Sars 1900, p. 64, pl. XVII; Mrázek 1902, p. 521.
— *obtusifrons* Sars 1903, p. 29, pl. XVII; Wolfenden 1904, p. 131.

Material. The species has been met with both in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas, but in both localities in comparatively few numbers and nearly exclusively at rather great depths.

Quantitative distribution. It appears from Table 15 that by far the greatest numbers of this species have been caught in hauls with 600—700 m.w. and when it has not been taken in other areas of the East Greenland waters or in the course of the "Dana"s investigations in the western part of the Danmarksstræde, this is surely due to the fact that collections have not been made at sufficiently great depths. The vertical distribution indicated coincides entirely with conditions in West Greenland waters, seeing that only in exceptional cases has it been taken in hauls with less than 350 m.w.

Table 15. *Chiridius obtusifrons.* Number of individuals taken in hauls with different lengths of wire in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

	Kejser Franz Joseph Fjord					Scoresby Sund Fjord		
St:	58	72	95	101	105	243	328	333
100—0 m	—	..	—	—	..	—	..	..
200—0 -	..	..	..	..	..	..	1	3
50 m.w.	..	..	..	—	..	..	—	..
200 —	..	..	..	..	..	—	..	—
300 —	..	..	—	—	10	..	..	..
400 —	..	5	..	..	..	..	..	..
500 —	..	..	..	..	..	..	..	..
600 —	..	..	..	..	..	70	..	..
700 —	30	..	40	40	15	..	..	..

Geographical distribution. The species is a rather pronouncedly arctic form, which in the western Atlantic has been met as far south as near Nova Scotia. It has probably been carried there with the cold Labrador current from Baffin Bugt and Davis Stræde, and in the eastern part of the Atlantic it does not appear to occur farther south

than in about 60° N. As to the distribution see otherwise JESPERSEN, 1934, p. 57, fig. 13.

Gaidius tenuispinus G. O. Sars.

Chiridius tenuispinus Sars 1900, p. 67, pl. XVIII.
Gaidius tenuispinus Sars 1903, p. 162, pl. XVIII, suppl. pl. VI.
— *borealis* Wolfenden 1903, p. 365.

Material. Besides in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas the species has been met with at the "Dana" St. 2436, $^{25}/_{7}$ 1925 (61°13′ N.—40°57′ W.).

Quantitative distribution. As appears from the appended Table 16, the species has not been taken in hauls near the surface, but exclusively in the deeper water layers. This is surely the reason why it has not been identified in the many surface hauls on the "Dana" in the western part of the Danmarksstræde,

By far the greater numbers of this species have thus been identified in water layers corresponding to hauls with 300—700 m.w. At Station 2436 which was mentioned above, the species has been taken in hauls with 600 and 1000 m.w. The vertical distribution corresponds entirely with former investigations of the occurrence of the species in West Greenland waters (JESPERSEN 1923 and 1934, STØRMER 1929).

Table 16. *Gaidius tenuispinus.* Number of individuals taken with different lengths of wire in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

	Kejser Franz Joseph Fjord					Scoresby Sund Fjord	
St:	94	95	97	102	105	243	333
100—0 m	..	—	—	—	..	—	..
200—0 -	..	..	..	..	..	..	1
100 m.w.	..	..	..	—	..	..	..
200 —	..	..	..	..	..	—	—
300 —	..	—	20	—	—	..	..
400 —	20	..	..	..	..	..	..
600 —	..	..	..	..	..	10	..
700 —	..	20	30	10	20	..	..

Geographical distribution. This species penetrates from the northern part of the Atlantic far into pronouncedly arctic regions, having e.g. been met with off the west coast of Greenland as far north as Smith Sund and along East Greenland as far north as 78° N. lat. (DAMAS and KOEFOED 1909).

Euchirella rostrata (Claus).

Undina rostrata Claus 1866, p. 11, pl. I, fig. 2.
Euchæta hessei Brady 1883, p. 63, pl. XX, figs. 1—13.
Euchirella rostrata Giesbrecht 1892, p. 222, pls. II and XV.

Material. At the "Dana" St. 2436 ($^{25}/_{7}$ 1925) which is situated directly off the coast of East Greenland (61°13′ N.—40°57′ W.) a couple of this species has been taken in a haul with 600 m.w.

Geographical distribution. From the eastern part of the Danmarksstræde the species was previously known from as far north as 65°50′ N. lat., but on September 18th, 1900, the Danish East Greenland Expedition at Kap Dan (Tarsuak Fjord) took a single adult female near the surface (With 1915) so that it is recorded from East Greenland waters. In the whole of its occurrence it must, however, be characterized as a rather pronouncedly northern Atlantic form.

Pareuchaeta norvegica (Boeck).

Euchaeta norvegica Boeck 1872, p. 40; Sars 1903, p. 38, pls. XIV—XVI.
Pareuchaeta norvegica A. Scott 1909, p. 69; Wilson 1932, p. 65, fig. 43.

Material. A considerable material of this copepod originates from the collections made in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas. Further, the species has been identified by the 2nd East Greenland Expedition to Kong Christian IX's Land (1932), where it was taken on August 20th in a haul with 250 m.w. in Kangerdlugssuak Nordfjord (68°30′ N.—32°30′ W.) and at the "Dana" St. 2436 ($^{25}/_{7}$ 1925) off the east coast of South Greenland in hauls with 600 and 1000 m.w.

Quantitative distribution. The investigations in the two East Greenland fjord systems yield rather full information as to the quantitative occurrence of the species, both vertically and horizontally. The vertical distribution occurs rather clearly from the following Table 17 which shows the number of individuals in the various hauls.

The species has not been met with in great numbers in the upper water layers, and it is hardly of common occurrence until at depths about 100—200 m. Thus the greatest quantities were taken in hauls with 300—800 m.w., but whereas it was only caught in half of the hauls with 300 m.w. it has been met with in all hauls with a length of wire exceeding 300 m. Also in West Greenland waters the species occurs by preference at rather great depths, *viz.* in hauls with more than 200 m.w.

As to the horizontal distribution in the two fjord systems only the hauls will be considered, which have been carried out at depths where the species is of fairly common occurrence. The chart Fig. 22 shows the number of individuals in the various hauls with a length of wire exceeding

200 m; only the greatest number of individuals has been indicated, when more than one haul has been taken at a station. Further, a special signature has been used to indicate the stations, where hauls have been made with 300—800 m.w., but where the species has not been found.

Table 17. *Pareuchaeta norvegica.* Number of individuals taken in hauls with varying lengths of wire in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

	Kejser Franz Joseph Fjord															Scoresby Sund Fjord				
St:	72	94	95	97	98	100	105	107	110	116	117	120	121	126	129	134	243	299	327	333
100—0 m ..	..	..	—	1	—	..	..	—	—	1	—	—	3	—	—	..	—	..	..	..
200—0 - ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	7
200 m.w....	..	..	..	..	..	..	..	..	..	..	..	..	..	—	—	..	—	..	4	—
300 — ...	..	..	14	—	1	..	—	—	—	—	..	18	17	..	1	..	..	..	..	..
400 — ...	22	4	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..
500 — ...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..
600 — ...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31	..	..	..
650 — ...	..	..	..	..	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..
700 — ...	..	..	4	6	..	..	3	30	..	..	..	..	..	..	..	4	..	..	..	..
800 — ...	..	..	..	..	12	3	..	..	..	..	..	..	2	..	..	..	..	..	..	..

When looking in the first place at the stations in the Kejser Franz Joseph Fjord area it appears that the negative stations are by preference situated, partly in the innermost branches of the fjord, and partly in the waters outside the fjord area proper. In the interior parts of Moskusokse Fjord, Is Fjord and Kjerulf Fjord the species has e. g. not been identified. This agrees very well with the fact that the greatest number of individuals of *Pareuchaeta norvegica* have been found in the central parts of the Kejser Franz Joseph Fjord area. As the number of specimens indicated refers to rather different depths, it is difficult to connect them with hydrographical conditions, but when the species does not penetrate into the interior parts of the various fjord branches, it has possibly some bearing upon the fact that the temperature in these parts is very low in the deeper water layers.

As the Scoresby Sund Fjord area only comprises a couple of stations with lengths of wire exceeding 300 m *viz.* St. 134, 700 m.w. and St. 243, 600 m.w., no great importance can be attached to the numbers of individuals, but it is striking that the quantity at the former station which is situated at the mouth of the fjord, is considerably lower than at the latter station which is situated in Nordvest Fjord. At the mouth of the Scoresby Sund Fjord the species seems to occur in relatively small quantities, as also in the Kejser Franz Joseph Fjord area.

Geographical distribution. This species which is widely spread in the northern parts of the North Atlantic penetrates far north in pronouncedly arctic areas. Thus it is undoubtedly found at suitable depths along the whole of the coast of East Greenland, where it has formerly been identified as far north as 78°—79° N. lat. (Damas and Koefoed 1909).

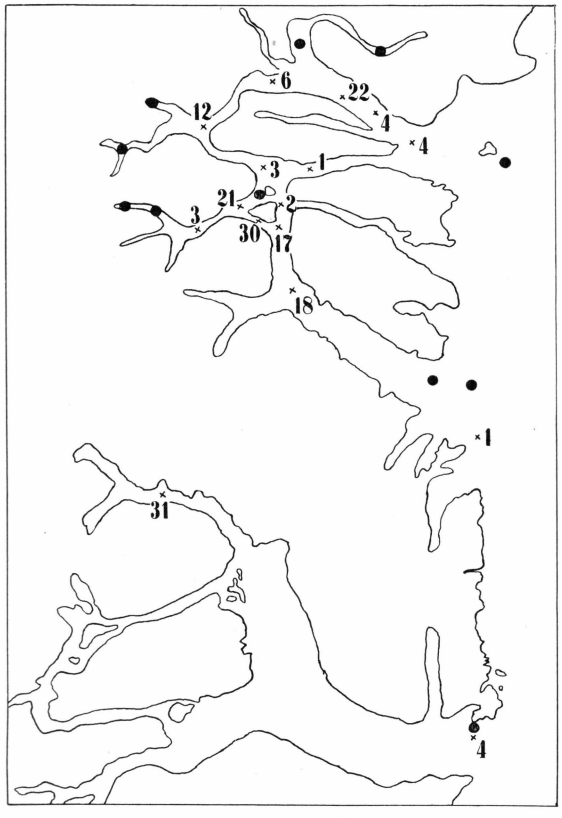

Fig. 22. *Pareuchaeta norvegica.* Number of individuals in hauls with 300—800 m.w. ● = negative stations.

Propagation. *Pareuchaeta norvegica* in all probability spawns in the East Greenland fjords, where a number of females with spermatophores have been found. The latter were identified in nearly all the depths where hauls were made, so they do not seem to occur in definite depths. In Kejser Franz Joseph Fjord and Scoresby Sund Fjord 25 females with spermatophores, in all, were identified in 11 different hauls. The total number of females taken was 85, so that females with spermatophores make 29.4 per cent of the total number in the hauls mentioned. In comparison it may be stated that at the "Dana" Station 2436 which is situated considerably farther south along the east coast of Greenland,

i. e. in 61°13′ N. lat., there were 7 females with spermatophores out of a total of 12, which makes 58.3 per cent. The number of spermatophores attached to each female was in a few cases two, but generally only one.

Females with spermatophores have been met with during the period July 24th to August 29th, which is within the period when spermatophorous females of this species have been identified in West Greenland waters, *viz.* from May 29th to September 14th (JESPERSEN 1934, p. 74), but whereas females bearing egg sacs have been of rather frequent

Fig. 23. *Pareuchaeta norvegica* ♀. Length of cephalothorax in material from West Greenland waters, from south of Davis Stræde and from Baffin Bugt, respectively, as well as from East Greenland waters (Kejser Franz Joseph Fjord and Scoresby Sund Fjord).

occurrence in the latter waters within the period June 11th to August 22nd, not a single female with egg sacs has been found in East Greenland waters.

Variation in the size of *Pareuchaeta norvegica* ♀. The examination of the material of this copepod having established the existence of a rather considerable variation in size in the adult females, I have measured the length of the cephalothorax of a number of these from the two fjord systems of East Greenland. This, furthermore, led me to investigate the length of the cephalothorax in part of the material collected by the "Godthaab" Expedition (1928) in West Greenland waters, as it was of interest to examine conditions both in East Greenland and West Greenland waters. The result of these measurements (scale: 1 division line = 0.077 mm) is graphically represented in Fig. 23. The material from West Greenland waters is divided into two groups, *viz.* material from stations in the waters south of Davis Stræde (south of 65° N.) and material from Baffin Bugt (north of 65° N.), as there has

proved to be some difference in the variation of size and the mean lengths in the two areas.

It appears directly from the graphical representation that *Pareuchaeta norvegica* in West Greenland waters on an average attains a greater size in Baffin Bugt than in the area south of Davis-Stræde, and that in East Greenland waters it has practically a length corresponding with that in Baffin Bugt. From the three different areas 440, 173 and 108 individuals, respectively, have been measured, and the average lengths of these are 73.8, 79.5 and 79.0 division lines. In the waters south of Davis Stræde the mean length is about 5.68 mm, in Baffin Bugt about 6.12 mm and in East Greenland waters about 6.08 mm. As it will appear, the variations are not very great, but there is no doubt that the species attains the greatest mean length in the colder areas, *viz.* in Baffin Bugt and off the coast of East Greenland. In comparison it may be stated that the material collected by the "Godthaab" Expedition (1928) southwest of Iceland (St. 1, 63°19′ N., 26°50′ W.) shows an average length of 69.5 division lines (about 5.35 mm), and this also points towards the species attaining a relatively smaller size in warmer waters. From the said station where the material has been collected in a haul with 1000 m.w. a total of 68 individuals have been measured with a range of variation of 62—75 division lines.

Pareuchaeta glacialis (H. J. Hansen).

Euchaeta glacialis Hansen, 1886, p. 74, pls. XXIII—XXIV.

Material. Like the preceding species by far the greater number of *Pareuchaeta glacialis* originates from the collections made in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas. Further, it has been met with in a few places farther south along the coast of East Greenland, *viz.* $^{22}/_{7}$, 1932, off Kap Stephensen (68°23′ N., 28°33′ W.) and $^{20}/_{8}$, 1932 in Kangerdlugssuak (68°30′ N., 32°30′ W.), on the 2nd East Greenland Expedition to Christian IX's Land and, finally, at the "Dana" St. 2436, $^{25}/_{7}$ 1925 (61°13′ N., 40°57′ W.). At the two former stations the species has been taken in a vertical haul in the upper water layers and in a haul with 250 m.w., respectively, and at the latter station in a haul with 600 m.w.

Quantitative distribution. Table 18 indicates the number of individuals taken in the various hauls in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas, thus giving an impression of the quantitative distribution in a vertical direction.

As distinguished from the preceding species *Pareuchaeta glacialis* has rather frequently been taken in the upper water layers, even though

Table 18. *Pareuchaeta glacialis.* Number of individuals taken in hauls with

	Kejser Franz Joseph Fjord															
St:	23	29	48	58	72	94	95	97	98	100	101	102	103	105	107	110
100—0 m	..	..	1	..	..	..	1	—	3	..	5	4	1	..	5	—
200—0 -	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50 m.w.....	..	..	..	..	..	..	..	..	..	..	46	..	..	..	..	..
100 —	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..
150 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
200 —	63	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
300 —	..	..	..	..	..	..	56	—	29	..	200	400	..	98	77	15
400 —	..	..	..	..	50	30	..	..	..	..	..	..	..	..	..	4
500 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
600 —	..	..	145	..	..	..	..	..	..	..	..	..	..	..	..	..
700 —	..	..	..	41	..	..	16	32	..	..	46	104	..	39	120	..
800 —	..	..	..	..	..	..	..	..	120	7	..	..	..	..	..	..

the average numbers are here considerably smaller than deeper down in the water. The greatest quantities seem to be met with in the intermediary water layers (about 300 m.w.), but in several stations the species has been met with in the greatest numbers at depths corresponding to hauls with 700—800 m.w.

From a comparison with Table 17 (p. 50) it appears that this species occurs in far greater quantities in both fjord areas than the closely related *Pareuchaeta norvegica*, and the most characteristic difference in the vertical distribution of the two species is the far greater frequency of *Pareuchaeta glacialis* in the upper water layers.

In order to get an impression of the quantitative occurrence of the species within the various areas of the two fjord systems, the number of individuals is indicated on the chart Fig. 24. As in the preceding species only the greatest number is indicated in such cases where several hauls have been taken at a station, but as it is sometimes of rather frequent occurrence near the surface, the numbers of individuals per haul with more than 150 m.w. have been indicated on the chart.

A glance at the chart (p. 56) shows that *Pareuchaeta glacialis*, as distinguished from *P. norvegica* appears in striking numbers in the innermost areas of the two East Greenland systems of fjords. At all the innermost stations in Moskusokse Fjord, Is Fjord, Kjerulf Fjord and Kempe Fjord, where *P. norvegica* has not been identified, *P. glacialis* occurs in very considerable numbers. Further, the latter species has been met with in surprising quantities at a station in Røde Fjord behind Milne Land in the Scoresby Sund Fjord area. As in its general occurrence *P. glacialis* seems to be a still more pronounced cold

various lengths of wire in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

								Scoresby Sund Fjord							
114	116	118	120	121	124	126	129	133	11	207	243	299	327	328	333
—	5	..	—	—	..	—	—	—	..	3	2	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	5	..	7	6
..	..	..	..	..	—	..	..	..	..	..	..	..	..	13	..
..	..	3	..	..	14	..	..	..	..	..	..	..	..	..	..
1	..	..	..	..	..	..	..	—	..	..	..	..	..	..	..
..	..	..	..	..	..	—	2	..	24	..	57	..	225	..	71
..	87	..	46	35	36	..	4	..	..	..	..	..	..	..	..
—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	11	..	..	..	..	14	..	..	..	..	..	..	..	..
..	..	..	..	..	..	25	..	..	..	..	37	..	..	..	..
..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..
..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..

water form than *P. norvegica*; this may possibly explain the different distribution of the two species in the two East Greenland systems of fjords. In another respect the quantitative distribution, on the other hand, seems to agree very well, both species undoubtedly occurring in relatively small quantities at the mouths of fjords and in the waters immediately outside the latter. This fact is very pronounced in the case of this species both in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas.

Geographical distribution. This species is a pronouncedly arctic form, much more so than the preceding one, and it does not occur much farther south in the Atlantic than about 60° N. lat. As to the distribution see the chart Fig. 20 in the report of the "Godthaab" Expedition 1928 (Jespersen 1934, p. 77). In the East Greenland fjord areas *Pareuchaeta glacialis*, as mentioned above, is of much greater frequency than *Pareuchaeta norvegica*, which corresponds very well with the fact that the former species is also by far the most numerous in Baffin Bugt, whereas *P. norvegica* in the more temperate areas south of Davis Stræde is by far the predominant species.

Propagation. As a few females bearing remains of egg sacs and a considerable number with spermatophores have been met with in the investigated fjords of East Greenland, it is beyond doubt that the species spawns in these northern waters. Whereas remains of egg sacs have only been found in 3 individuals of the material examined, one of these only containing a few eggs and so in all probability being very nearly on the point of being emptied, the number of females with spermatophores is

much greater. From Kejser Franz Joseph Fjord and Scoresby Sund Fjord a total of 116 females with spermatophores were found, being identified in 30 different hauls. The total number of females in these hauls were 734, the females with spermatophores thus making 15.8 per cent of the total number of females in the said hauls. The investigations

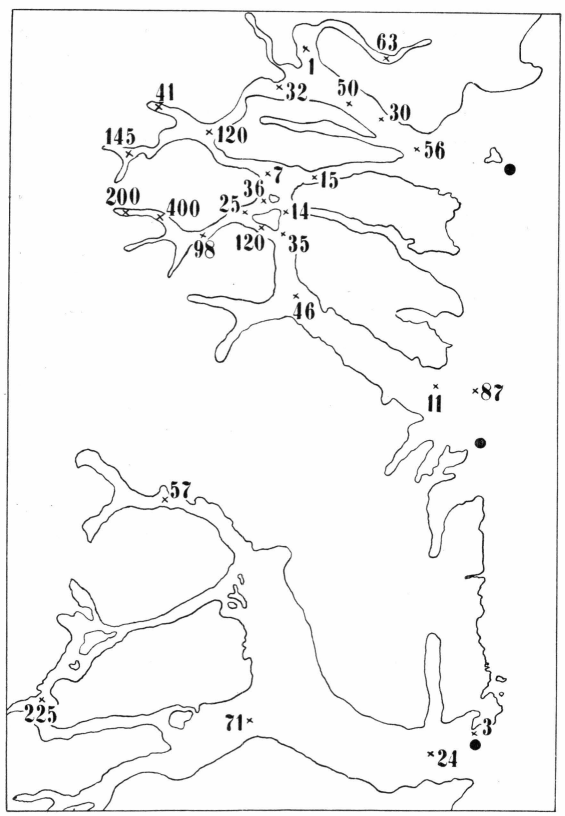

Fig. 24. *Pareuchaeta glacialis*. Number of individuals in hauls with 200—800 m.w. • = negative stations.

hitherto made do not seem to prove that there are certain water layers where the females bearing spermatophores by preference occur, seeing that they have been taken in all kinds of hauls from mere surface hauls to the greatest depths where fishing operations have been carried out; still, they seem to occur in relatively greatest numbers at depths corresponding to hauls with 600—650 m.w. The relative number of females with spermatophores, calculated per total number of females at various depths, appears from the following: 50—150 m.w. (36:5) 13.9 per cent, 200—300 m.w. (425:65) 15.3 per cent, 400—500 m.w. (35:5) 14.3 per cent, 600—650 m.w. (68:17) 25.0 per cent and 700—800 m.w. (163:13)

8.0 per cent. As a rule the females caught have only had a single spermatophore attached to them, but in a few cases 2 spermatophores have been found in the same individual. It is a point of interest bearing upon the above-mentioned fact that the three females carrying remains of egg sacs have been identified in three different hauls with wire lengths of 600—700 m.

The females with spermatophores have been identified during the whole of the period when investigations were carried out in the two East

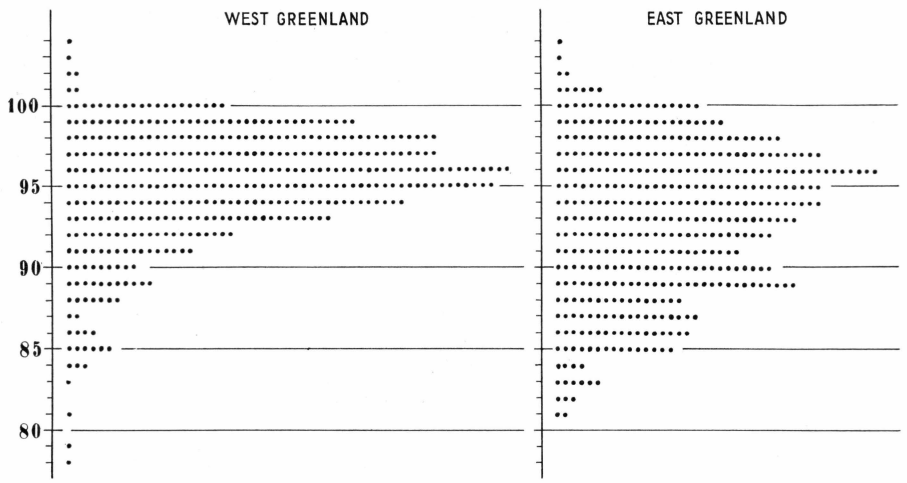

Fig. 25. *Pareuchaeta glacialis* ♀. The length of cephalothorax (measurement scale: 1 division line = 0.077 mm) in material from West Greenland and East Greenland waters.

Greenland fjords, *viz.* from the end of June till the end of August. While, as mentioned above, only very few females have been found with remains of presumably emptied egg sacs, several egg-bearing females have been identified in Baffin Bugt by the "Godthaab" Expedition 1928 in the period from medio July to medio September, and so one is presumably justified in supposing that the spawning period of this species takes place at an considerably earlier date in the East Greenland waters than in the waters west of Greenland.

Variation in the size of *Pareuchaeta glacialis* ♀. As was the case with the preceding copepod species, measurements of the length of cephalothorax (measurement scale: 1 division line = 0.077 mm) have been made of a large number of *Pareuchaeta glacialis* ♀, in order to be able to compare the sizes of the species in East Greenland and West Greenland waters. Fig. 25 is a graphic representation of these measurements. From West Greenland waters (Baffin Bugt and Davis Stræde) 420 individuals have been measured, and from East Greenland waters

(Kejser Franz Joseph Fjord and Scoresby Sund Fjord) 434 individuals, or in other words about the same number from both areas.

When looking at the two curves which the measurements form, it appears that the results are somewhat different, though the range of variation is very nearly the same in both areas, and also that the length which shows the greatest number of individuals in both cases is 96 division lines. This agrees with the fact that there is very little difference in the mean length, 94.9 division lines for West Greenland and 92.9 for East Greenland. When reduced to mm the average length becomes about 7.30 and 7.15 mm respectively, a difference so small that it is surely only due to the fortuitous composition of the material. From more temperate areas, as e. g. the waters south of Davis Stræde, the available material of this species is so slight that it does not lend itself to comparison with the measurements mentioned above, and so we must content ourselves with stating that there is no ostensible difference in the length of *Pareuchaeta glacialis* from West Greenland waters and the East Greenland fjords from which material is at hand.

Xanthocalanus fallax G. O. Sars.

Xanthocalanus borealis Sars 1903, vol. IV, p. 46, pls. XXXI—XXXII.
— *fallax* Sars 1925, p. 128, pl. XXXV.

At a single station in Kejser Franz Joseph Fjord, St. 101, 3 specimens (♀♀) of the genus *Xanthocalanus* have been caught, and according to the description given I think that they must be regarded as belonging to this species. It is not previously recorded from Greenland waters, but besides having been met with in several localities in the northern Atlantic it is i. a. identified in Norwegian fjords, where it has been found in great depths. At the above-mentioned station in Kejser Franz Joseph Fjord the species was taken in a haul with 700 m.w.

Xanthocalanus borealis G. O. Sars.

Xanthocalanus borealis Sars 1900, p. 49, pl. XI; Sars 1925, p. 137, pls. XXXV and XXXVIII.
— *hirtipes* With 1915, p. 241; (?)Vanhøffen 1897, p. 282, fig. 18.

4 individuals (♀♀) of this species have been caught at the same station in Kejser Franz Joseph Fjord where the preceding species was identified. The size of the individuals, as also the structure of the fifth foot decidedly points towards their having to be classed with this species which has not previously been recorded from East Greenland, but from West Greenland waters and other arctic areas, and it has also been met with in several localities in the northern Atlantic.

Undinella oblonga G. O. Sars.

Undinella oblonga Sars 1900, p. 52, pl. 12; van Breemen 1908, p. 68, fig. 79.

A single specimen (♀) of this species, which is generally considered a rather pronouncedly arctic form, has been taken in a vertical haul from 500—300 m at the "Dana" St. 2308 ($^1/_6$ 1925), situated almost to the east of Kap Farvel (59°21′ N., 37°56′ W.). The species is previously known i. a. from the waters between East Greenland and Spitsbergen (Damas and Koefoed 1909).

Scolecithricella minor (Brady).

Scolecithrix minor Brady 1883, p. 58, pls. XVI—XVII.
Scolecithricella minor Sars 1903, p. 55, pls. XXXVII—XXXVIII.

Material. In the East Greenland fjords where investigations have been made, the species has only been identified in Scoresby Sund Fjord. It is taken in a few specimens, and exclusively in vertical hauls from 200 m and 100 m to the surface. At the "Dana" St. 2436, $^{25}/_7$ 1925 (61°13′ N., 40°57′ W.) a couple of specimens were further caught in a haul with 600 m.w., whereas it is only represented by one specimen in the collections made by the "Dana" (1931—33) in the waters along the east coast of Greenland from off Angmagssalik to Kap Farvel. This specimen was taken in a vertical haul from 50 m to the surface at a single station (St. 4675, $^{13}/_8$ 1933, 61°57′ N., 40°41′ W.) in the western part of the Danmarksstræde.

Geographical distribution. This species which is widely distributed in the Atlantic extends its area of distribution far into the arctic region. Besides in West Greenland waters, it has also been met with by the Duc d'Orleans Expedition in very northern latitudes near the coast of East Greenland (Damas and Koefoed 1909), and it has recently been identified as far north of Spitsbergen as between 81° and 82° N. (Farran 1936).

Scolecithricella ovata (Farran).

Scolecithrix ovata Farran 1905, p. 37, pls. VI—VII.
Scolecithricella ovata With 1915, p. 208, pls. VII—VIII; Sars 1925, p. 188, pl. LII.

Material. This species has not been identified in the investigations of the fjords of East Greenland, and along the east coast it undoubtedly only occurs at the south point of Greenland. Here it was taken in a single specimen (♀) at the "Dana" St. 2436, situated nearly straight off Kap Herluf Trolle, where also the previously mentioned species was caught. It was taken in a haul with 1000 m.w.

Geographical distribution. As contrasted with the preceding species this is a rather pronouncedly Atlantic form, the northern limit of its distribution being in the southern part of Danmarksstræde where it was identified at several of the "Dana" stations; further, it was found by the "Michael Sars" Expedition 1924 (STØRMER 1929) and the "Ingolf" Expedition (WITH 1915). The most northerly find in Danmarksstræde dates from the latter expedition, where the species has been identified at St. 11 (64°34′ N., 31°12′ W.). In West Greenland waters its distribution in a northern direction only extends to the area south of Davis Stræde.

Temora longicornis (O. F. Müller).

Cyclops longicornis O. F. Müller 1792, p. 115, pl. XIX.
Temora finmarchicus Baird 1850, p. 228, pl. XXVIII.
— *longicornis* Sars 1903, p. 97, pls. LXV—LXVI.

Material. The including of this species in the East Greenland fauna is due to the fact that it is represented in the material collected at several stations during the cruises of the "Dana" in Danmarksstræde, and so far towards the west that it may undoubtedly be met with relatively near the coast of East Greenland. The species is found in sparse numbers at the Stations 4223 and 4226 in 1931 and 4663 in 1933, which stations are situated in about 65°—66° N. lat.; the most westerly find was made in 34° W. long. On the chart Fig. 26 the stations are indicated, where this species has been identified during the investigations of the "Dana" in Danmarksstræde, and it is a very likely supposition that the western branch of the Irminger current carries it to the coast of East Greenland from Iceland, where it is of common occurrence (JESPERSEN 1932). At the "Dana" stations in Danmarksstræde this species has been taken in vertical hauls from 25 and 50 m to the surface.

Geographical distribution. *Temora longicornis* is generally considered a more temperate species, but as the "Nautilus" Expedition 1931 identified it as far north as 81°50′ N., 20°15′ E. in the waters north of Spitsbergen (FARRAN 1936), it is not to be wondered at that it can also be met with near the coast of East Greenland.

Metridia longa (Lubbock).

Calanus longus Lubbock 1854, p. 127, pl. V.
Metridia armata Boeck 1864, p. 14.
— *longa* Sars 1903, p. 112, pls. LXXV—LXXVI.

Material. This species which must be characterized as being extremely common in the East Greenland waters, was first and foremost identified in great numbers by the present investigations in the fjords of East Greenland and farther out in Danmarksstræde. When the

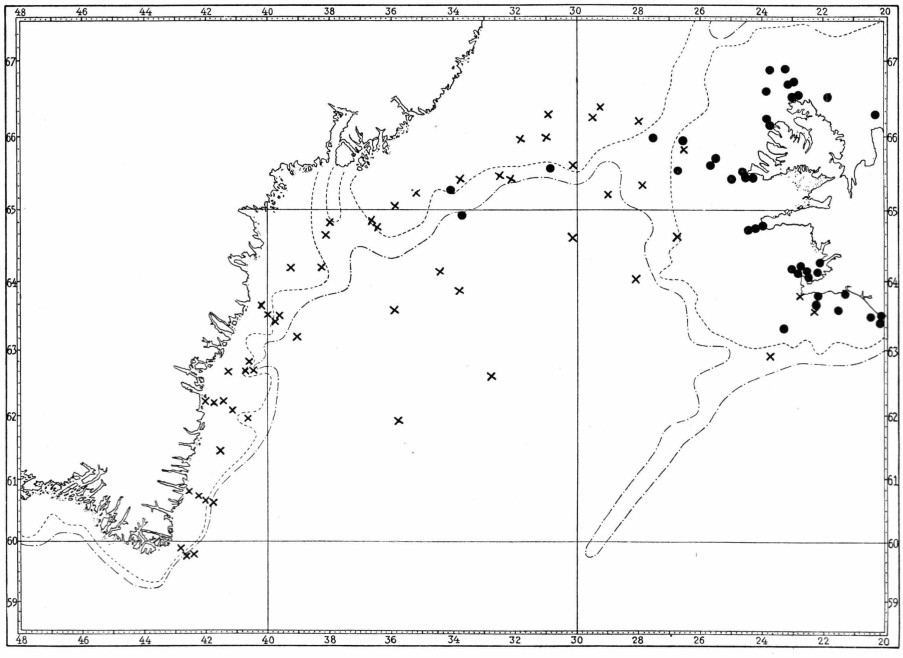

Fig. 26. *Temora longicornis*. The occurrence of the species at the "Dana" stations in 1931—33. ● = positive stations. × = negative stations.

species has only been caught at comparatively few stations on the cruises of the "Dana" from off Angmagssalik to Kap Farvel, this is surely due to the fact, partly that only vertical hauls have been taken, and partly that collections have been made in the upper water layers only (50—0 m).

Quantitative distribution. The vertical distribution of the species is very great; sometimes it may be met with in considerable numbers quite close to the surface, and besides it has been taken in the deepest hauls made. An impression of the vertical distribution in the two East Greenland fjords, where investigations have been made, is conveyed by looking at Table 19, which shows the approximate number of individuals taken in hauls at various depths.

In the vertical hauls from 100 m and 200 m to the surface the numbers of this species are greatly varying at the different stations, as many as 710 individuals having been taken in a single haul, whereas at other stations no specimens whatsoever have been found. When looking at the hauls taken with different lengths of wire, it appears that *Metridia longa* has been taken in considerable numbers in all hauls with more than 150 m.w. Very considerable quantities have already been caught in depths corresponding to hauls with 200—300 m.w., but at several stations where more hauls were made, the greatest numbers were.

Table 19. *Metridia longa.* Number of individuals taken in hauls with differe

	Kejser Franz Joseph Fjord															
St.	23	29	58	72	84	94	95	97	98	101	102	103	105	107	110	11
100—0 m	..	..	..	..	..	..	190	90	460	710	200	70	..	10	10	–
200—0 -	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
50 m.w.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
100 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
150 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
200 —	1100	580	..	..	90	..	..	..	..	..	..	..	..	..	..	.
300 —	..	..	..	..	..	..	250	280	940	12000	..	..	740	320	190	.
400 —	..	..	..	120	..	410	..	..	..	..	..	..	..	..	80	.
500 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
600 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.
700 —	..	..	70	..	..	..	520	760	..	670	..	..	..	290	..	.
800 —	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	.

however, caught still deeper, *viz.* in depths corresponding to hauls with 600—700 m.w. At a single station, St. 101, which is situated in the interior part of Kempe Fjord, the colossal number of about 12,000 individuals have been taken in a haul with 300 m.w., a quantity of individuals far surpassing the numbers of the other hauls. At the same station only 670 specimens were taken in a haul with 700 m.w., which decidedly suggests a decreasing quantity of individuals in the deepest water layers, at any rate in this locality.

As the number of individuals varies so greatly in various depths and at the various stations, the more detailed investigation of the quantitative distribution will be limited to the stations, where vertical hauls have been made from 100—0 m. The latter are indicated on the chart of Fig. 27 (p. 64).

When considering the number of individuals of this copepod species in the upper 100 m, it thus appears that the greatest quantities undoubtedly are to be found in the interior parts of the fjord systems, and that in the upper water layers the species only occurs in very small numbers in the waters outside the fjord areas proper. The greatest numbers in the Kejser Franz Joseph Fjord system have been met with behind Ymer Ø, and in the interior of Kempe Fjord and in the Scoresby Sund Fjord system far up in Nordvest Fjord. Outside the Kejser Franz Joseph Fjord area and at the mouth of Scoresby Sund Fjord the species has either not been identified at all in the upper water layers, or at any rate only in very sparse numbers. It is worth noticing that the greatest number in vertical hauls of 100—0 m has been taken at the station in Kempe Fjord (St. 101) where, as mentioned

ɔngths of wire in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

									Scoresby Sund Fjord									
15	116	117	118	120	121	124	126	129	134	11	141	142	207	243	299	327	328	333
—	30	—	..	10	30	..	—	10	—	..	20	—	10	160	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	..	400	150
..	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	390	..
..	..	..	..	..	..	..	..	..	..	..	10	—	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	430	50	..	160	..	..	..	..	..	1930	..	..
..	160	..	..	260	..	390	..	460	..	..	..	..	..	..	..	..	..	..
..	140	130	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	130	..	..	..	..	950	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	530	..	..	..	..	..	..	760	..	..	..	..
..	..	..	..	..	..	..	..	..	70	..	..	..	..	..	..	..	..	..
..	..	..	..	..	380	..	..	..	..	..	..	..	..	..	..	..	..	..

above, the considerable number of 12,000 specimens were caught in a haul with 300 m.w.

As to the vertical distribution of the species throughout the year see Ussing (1938, p. 25).

By far the greater number of adult individuals of this copepod, taken in the various hauls, are females, the males as a rule only making a small percentage of the total number of adult individuals. This appears from Table 20 where the relative quantity of males is indicated for a number of hauls; only those stations are registered where males have been met with in at least one of the hauls made.

As appears from the table, adult males of *Metridia longa* appear in far the greater number in the deepest water layers where investigations have been made, *viz.* chiefly in depths corresponding

Table 20. *Metridia longa.* The relative number of males at various stations in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

St:	58	95	97	101	102	107	116	118	121	126	129	134
100—0 m...	..	—	—	2.1	—	—	—	..	—	—	—	—
100 m.w....	..	..	..	..	..	..	..	—	..	..	..	..
200 — ...	..	..	..	..	..	..	..	..	..	—	—	..
300 — ...	..	—	—	—	..	—	5.6	..	..	..	—	..
500 — ...	..	..	..	..	..	..	..	4.5	..	..	1.8	..
600 — ...	..	..	..	..	..	..	..	..	..	4.8	..	..
700 — ...	56.2	4.4	1.9	10.6	6.2	18.2	..	..	..	..	..	5.9
800 — ...	..	..	..	..	..	..	..	..	4.3	..	..	..

to hauls with about 700 m.w. This agrees with investigations of the vertical distribution of the species in Barent Sea and White Sea (BOGOROV 1932). At a single station (St. 58) the males even predominated in numbers, *viz.* 56.2 per cent, but in by far the greater number of cases the males make a much smaller percentage of the total number of adult

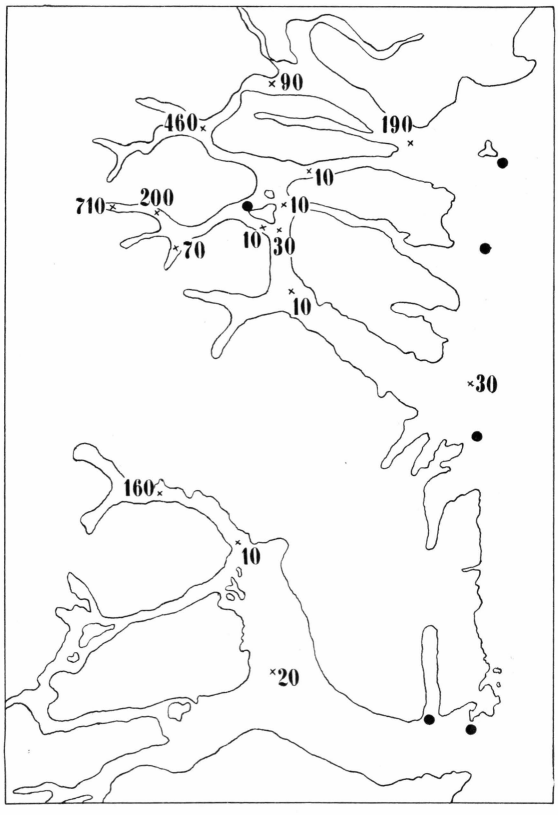

Fig. 27. *Metridia longa.* Number of individuals in vertical hauls 100—0 m. ● = negative stations.

individuals. It is worthy of mention that the said St. 58 is situated in the innermost part of Is Fjord in the Kejser Franz Joseph Fjord area.

Geographical distribution. *Metridia longa* is widely distributed in all northern seas and undoubtedly occurs in most arctic areas. It has been identified rather far down in the Atlantic, but then nearly always only in great depths, whereas in the northern seas it is frequently found rather close to the surface.

Variation in the size of *Metridia longa* ♀. Measurements of the length of cephalothorax have been carried out for this as for a few other

Table 21. *Metridia longa* ♀. Measurements of the length of cephalothorax in material from East Greenland and West Greenland waters. (Measurement scale: 1 division line = 0.077 mm). (See text.)

	East Greenland	West Greenland			
		St. 24	St. 77	St. 99	Total
39	2	..	..	..	..
38	17	..	..	1	1
37	45	1	5	6	12
36	85	15	22	27	64
35	35	26	29	32	87
34	12	19	14	8	41
33	4	4	5	1	10
32	..	1	..	..	1
	$a_{200} = 36.1$	$a_{66} = 34.8$	$a_{75} = 35.1$	$a_{75} = 35.4$	$a_{216} = 35.1$

copepod species. For comparison measurements have further been made of a number of specimens collected by the "Godthaab" Expedition 1928,

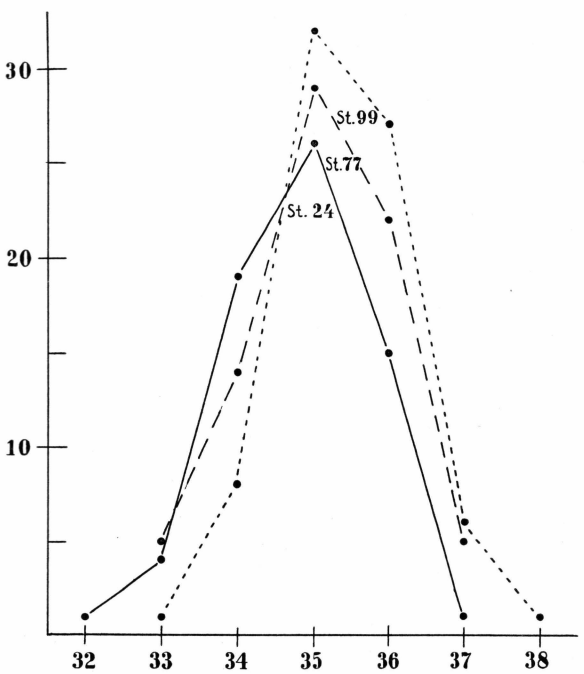

Fig. 28. *Metridia longa* ♀. Measurements of the length of cephalothorax in material from three stations in West Greenland waters.

in West Greenland waters. The East Greenland material measured originates from Kejser Franz Joseph Fjord and Scoresby Sund Fjord,

and the number of individuals amounts in all to 200, while the material measured from West Greenland waters comprises 216 specimens. As in the other measurements the lengths are given in division lines of about 0.077 mm each. As there has proved to be a variation of size, though

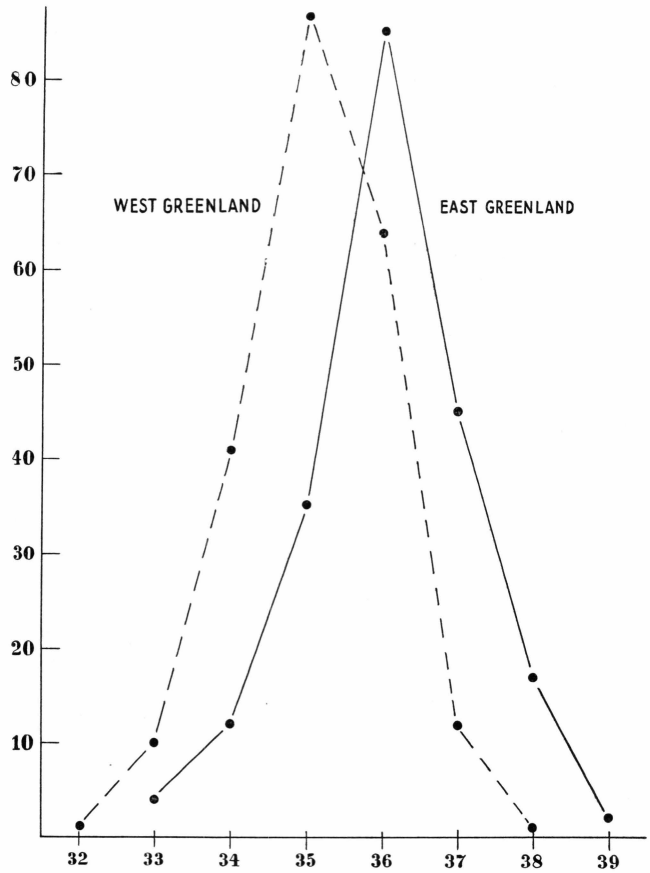

Fig. 29. *Metridia longa* ♀. Measurements of the length of cephalothorax in material from West and East Greenland waters.

quite a small one, in various localities in West Greenland waters, the material from the different stations has to a certain extent been kept separate. It is here a question of the following three stations: St. 24, situated in the waters south of Davis Stræde (66 specimens), St. 77, situated in Melville Bugt (75 specimens) and St. 99, situated in Smith Sund (75 specimens). Table 21, p. 65 is a summary of the measurements both for the East Greenland and the West Greenland material with the calculated mean lengths.

First of all we will consider the variation of size at the 3 stations in West Greenland waters. As already appears from the mean lengths

in Table 21, there is a gradual increase in these from south towards north, the mean length at St. 24 south of Davis Stræde being 34.8, at St. 77 in Melville Bugt 35.1 and in Smith Sund 35.4 division lines. That it is here really a question of an increasing average length appears from the 3 curves in Fig. 28 (p. 65), which shows the length measurements from the 3 said stations.

The size of *Metridia longa* in West Greenland waters thus seems to increase, although in an inconsiderable degree, from south towards north. If we then deal with the material under one and compare the lengths of the material from East Greenland waters, it turns out that the sizes are on an average somewhat greater in East Greenland than in West Greenland waters, as appears from Fig. 29.

The average length of the total material from West Greenland waters (216 specimens) is 35.1 and from the East Greenland waters (200 specimens) 36.1 division lines. As it appears from the two curves which are strikingly alike in their course, this difference in size, although in itself rather inconsiderable, is quite evident. As the average length for the most northerly station in West Greenland waters (St. 99 in Smith Sund) is 35.4 and in East Greenland waters, as mentioned above, 36.1, it may generally be said that the length of *Metridia longa* is on an average greater in East Greenland than in West Greenland waters.

As appears from the description given above, there is only one size group of *M. longa* in East Greenland fjords. This was already demonstrated by Ussing (1938, p. 78), who mentions the short spawning season during the later part of the summer as the reason, why there is no variation of size worth mentioning for this species in East Greenland fjords.

Metridia lucens Boeck.

Metridia lucens Boeck 1864, p. 238; Sars 1903, p. 113, pl. LXXVII.

Material. In the material at hand only a few specimens of this species have been met with at the "Dana" St. 2436, $^{25}/_{7}$ 1925, which is situated rather near the coast of East Greenland in 61°13′ N., 40°57′ W. The species was found in a haul with 600 m.w.

Geographical distribution. The species is a rather pronouncedly Atlantic form, and the northern boundary of its common occurrence in East Greenland waters is presumably in the southern part of the Danmarksstræde, where the collections of the "Dana" proved its presence at several stations out in the open water. Sometimes it can be carried much farther north with the current, as shown by a single specimen ♀, stage V, which was found by the "Nautilus" Expedition 1931 in 81°40′ N., 11°20′ E., to the northwest of Spitsbergen (Farran 1936). In West

Greenland waters the species has only been met with in the waters south of Davis Stræde.

?*Metridia Boecki* Giesbrecht.

Metridia boeckii Giesbrecht 1892, p. 340; A. Scott 1909, p. 120, pl. XXXVII.

Material. In the material from the "Godthaab" Expedition 1932 in the Kejser Franz Joseph Fjord area one specimen (♀) of the genus *Metridia* has been met with at St. 126, situated within Ella Ø. This specimen cannot be referred to any of the above-mentioned two species, but in all probability belongs to the species *Metridia Boecki*. The individual which was found in a haul with 650 m.w. was unfortunately somewhat defective.

Geographical distribution. It is rather surprising to meet with this species in such northern latitudes, as it is principally known from rather southern areas of the northern Atlantic. However, it has also been identified in West Greenland waters (JESPERSEN 1934), where it has been taken in hauls with 1000—3000 m.w. in the waters south of the Davis Stræde.

Pleuromamma robusta (Dahl).

Pleuromamma robusta Dahl 1893, p. 105; Sars 1903, p. 115, pls. LXXVIII—LXXIX.

Material. Scattered individuals of this species occur in two hauls taken with 600 and 1000 m.w., respectively, at "Dana"s St. 2436, off Kap Herluf Trolle on the coast of East Greenland. It is the first time that the species has been identified in East Greenland waters where, being a rather pronouncedly Atlantic form, it is presumably not found much farther north, and in the West Greenland waters it is only known from the area south of Davis Stræde.

Centropages hamatus (Lilljeborg).

Ichtyophorba hamata Lilljeborg 1853, p. 185, pls. XXI and XXVI.
— *angustata* Claus 1863, p. 199, pl. 35.
Centropages hamatus Sars 1903, p. 76, pl. LII.

Material. A few individuals (♀) of this species have been identified in a surface haul taken at Angmagssalik ($^{8}/_{9}$ 1932) by the 2nd East Greenland Expedition to Kong Christian IX's Land. The species is new to the East Greenland fauna.

Geographical distribution. The occurrence of this species along the coast of East Greenland must presumably be ascribed to the fact that the western branch of the Irminger current has carried it across the Danmarksstræde from Iceland, where it is quite common. As appears

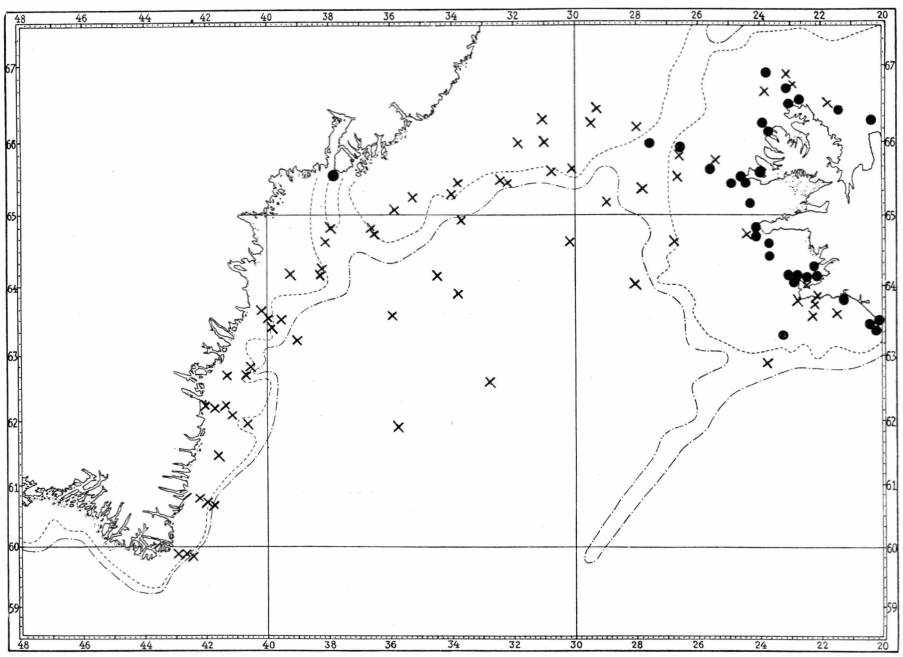

Fig. 30. *Centropages hamatus*. The occurrence of the species at the "Dana" stations in 1931—33. ● = positive stations. × = negative stations.

from the chart Fig. 30 which shows the localities where the species was found by the "Dana" in the years 1931—33, it has, however, not been identified across the Danmarksstræde, but only as far out as about 28° W. long. For this species the collections of the "Dana" consequently do not enable us to follow a connection between the Icelandic waters and the East Greenland coast water, but such an isolated occurrence in East Greenland rather seems to suggest that this copepod has been carried there with the current.

Along the coasts of West Greenland this species is known from a couple of localities which are situated very close to one another, and so the probability is also here that it has been carried across the Davis Stræde from the Canadian coasts (JESPERSEN 1934). In the whole of its occurrence it must rather be regarded as a form which chiefly occurs near the coast, or in any case in relatively shallow water.

Heterorhabdus norvegicus (Boeck).

Heterochæta norvegica Boeck 1872, p. 40.
Heterorhabdus norvegicus Sars 1903, p. 118, pls. LXXX—LXXXI.

Material. The species is of rather common occurrence in the East Greenland fjords, where investigations have been made, but it rarely

occurs in great numbers. It has further been identified at Kangerdlugssuaq, $^{20}/_{8}$ 1932, as well as at the "Dana" St. 2436, $^{25}/_{7}$ 1925, off Kap Herluf Trolle. When it has not been met with at the many "Dana" stations in 1931-33 in the Danmarksstræde, this is undoubtedly simply due to the fact that it occurs by preference in the somewhat deeper water layers, and is rarely met with at the very surface.

Quantitative distribution. The collections made in Kejser Franz Joseph Fjord and Scoresby Sund Fjord have supplied a material

Table 22. *Heterorhabdus norvegicus*. Number of individuals taken in hauls with different lengths of wire in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

	Kejser Franz Joseph Fjord						Scoresby Sund Fjord				
St:	58	72	95	97	105	107	12	207	243	327	328
100—0 m	..	..	—	—	..	—	..	1	2	..	..
200—0 -	..	..	..	..	..	..	..	..	..	..	10
50 m.w.	..	..	..	..	..	..	..	..	..	..	15
75 —	..	..	..	..	..	..	5	..	..	..	..
200 —	..	..	..	..	..	..	..	..	..	10	..
300 —	..	..	—	—	—	20	..	..	..	..	..
400 —	..	15	..	..	..	..	..	..	..	..	..
600 —	..	..	..	..	..	..	..	..	130	..	..
700 —	10	..	20	100	15	5	..	..	..	..	..

which shows that the species principally lives in somewhat deeper water layers, the greatest numbers having been identified at depths corresponding to hauls with 600—700 m.w. Table 22 indicates the approximate numbers at the stations where the species has been identified in the two East Greenland fjords.

At the above-mentioned station at Kangerdlugssuaq a single individual has been caught in a haul with 200 m.w., and at St. 2436 the species has been identified in small numbers in hauls with 600 and 1000 m.w.

Propagation. The fact that the material from the Scoresby Sund Fjord area, St. 243, 600 m.w. and St. 328, 200—0 m includes a few females with spermatophores points towards spawning taking place at any rate in the summer (July—August) in this area.

Geographical distribution. The species is widely distributed over great parts of the northern Atlantic and high up into arctic regions. As to its distribution see further STEUER 1933, who on p. 283 reproduces a chart of the distribution of the species and i. a. shows that it has been

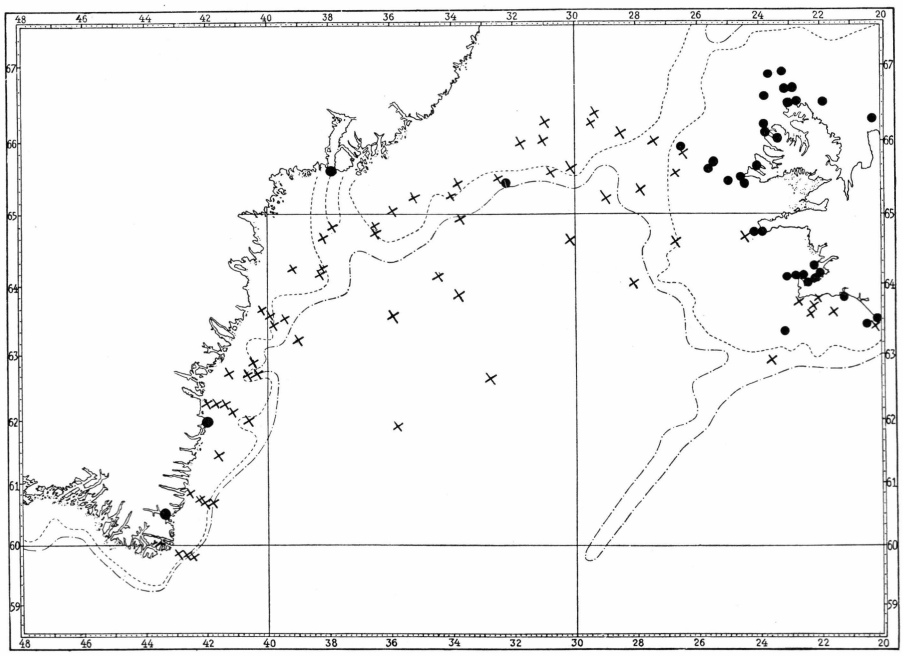

Fig. 31. *Acartia longiremis*. The occurrence of the species at the "Dana" stations 1931—33, and also in other places along the southern part of East Greenland. ● = positive stations. × = negative stations.

commonly met with by the Duc d'Orleans Expedition in the waters between Spitsbergen and East Greenland.

Acartia longiremis (Lilljeborg).

Dias longiremis Lilljeborg 1853, p. 181, pl. XXIV.
Acartia longiremis Sars 1903, p. 149, pls. XCIX—C.

Material. This species is represented by a small material scattered along the coast of East Greenland. In the Kejser Franz Joseph Fjord area single individuals were taken in 1932 at a few stations, *viz.* St. 101, 100—0 m and St. 124, 100 m.w. and in a surface haul ($^{10}/_{8}$ 1933) in Dusen Fjord. That this species only occurs in sparse quantities in the Kejser Franz Joseph Fjord area also appears from the fact that it has not been identified at all in the great number of plankton samples collected throughout the year at two stations within this area (Ussing 1938). From the Scoresby Sund area only a few individuals are at hand, taken in a surface haul at St. 327. Farther south it has been identified $^{16}/_{7}$ 1932, in d'Aunay Bugt (about 69° N., 25°25′ W.), $^{8}/_{9}$ 1932, at Angmagssalik (about 65°30′ N., 38° W.), $^{6}/_{7}$ 1935, at Karra (about 62° N., 41°30′ W.) and $^{21}/_{7}$ 1935, Lindenows Fjord (60°25′ N., 43°20′ W.). The species has

everywhere been met with near the surface, and with the exception of the station at Angmagssalik it has only been found in sparse quantities. In the sample from Angmagssalik it occurred, however, in such considerable numbers that in a horizontal haul with 40 m wire about 120 individuals of this species were taken in the course of 7 minutes. *Acartia longiremis* made no less than about 61.5 per cent of the total number of copepods in the said haul.

On the chart Fig. 31 (p. 71) which indicates the stations of the "Dana" in the years 1931—33, the localities where *A. longiremis* has been identified are marked, and also the places where the species has been met with in other collections along the southern coast of East Greenland. The species is, as it appears, of common occurrence near the coasts of Iceland, and in the northern part of the Danmarksstræde it has only been identified at a single station in the middle of the strait, but this find possibly forms a connection between the Icelandic and East Greenland occurrences. As mentioned above the species has been identified in particularly great numbers at Angmagssalik, which is a point of interest in this connection.

Geographical distribution. According to the investigations at hand the species seems to be of rather scattered occurrence along the coast of East Greenland, but that this copepod extends far towards north appears i. a. from the fact that it has been identified at several stations in the waters north of Spitsbergen in about 81°30′ N. (FARRAN 1936). As to the distribution of the species elsewhere see my paper on the copepods of the "Godthaab" Expedition, 1928 (p. 122, fig. 31).

?*Ectinosoma finmarchicum* T. Scott.

Ectinosoma finmarchicum T. Scott 1903; Farran 1936, p. 408, fig. 2.

Material. At the "Dana" St. 4677, $^{13}/_{8}$ 1933, which is situated in 60°47′ N., 42°34′ W. three specimens (♀♀) have been taken in a vertical haul 50—0 m, and according to the opinion of Mr. WALTER KLIE they are thought to belong to this species. A note of interrogation is, however, appended to the determination.

Geographical distribution. This species in the whole of its distribution is pronouncedly arctic, being known from the following places: Varangerfjord in northern Norway (T. SCOTT 1903), at Franz Joseph Land and in the Kara Sea (SMIRNOV 1932), from the northern coast of Alaska (WILLEY 1920) and from the waters north of Spitsbergen (FARRAN 1936), and so its presence in the polar waters along the coast of East Greenland would seem rather natural.

Ectinosoma neglectum Sars.

Ectinosoma neglectum Sars 1911, p. 31, pl. XVII; Willey 1920, p. 24, figs. 29—32.

Material. 1 ♂ and 4 ♀♀ of this species have been caught in a surface haul (25—0 m) at Karra, about 62° N. lat., 41°30′ W. long. (K. Lang det.).

Geographical distribution. Like the preceding species this one is chiefly known from arctic areas, i. a. the waters round Spitsbergen and Franz Joseph Land, but it also has been found along the Norwegian coast and in the Mediterranean.

Microsetella norvegica (Boeck).

Setella norvegica Boeck 1864, p. 281.
Ectinosoma atlanticum Brady 1880 II, p. 13, pl. 38.
Microsetella norvegica Sars 1911, p. 44, pl. XXIV.

Material. On the "Godthaab" Expeditions, 1932 and 1933 the species was only met with at a single station in the Kejser Franz Joseph Fjord area, *viz.* St. 29 (50—0 m) which is situated in Nord Fjord. Apart from this, the species has neither been found in this fjord area nor in the Scoresby Sund Fjord area. In more open water, *viz.* at the mouth of Gael Hamkes Bugt (about 74° N. lat.) it has, on the other hand, been found by the said expeditions at a couple of stations, *viz.* St. 3 (100—0 m) and St. 6 (100—0 m). Whereas the species is very rarely to be found within the fjords of East Greenland, it is of common occurrence in the more open water along the coast of East Greenland as well as across the Danmarksstræde, as appears from the "Dana" stations in these waters.

Quantitative distribution. On the "Dana" Expedition in the Danmarksstræde in the year 1931 the species has only been identified in very small quantities, which is presumably due to the fact that only vertical hauls from 25—0 m were taken on this expedition, whereas in the two following years vertical hauls were taken from 50 m to the surface. The examination of the frequency of the species will, therefore, merely be based on the collections of 1932 and 1933. On the chart Fig. 32 various signatures are used to indicate the stations where the species is met: common or numerous (+—cc), scarce (rr—r) and not at all identified.

It appears from the chart that *Microsetella norvegica* has been found in particularly great numbers in the central and western part of the Danmarksstræde. Near the coasts of Iceland it is evidently of rather sparse occurrence, and there are several stations where it has not been met with. Along the coast of East Greenland it has, on the other hand,

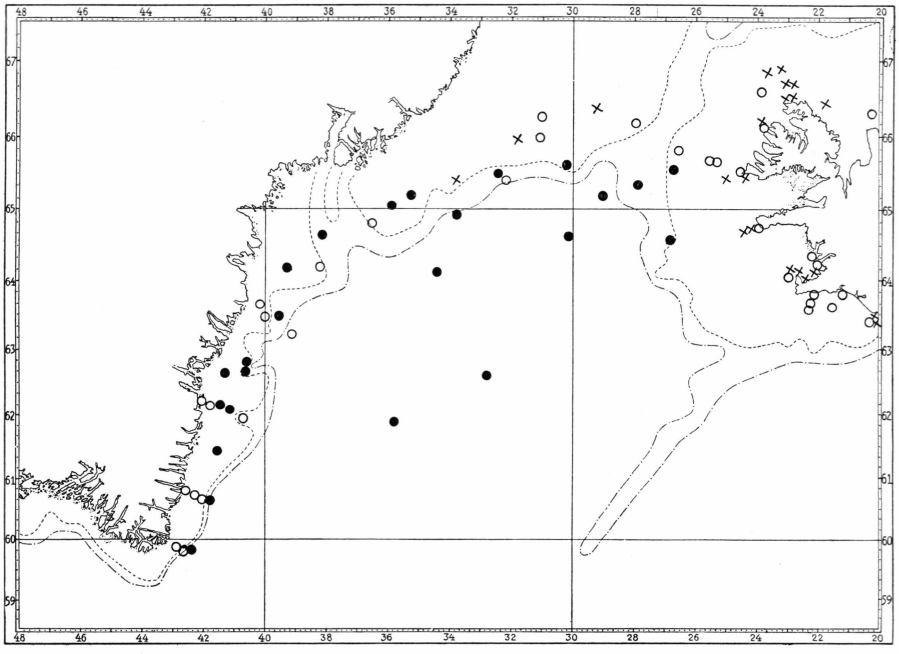

Fig. 32. *Microsetella norvegica*. The occurrence of the species at the "Dana" stations 1932—33. ● = + — cc. o = rr — r. × = negative stations.

been taken at all stations, but in particular it seems to be common at some distance from land, as is shown by the sections from off the shore, and this agrees very well with the fact that the species is rare within the East Greenland fjords. In the more central parts of the Danmarksstræde, at any rate south of about 66° N. it has everywhere been found to be of common occurrence.

Geographical distribution. As appears from the above, *Microsetella norvegica* is a rather pronounced oceanic form which principally belongs in the upper water layers. It is otherwise very widely distributed in the Atlantic and adjoining seas and penetrates far north in purely arctic areas. In West Greenland waters it has thus been met with as far north as about 76° N. lat. (JESPERSEN 1923), and between East Greenland and Spitsbergen it has been identified in 81° N. lat. approx. (FARRAN 1936).

Propagation. Many egg-bearing females have been found at several of the "Dana" stations in the Danmarksstræde and along the east coast of Greenland, and so it is beyond a doubt that the species breeds in these waters. Egg-bearing females have been met with in the months of July and August.

Harpacticus uniremis Krøyer.

Harpacticus uniremis Krøyer 1845, p. 43; Sars 1911, p. 51, pl. XXIX.

Material. This species has been met with in rather great numbers along the coast of East Greenland: $^{20}/_{7}$ 1935, at Kap Tordenskjold (61°30′ N., 42°10′ W.) 2 ♂♂, 1 ♀, 4 couples in copulation; $^{28}/_{7}$ 1932, in Ravns Fjord (68°30′ N.—28°15′ W.) 9 ♂♂, 1 ♀, 3 couples in copulation, and $^{14}/_{7}$ 1932, in Barclay Bugt (69°15′ N.—24°50′ W.) 45 ♂♂, 1 ♀, 8 juv. (K. Lang det.). There is the following noticeable fact that among the specimens, which were all taken in surface hauls, the males by far predominate in number.

Geographical distribution. The species surely occurs in most arctic regions and extends so far south along the coasts of western Europe as to pass right down into the Mediterranean. On the American side it has been met with as far down as Woods Hole. It was formerly known from East Greenland, being identified at Clavering Ø (Lang 1936) by the Swedish expedition to East Greenland, 1899.

Harpacticus superflexus Willey.

Harpacticus superflexus Willey 1920, p. 25, figs. 39—46.

Material. A single specimen (♀) was taken at the mouth of Scoresby Sund Fjord, 1933, at St. 142 (W. Klie det.).

Geographical distribution. Previously only known from waters in arctic Canada (Willey op. cit.), the Kara Sea (Jashnov 1927) and the White Sea (Bogorov 1932).

Idyaea furcata (Baird).

Canthocamptus furcatus Baird 1850, p. 210, pls. XXV & XXX.
Idyæa furcata Sars 1911, p. 88, pls. LI—LII.

Material. This species is evidently of common occurrence along the coast of East Greenland. It is to be found in the following localities, from south towards north: Kap Tordenskjold (61°30′ N.) $^{20}/_{7}$ 1935, 2 ♀♀; Angmagssalik (65°30′ N. lat.) $^{8}/_{9}$ 1932, 1 ♀ with ovisacs; Ravns Fjord (about 68°30′ N.) $^{28}/_{7}$ 1932, 2 ♀♀; Barclay Bugt (69°15′ N.) $^{14}/_{7}$ 1932, 2 ♀♀, and at the mouth of Scoresby Sund Fjord $^{29}/_{6}$ 1933, 1 ♀, and $^{14}/_{8}$ 1933, 3 ♀♀ (K. Lang det.). Further, a few juvenile specimens of the genus *Idyaea* have been found in Kejser Franz Joseph Fjord (St. 29) and in Scoresby Sund Fjord (St. 142), but it has been impossible to determine them as to species.

Geographical distribution. The species which is very widely distributed has previously been met with in many localities in arctic waters.

Idyaea gracilis Th. Scott.

Idyaea gracilis Th. Scott 1894, p. 171, pl. IV; Karl Lang 1936, p. 17, fig. 20.

Material. This species is only represented in the present material from a single locality along the coast of East Greenland, 2 ♀♀ having been caught in a horizontal haul in low water at the Scoresbysund settlement, $^{14}/_{8}$ 1933 (K. LANG det.).

Geographical distribution. This copepod which is previously known from Scoresby Sund Fjord (K. LANG op. cit.) is rather widely distributed in arctic marine areas, but is otherwise found towards south along the European coasts of the Atlantic as far as France, and in the western part of the Atlantic it is recorded from the Bermudas.

Parathalestris Jacksoni (T. Scott).

Thalestris Jacksoni T. Scott 1898, p. 109, pl. 8.
Parathalestris Jacksoni Sars 1911, p. 114, pl. LXIX.

Material. In Barclay Bugt, 69°15′ N., 24°50′ W. a few specimens (3 ♂♂, 3 juv.) of this species were taken in a surface haul, $^{14}/_{7}$ 1932. (K. LANG det.)

Geographical distribution. The chief occurrence of this species is undoubtedly in the arctic regions, where it has been identified in several localities, but it has also been identified as far south as the south coast of Norway. The species is not previously known from East Greenland, but has been identified at Spitsbergen (KARL LANG 1936).

Halithalestris Croni (Krøyer).

Harpacticus Croni Krøyer 1845, pl. 43, fig. 3.
Thalestris serrulata Brady 1880, p. 133, pl. 59.
Halithalestris Croni Sars 1911, p. 118, pl. LXXII.

Material. This rather pronouncedly pelagic Harpacticid has only been identified at a single station in the East Greenland waters proper, *viz.* at the "Dana" St. 4227, $^{17}/_{7}$ 1931, which is situated in 64°45′ N., 36°30′ W., south of Angmagssalik. At this station a female bearing egg sacs has been identified. The specimen was taken in a $^{1}/_{2}$ m stramin net which was hauled near the surface. From the western part of the Danmarksstræde the species has besides been found at a couple of other "Dana" stations, *viz.* St. 4234 and St. 4235, both $^{19}/_{7}$ 1931, (see the chart fig. 2 p. 5) where it was also taken in surface hauls.

Geographical distribution. This species must rather be characterized as an Atlantic form, though it also occurs in arctic areas. It is thus of common occurrence at the north coast of Iceland and has

been met with at Spitsbergen (Th. Scott 1903). In West Greenland waters it has been identified as far north as in Melville Bugt (74°55′ N., 62°45′ W.) (Jespersen 1923).

Dactylopusia glacialis Sars.

Dactylopusia glacialis Sars 1909, Crust. Rep. 2nd Fram Expedition. No. 18.

Material. 1 individual (♀) of this species bearing an egg sac has been identified at the mouth of Scoresby Sund, $^{14}/_{8}$ 1933 (K. Lang det.); it was taken in a horizontal haul in shallow water.

Geographical distribution. The species, which is new to Greenland, is previously only known from pronouncedly arctic areas, *viz.* at Karl XII's Ø, Spitsbergen (Lang 1936) and from north of Grinnell Land (Sars 1909).

Amenophia peltata Boeck.

Amenophia peltata Boeck 1864, p. 269; Sars 1911, p. 136 and p. 376, pls. LXXXIII—LXXXIV.

Material. At a couple of stations along the coast of East Greenland individuals of this species (K. Lang det.) have been taken, *viz.* 2 ♂♂ 15 ♀♀ $^{29}/_{6}$ 1933, at Kap Hope at the mouth of Scoresby Sund Fjord, and 1 ♂ $^{6}/_{7}$ 1935 at Karra (about 62° N., 41°30′ W.). In the former locality, where the species was indubitably of frequent occurrence, the specimens were taken in a dredge, in the latter in vertical hauls from 25—0 m.

Geographical distribution. Besides at the coasts of the North Sea, Skagerak and Øresund the species seems, before this find, only to be on record from a single locality in the arctic areas, *viz.* north of Grinnell Land, where it has been found by the 2nd "Fram" Expedition (Sars 1909).

Amphiascus nasutus (Boeck).

Dactylopus Strömii var. *arcticus* T. Scott 1898.
Amphiascus nasutus Sars 1911, p. 153, pl. XCV; Lang 1936, p. 21, figs. 21—22.

Material. This species seems to be of rather common occurrence at Angmagssalik. In a surface haul $^{8}/_{9}$ 1932, no less than 12 ♀♀, 2 ♂♂ and 1 juv. have been taken (K. Lang det.).

Geographical distribution. This is the first time that the species has been identified on the coast of East Greenland, but as it is widely spread in arctic areas as e. g. at Spitsbergen, Grinnell Land and Alaska, it is not to be wondered at that it is also met with off East Greenland. Otherwise it is a species which has also been found in several localities in more southerly latitudes.

Danielssenia Stefanssoni Willey.

Danielssenia Stefanssoni Willey 1920, pp. 39—42, figs. 60—67.

Material. In Barclay Bugt, 69°15′ N., 24°50′ W. a few individuals (2 ♂♂, 2 ♀♀) of this species have been taken in a surface haul (KARL LANG det.).

Geographical distribution. As far as is known to the author, this species is hitherto only recorded from Dolphin and Union Strait in arctic Canada.

Oithona atlantica Farran.

?*Oithona spinirostris* Claus 1863, p. 105, pl. XI.
Oithona atlantica Farran 1908, p. 500; Rosendorn 1917, p. 12, fig. 2.

Material. The available material of this species is sparse, both from the two fjords of East Greenland, where more thorough investigations have been made, and from the western part of the Danmarksstræde.

As appears from Table 23, this species has everywhere in Kejser Franz Joseph Fjord and Scoresby Sund Fjord been met with in sparse numbers, and has practically been taken in all the depths where hauls have been made.

Table 23. *Oithona atlantica.* Occurrence in various hauls in Kejser Franz Joseph Fjord and Scoresby Sund Fjord.

	Kejser Franz Joseph Fjord					Scoresby Sund Fjord	
St:	107	110	116	121	129	328	333
100—0 m	r	r	rr	r	—	..	..
200—0 -	..	..	..	..	..	rr	r
50 m.w.....	..	..	..	..	..	—	..
200 —	..	..	..	..	—	..	—
300 —	rr	—	rr	..	r	..	..
400 —	..	rr	..	..	..	..	..
500 —	..	..	..	..	rr	..	..
700 —	—	..	..	..	..	..	..
800 —	..	..	..	rr	..	..	..

Besides off Kap Stephensen (68°23′ N., 28°33′ W.) where a single specimen was taken $^{22}/_{7}$ 1932, in a surface haul, the species has been identified in the western part of the Danmarksstræde at the following "Dana" stations: 1931, St. 4223; 1932, Sts. 4445 and 4447; 1933, Sts. 4665, 4674, 4675, 4680 and 4685. It has everywhere been taken in vertical

hauls at the surface, but always only in very few specimens. At the "Dana" station 2436, $^{25}/_{7}$ 1925, which is situated off Kap Herluf Trolle in 61°13′ N., 40°57′ W. the species, on the other hand, has been caught in rather considerable numbers in hauls with 600 and 1000 m.w.

Geographical distribution. The species must presumably rather be characterized as an Atlantic form, which in several localities extends into arctic areas. Whereas in the waters east of Greenland it has been identified as far north as north of Spitsbergen (Farran 1936), it has not until now been found farther north in West Greenland waters than the Davis Stræde (Jespersen 1934).

Oithona similis Claus.

Oithona helgolandica Claus 1863, p. 105, pl. XI.
— *similis* Claus 1866, p. 14; Sars 1918, p. 8 and 207, pl. III.

Material. This species is one of the most frequently occurring copepods in the East Greenland fjords. It has been caught in every single haul from the uppermost 100 m, both in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas and rather frequently also in deeper hauls, as a rule in considerably smaller numbers than nearer the surface; there seems no doubt that, at any rate an essential part of the specimens caught in hauls with greater lengths of wire have been fished in the upper water layers, while the nets were being hauled in. In the Danmarksstræde, where in 1931—33 vertical hauls were taken by the "Dana" from 25 m and 50 m to the surface, this species has also been identified in practically all hauls and often in considerable numbers; it has also been identified in all other hauls along the coast of East Greenland.

Quantitative distribution. In the two East Greenland fjords where more detailed investigations have been carried out, the species has especially been found in great numbers in vertical hauls from 100 and 200 m to the surface. In these hauls *Oithona similis* on an average amounts to about 11 per cent of the total number of copepods, whereas in horizontal hauls with 300—800 m.w. it only amounts to 1.4 per cent, which shows that the species principally belongs in the upper water layers.

In order to get an impression of the quantitative distribution in the various parts of the two East Greenland fjord systems, we will consider in details the quantities in which the species was caught at the various stations, where vertical hauls were made with Hensen net from 100 m to the surface. The approximate numbers are as follows:

Table 24. *Oithona similis.* Number of individuals taken in vertical hauls (100—0 m) with Hensen net.

	Kejser Franz Joseph Fjord													Scoresby Sund Fjord			
St:	95	97	98	101	102	103	107	110	114	115	116	117	121	141	142	207	243
No. of specimens..	10	140	120	60	290	440	460	2200	60	10	160	70	820	60	290	120	10

The various quantities are indicated on the chart Fig. 33, from which it appears that in the Kejser Franz Joseph Fjord area the greatest quantities of this species occur in the central parts of the fjord system, whereas the numbers decrease towards the interior parts of the fjords,

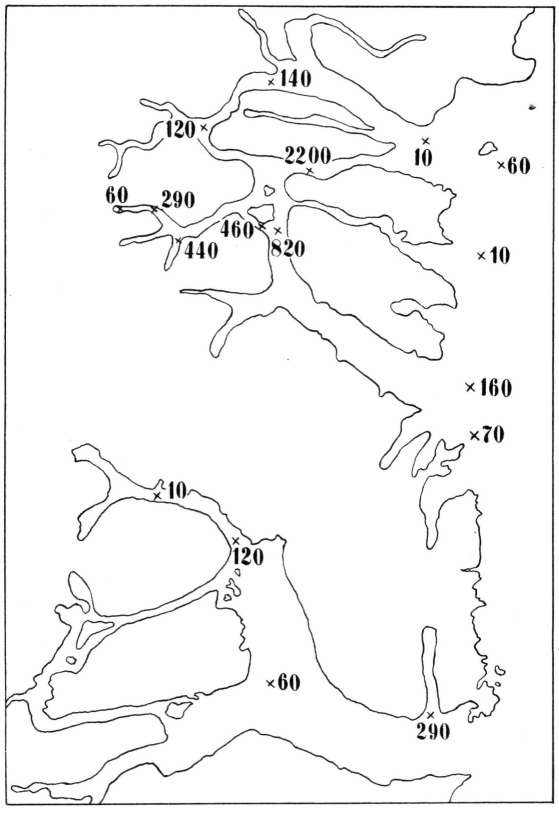

Fig. 33. *Oithona similis.* Numbers taken in vertical hauls of 100—0 m in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas.

being also relatively small in the waters outside the fjord system proper. In Scoresby Sund Fjord this is not quite so pronounced, but it is nevertheless beyond a doubt that the number is small in the interior of Nordvest Fjord.

As to the vertical distribution of the species throughout the year see USSING (1938, p. 27).

Geographical distribution. This species is widely distributed in great parts of the northern Atlantic and adjoining waters as also along the coasts of Europe and America, and it further penetrates far into arctic areas, being thus previously known from East Greenland waters and the waters round Spitsbergen.

Propagation. In Kejser Franz Joseph Fjord and Scoresby Sund Fjord only a relatively small number of egg-bearing females have been found in the months of July and August, but exclusively in hauls from the upper water layers. In other localities along the coast of East Greenland egg-bearing females have further been found as late as the first ten days of September.

USSING (1938) considers it probable that spawning takes place at all seasons within the Kejser Franz Joseph Fjord area, egg-bearing females having been identified throughout the year.

Finally, on the investigations in 1931—33 across the Danmarksstræde and along the southeastern coast of East Greenland the "Dana" in July and August found a great number of females bearing egg sacs, which proves beyond a doubt that the spawning of *Oithona similis* in these northern waters takes place in the summer and possibly further on in the autumn.

Oncaea borealis G. O. Sars.

Oncæa conifera Sars 1900, p. 113, pl. 32.
— *borealis* Sars 1918, p. 191, pl. CVIII.

Material. This species has been identified in various hauls both from Kejser Franz Joseph and Scoresby Sund Fjord, but everywhere in comparatively small quantities. Besides having been identified in other collections from more southerly latitudes near the coast of East Greenland, the "Dana" on its investigations in the Danmarksstræde found it to be of common occurrence; here it was taken in vertical hauls from 50 m to the surface.

Quantitative distribution. As the species was everywhere taken in comparatively small numbers in the two East Greenland fjords, where investigations were carried on, *viz.* Kejser Franz Joseph Fjord and Scoresby Sund Fjord, it is difficult, on the strength of the material at hand, to arrive at a result as regards the quantitative distribution in the various parts of the two fjord systems. As regards the vertical distribution it is, however, clear that it is a species which almost exclusively lives in the uppermost water layers, seeing that it has only been caught in few hauls from greater depths and then always in sparse

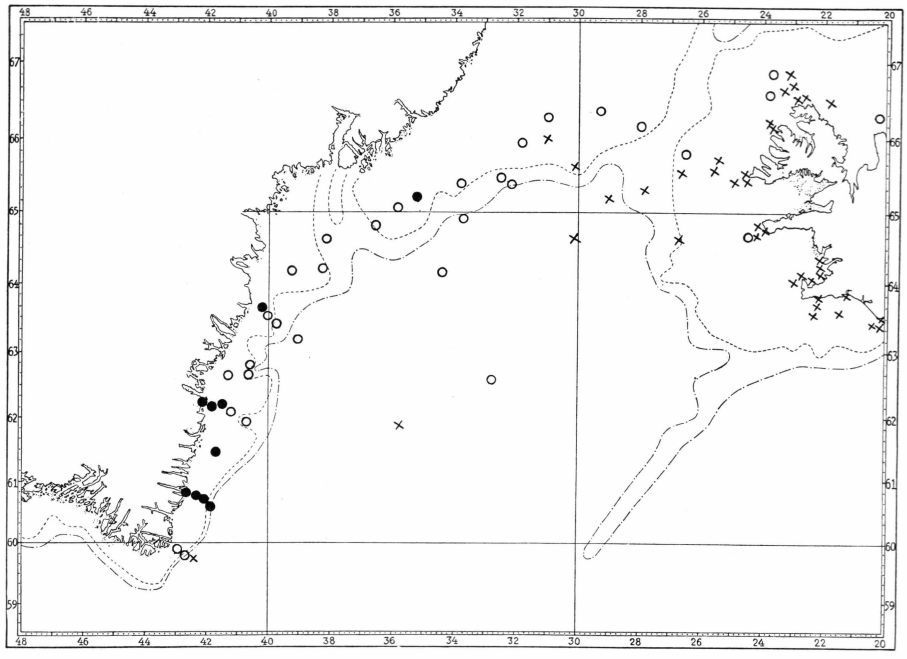

Fig. 34. *Oncaea borealis*. The occurrence of the species at the "Dana" stations in 1932 and 1933. ● of common occurrence (+). o few in numbers (rr — r). × negative stations.

numbers, the individuals having presumably been taken in the upper water layers, while the net was being hauled in.

As regards the frequency of the species throughout the year in the Kejser Franz Joseph Fjord area USSING (1938, p. 29) proves it to have a pronounced maximum occurrence during the months of July and August.

On the "Dana"s cruise in the Danmarksstræde 1931, where vertical hauls of 25—0 m were carried out, this species was only taken in extremely few localities, and in so few specimens that the material hardly gives any representative picture of the distribution, whereas on the cruises 1932 and 1933, where vertical hauls of 50—0 m were made, it was caught in rather considerable numbers. Therefore, we will only consider the material from the two latter years, and the chart Fig. 34 gives a picture of the distribution of the species with signatures indicating a more or less frequent occurrence.

As appears from the chart, the species has been identified in greatest numbers near the coast of East Greenland. In the more central parts of the Danmarksstræde it has been met with at many stations, but always in rather sparse numbers, and nearer the coast of Iceland it has only been found at relatively few stations, and chiefly only at a considerable distance from the shore.

Geographical distribution. The chief distribution of this species is undoubtedly in the colder, partly purely arctic areas. On the Duc d'Orleans Expedition, 1905, it was identified at several stations in the waters between East Greenland and Spitsbergen (DAMAS and KOEFOED 1909); the "Nautilus" Expedition, 1931, found it of common occurrence north of Spitsbergen (FARRAN 1936), so it is not to be wondered at that it is more particularly to be met with in the south-going Polar current along East Greenland.

III. QUANTITY OF COPEPODS AND ITS COMPOSITION IN VARIOUS PARTS OF THE KEJSER FRANZ JOSEPH FJORD AND SCORESBY SUND FJORD AREAS

The material which best illustrates the quantity of copepods in the various parts of the fjord areas and also in the waters outside these, are the plankton samples collected with Hensen net in vertical hauls from 100 m depth to the surface. All the samples collected in greater depths have been taken by means of horizontal hauls with open nets, and as the fishing has gone on, also while the nets were being hauled in, they do not with absolute exactitude express the quantities of copepods in the respective depths. Owing to the complicated system of the fjord areas, the varying current conditions surely often exercise a great influence on the distribution of the quantity of copepods and cause great variations in the latter. Still, it seems possible to deduce certain main features from the material at hand, which in the following will be divided into three sections according to the various depths in which fishing has been undertaken, *viz.* the upper water layers (vertical hauls 100—0 m), intermediary water layers (horizontal hauls with 200—400 m.w.) and deeper water layers (horizontal hauls with 500—800 m.w.).

Quantity of Copepods in the upper Water Layers (Hensen net 100—0 m)

On the chart Fig. 35 the quantity of copepods is indicated at the various stations where vertical hauls have been made with Hensen net from 100 m to the surface. There are very considerable variations in the quantity of copepods at the different stations, but it appears rather clearly from the chart that the greatest numbers in the upper water layers of the Kejser Franz Joseph Fjord area are to be found in the inner parts of the system of fjords. In the interior of Kempe Fjord vertical hauls have thus been taken with Hensen net at three stations

(Sts. 101—103). The three hauls yield 11,810, 9820 and 14,700 individuals, respectively, the average number of copepods being 12,110. If we compare this with the result of hauls at stations outside the fjord area proper, *viz.* Sts. 114—117, the number is considerably smaller, amounting to 1550, 690, 2000 and 750 individuals, respectively, which

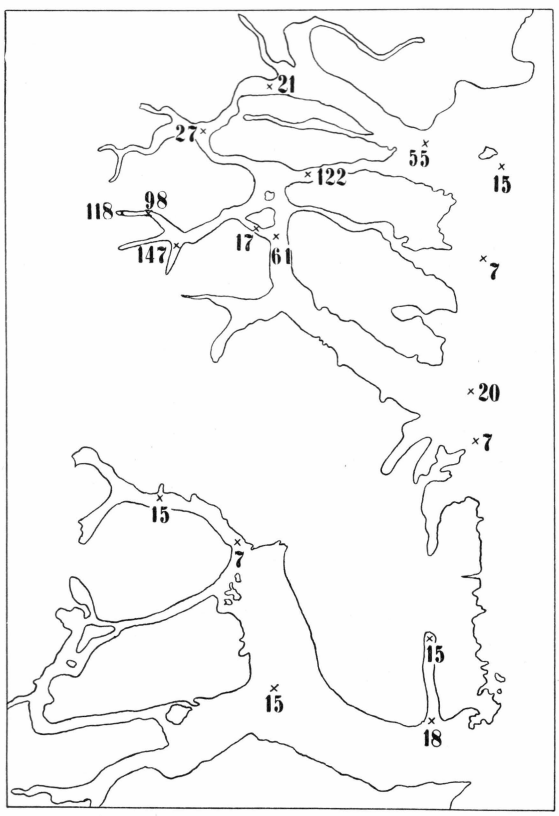

Fig. 35. The number of copepods in hundreds in the upper water layers in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas. Hensen net 100—0 m.

yields a mean figure of 1247 individuals. It thus appears that there are 9—10 times as many copepods in the upper water layers in the interior parts of the Kejser Franz Joseph Fjord area as in the waters outside this fjord system.

In Scoresby Sund Fjord there are only 5 stations in all, where hauls have been made with Hensen net from 100—0 m. As appears from the chart, Fig. 35, there do not seem to be proven differences in the quantity of copepods in the upper layers of the various parts of this fjord area. On the other hand, it is striking that the quantity of copepods, taken as a whole, is much smaller in the surface layers of Scoresby Sund Fjord than in the Kejser Franz Joseph Fjord area.

When the quantity of copepods is so much larger in the upper water layers in the interior parts of the Kejser Franz Joseph Fjord system than outside the fjord area, this is principally due to the fact that a single copepod, *viz. Pseudocalanus minutus* predominates entirely in the inner waters. Table 25 gives an impression of the relative quantity of the various copepods at the stations mentioned above, that is in the interior parts of the Kejser Franz Joseph Fjord area (Sts. 101—103) and outside the fjord area proper (Sts. 114—117).

Table 25. Relative quantity of the various copepods in the upper water layers in the interior parts of the Kejser Franz Joseph Fjord area and outside the latter (Hensen net 100—0 m).

	Farthest into the fjord				Outside the fjord area				
	St.101	St.102	St.103	%	St.114	St.115	St.116	St.117	%
Calanus finmarchicus	1480	880	370	7.5	810	120	320	260	30.3
— hyperboreus	350	150	880	3.8	330	50	60	30	9.4
— juv.	240	250	150	1.8	280	380	1,260	340	45.3
Pseudocalanus minutus	8260	6580	12,130	74.2	50	110	150	50	7.2
Microcalanus pygmæus	650	1320	590	7.0	10	10	20	—	0.8
Spinocalanus abyssalis	60	—	—	0.2	—	—	—	—	—
Metridia longa	710	200	70	2.7	—	—	30	—	0.5
Oithona similis	60	290	440	2.2	60	10	160	60	6.0
Oncaea borealis	—	50	—	0.1	—	—	—	—	—
Copepod Nauplii	—	100	70	0.5	10	10	—	10	0.5
Total	11,810	9820	14,700	100.0	1550	690	2000	750	100.0

It is noticeable that whereas the number of *Pseudocalanus minutus* only amounts to 7.2 per cent of the total number of copepods outside the fjord area, this copepod makes no less than 74.2 per cent of the total number of copepods taken at stations in the interior part of the fjord system, being thus by far the predominant species in the inner waters. In the waters off the coast it is, on the other hand, juvenile stages of calanids which make the dominating number of copepods (45.3 per cent), calanids on the whole playing a far greater part here than in the interior parts of the fjord. The relative quantities of calanids in the outer and inner waters are thus 85.0 per cent and 13.1 per cent, respectively.

If, after this, we investigate the occurrence of the various copepods in the inner and outer parts of the Scoresby Sund Fjord area, it will appear that though there are far fewer copepods in the surface layers than

in the Kejser Franz Joseph Fjord area, conditions here in several respects show a distinct correspondance with conditions in Kejser Franz Joseph Fjord. Table 26 gives the relative quantity of the various copepods at stations in the interior parts (Sts. 207, 243 and 299) and near the mouth of Scoresby Sund Fjord (Sts. 141—142) respectively.

Table 26. Relative quantity of the various copepods in the upper water layers in the interior parts and near the mouth of Scoresby Sund Fjord (Hensen net 100—0 m).

	Interior parts of the fjord				Near the mouth of the fjord		
	St.207	St.243	St.299	%	St.141	St.142	%
Calanus finmarchicus	90	810	260	31.3	340	380	21.8
— hyperboreus	20	230	60	8.4	5	20	0.8
— juv.	30	10	230	7.3	620	590	36.7
Pseudocalanus minutus	400	260	330	26.8	50	80	3.9
Microcalanus pygmæus	20	—	70	2.4	5	5	0.3
Scolecithricella minor	—	20	—	0.5	—	—	—
Metridia longa	10	160	100	7.3	20	—	0.6
Oithona similis	120	5	310	11.8	60	300	10.9
Harpacticidae	—	—	—	—	—	5	0.2
Copepod Nauplii	10	5	140	4.2	400	420	24.8
Total...	700	1500	1500	100.0	1500	1800	100.0

As in the interior parts of the Kejser Franz Joseph Fjord area, *Pseudocalanus minutus* plays a considerable part (26.8 per cent) in the interior of Scoresby Sund Fjord, even though it here appears in relatively fewer numbers. At the two stations near the mouth of the fjord its relative quantity is much less, being here only 3.9 per cent of the total number of copepods. On this point conditions thus agree very well with those in the Kejser Franz Joseph Fjord area, and this also applies to the relative quantity of young calanids, which likewise occur in greatest numbers in the outer waters of the Scoresby Sund Fjord. In the interior and outer parts of the Kejser Franz Joseph Fjord area they thus amount to 1.8 and 45.3 per cent, respectively, and for the corresponding parts of Scoresby Sund Fjord to 7.3 and 36.7 per cent. A further point of interest is that copepod nauplii in Scoresby Sund Fjord, where upon the whole they occur in much greater numbers than in the Kejser Franz Joseph Fjord area, are relatively far more numerous at the stations near the mouth than in the inner waters. In the two different areas the copepod nauplii make 24.8 and 4.2 per cent of the total number of copepods.

Quantity of Copepods in intermediary Water Layers (1 m stramin net 200—400 m. w.).

The chart Fig. 36 represents the number of copepods in the intermediary water layers in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas. We are here dealing with the number of copepods caught with 1 m stramin net in hauls with 200—400 m.w., calculated per 15 minutes' haul.

As in the upper water layers so also in the intermediary water layers both in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas, the greatest numbers of copepods occur in the interior and more closed areas of the two fjord systems. Thus, hauls of more than 10,000 individuals have been made in the Kejser Franz Joseph Fjord area, in the interior part of Moskusokse Fjord (St. 23: 11,650 specimens), at the innermost station in Dusen Fjord (St. 84: 17,700 specimens), at the innermost station in Kempe Fjord (St. 101: 20,400 specimens) and at a couple of stations round Ella Ø (St. 126: 21,600 specimens and St. 129: 16,430 specimens). Outside the fjord area proper the numbers in question are very much smaller. At the three stations, Nos. 114, 116 and 117 the numbers amount to 1520, 1950 and 3950 specimens, respectively. It thus seems evident that in many of the interior waters of the Kejser Franz Joseph Fjord area, not only in the surface layers but also in depths corresponding to hauls with 200—400 m.w., the quantity of copepods is far greater than in the open water outside the coast.

In the Scoresby Sund Fjord area the distribution of the quantity of copepods is very nearly the same, and this appears still more clearly than in the Kejser Franz Joseph Fjord area, where the many branches of the fjord system undoubtedly contribute to making conditions more complicated. At St. 11 at the mouth of Scoresby Sund Fjord 4040 copepods were taken in a haul with 200 m.w.; at St. 333, which is situated in a section between Kap Leslie and Kap Stevenson, the number is 16,000; at St. 327, which is situated at Røde Ø in Røde Fjord, 15,000 individuals, and at St. 243, which is situated in Nordvest Fjord, the number is as high as 25,000 specimens. It thus appears that the quantity of copepods in Scoresby Sund Fjord increases greatly from the mouth of the fjord and into the interior parts of the fjord area.

In water layers corresponding to hauls with 200—400 m.w. the quantity of copepods both in the Kejser Franz Joseph Fjord and the Scoresby Sund Fjord areas, is many times greater in the interior and more closed parts than in the outer parts of the fjords. As distinguished from the upper water layers there are no proven differences in the quantity of copepods in the inter-

mediary water layers of the Scoresby Sund Fjord and the Kejser Franz Joseph Fjord areas.

When comparing the composition of the quantity of copepods in the interior parts of the Kejser Franz Joseph Fjord area and the waters outside the latter, the material used is that from the stations mentioned

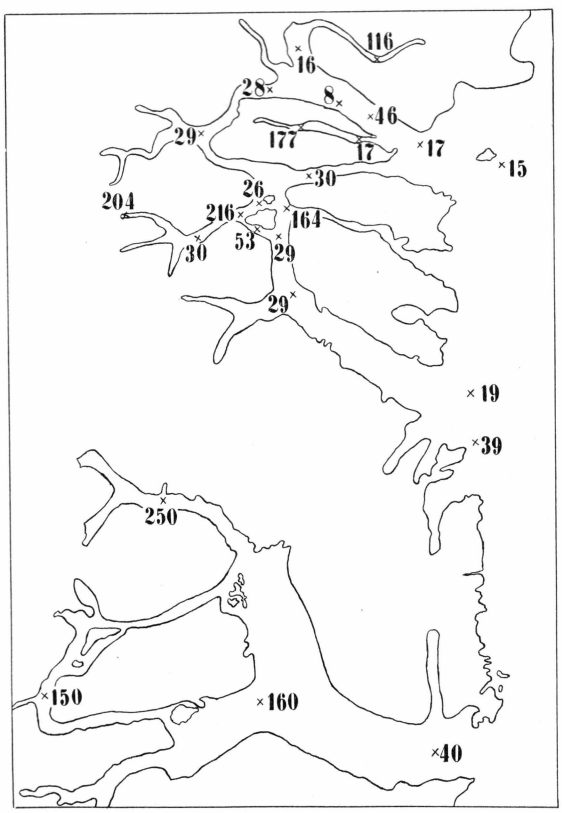

Fig. 36. The number of copepods in hundreds in intermediary water layers in the Kejser Franz Joseph Fjord and Scoresby Sund Fjord areas. 1 m stramin net 200—400 m.w.

above, *viz.* Sts. 23, 84, 101, 126 and 129 which are situated in the interior and more closed parts of the fjord system, and Sts. 114, 116 and 117 which are situated in the open waters outside the fjord area.

Table 27 indicates the number of individuals of the different copepod species at the various stations, and also the relative quantities of the different copepods at stations in the interior parts of the Kejser Franz Joseph Fjord area and in the open waters outside the coast.

Calanids by far predominate in numbers, both in the interior of the fjord and in the open waters, amounting to 83.9 and 95.6 per cent respectively of the total number of copepods. Generally speaking, the

Table 27. Relative quantity of the various copepods in the intermediary water layers of the interior parts of the Kejser Franz Joseph Fjord area and outside the latter (200—400 m.w.).

	Farthest into the fjord						Outside the fjord area			
	St. 23	St. 84	St.101	St.126	St.129	%	St.114	St.116	St.117	%
Calanus finmarchicus .	7570	10,880	2450	10,370	7160	43.8	580	1,180	2210	53.5
— hyperboreus .	1870	6,730	5920	10,260	7330	36.6	910	520	1580	40.6
— juv.	1100	—	—	430	1570	3.5	30	60	20	1.5
Pseudocalanus minutus	—	—	—	110	60	0.2	—	—	—	—
Microcalanus pygmæus	—	—	—	—	—	—	—	20	—	0.3
Metridia longa.....	1110	90	12,030	430	255	15.8	—	160	140	4.0
Oithona similis	—	—	—	—	55	0.1	—	10	—	0.1
Total...	11,650	17,700	20,400	21,600	16,430	100.0	1520	1950	3950	100.0

composition of the quantity of copepods offers no great difference, as will appear from a survey of the relative quantities; still, it is worth noticing that the relative number of *Metridia longa* is considerably greater in the interior of the fjord than outside the latter, *viz.* 15.8 per cent as against 4.0 per cent. In this connection it is, however, worthy of notice that the relatively great number of *Metridia* in the interior fjord system is essentially due to the fact that at a single station (St.101), which is situated in the interior part of Kempe Fjord, the species has been identified in strikingly great numbers. At this station *Metridia longa* makes no less than about 59 per cent of the total number of copepods, an immense frequency which is undoubtedly due to special conditions.

Table 28 shows the conditions in Scoresby Sund Fjord, where hauls have been made with 200 m.w. at three stations in the interior parts of the fjord and at a single station near its mouth.

Even though the quantities of copepods are far greater in the interior parts of the fjord than at the mouth of the latter, there are no essential differences in the composition of the quantity of copepods within the two areas. At the mouth of the fjord *Calanus finmarchicus* occurs in greater quantities than *C. hyperboreus*, as was also the case both in the interior of the Franz Joseph Fjord area and outside the latter, but in the interior parts of Scoresby Sund Fjord *C. hyperboreus*, on the other hand, seems to be the dominating species. At the innermost station (St. 243) which is situated in Nordvest Fjord, *C. hyperboreus*, roughly speaking, makes 80 per cent and *C. finmarchicus* 20 per cent of the total number of copepods, and so there is no doubt that the former species is by far the more numerous in this part of the Scoresby Sund area. In this connection it should be borne in mind that *Calanus*

Table 28. Relative quantity of the various copepods in the intermediary water layers of the interior parts and near the mouth of Scoresby Sund Fjord (200 m.w.).

	Interior parts of the fjord				Near the mouth of the fjord	
	St. 243	St. 327	St. 333	%	St. 11	%
Calanus finmarchicus.....	4530	8620	7770	37.3	2030	50.2
— hyperboreus	20,420	4420	8180	59.0	1830	45.3
Microcalanus pygmæus	—	—	50	0.1	—	—
Pareuchaeta juv.	—	—	—	—	20	0.5
Metridia longa.....	50	1930	—	3.5	160	4.0
Oithona similis	—	30	—	0.1	—	—
	25,000	15,000	16,000	100.0	4040	100.0

hyperboreus was also the most numerous of the two copepods in the innermost part of Kempe Fjord, St. 101 (see Table 27).

Quantity of Copepods in the deeper Water Layers (1 m stramin net 500—800 m. w.).

When investigating the quantity of copepods in the deepest water layers where hauls have been made (500—800 m.w.), it will be seen, as also appears from the chart Fig. 37, that as contrasted with the upper and intermediary water layers the deepest water layers in the Kejser Franz Joseph Fjord area contain relatively more copepods outside the coast than in the interior parts of the fjord system. The innermost stations in the fjord area are thus St. 58 in the interior of Is Fjord, St. 48 off the mouth of Kjerulf Fjord and Sts. 101 and 102 in the interior of Kempe Fjord. Stations outside the fjord area are St. 95, St. 116 and St. 118. The quantities of copepods at the respective stations appear from the following summary:

Farthest into the fjord area		Outside the fjord area	
St. 58	650 specimens	St. 95	4000 specimens
- 48	1290 —	- 116	3650 —
- 101	1760 —	- 118	1410 —
- 102	990 —		

When calculating the mean figures of the comparatively few hauls the result is that there are about 1172 specimens per 15 minutes' haul in the interior parts of the fjord area, whereas there are about 3020

specimens outside the coast. In the deep water layers corresponding to hauls with 500—800 m.w. there are thus about three times as many copepods outside the coast as in the innermost parts of the fjord system.

In this connection it should, however, be borne in mind that whereas there are relatively small quantities of copepods in the interior parts

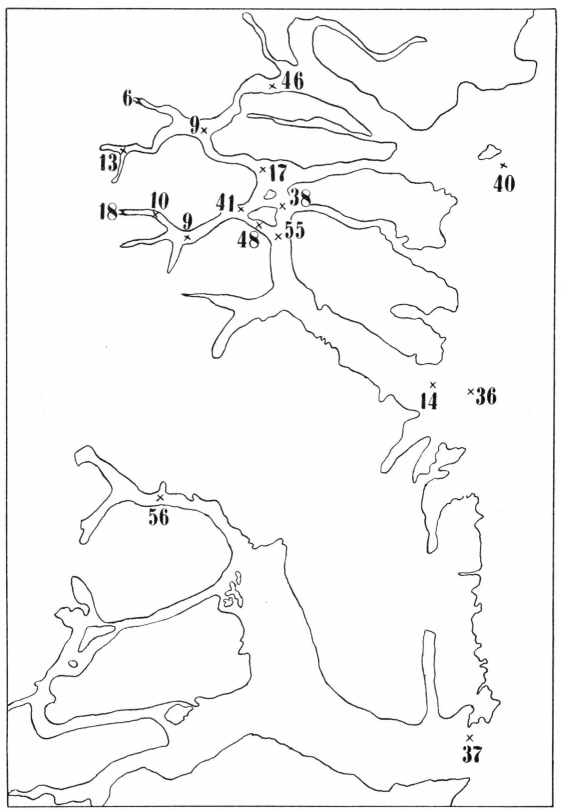

Fig. 37. Number of copepods in hundreds in the deeper water layers in the Kejser Franz Joseph and Scoresby Sund Fjord areas. (1 m stramin net 500—800 m.w.)

of the Kejser Franz Joseph area, the number of copepods in the waters round Ella Ø already seems considerably greater. At 4 stations in the latter water we have the following number: St. 107: 4790 specimens; St. 121: 5520; St. 126: 4100 and St. 129: 3800 specimens, which yields a mean figure of about 4500 specimens per 15 minutes' haul, or about four times as many copepods as in the interior parts of the Kejser Franz Joseph Fjord area.

In the Scoresby Sund Fjord area only a couple of hauls have been made in the deeper water layers. Thus a haul with 600 m.w. was taken in the interior parts, at St. 243 (1933), which is situated in Nordvest

Table 29. Relative quantity of the various copepods in the deeper water layers of various parts of the Kejser Franz Joseph Fjord area and outside the latter (500—800 m.w.).

	Farthest into the fjord			The waters round Ella Ø					Outside the fjord area		
	St.58	St.101	%	St.107	St.121	St.126	St.129	%	St.95	St.118	%
Calanus finmarchicus ...	450	670	46.5	720	2590	1850	1580	37.0	1740	790	46.8
— hyperboreus....	70	250	13.3	3620	2440	1640	1140	48.6	1580	480	38.1
— juv.....	—	—	—	50	80	40	90	1.4	80	10	1.6
Pseudocalanus minutus .	5	—	0.2	20	—	20	20	0.3	—	—	—
Microcalanus pygmæus..	5	—	0.2	—	—	—	—	—	—	—	—
Chiridius armatus	10	40	2.1	—	—	—	—	—	—	—	—
— obtusifrons....	30	40	2.9	—	—	—	—	—	40	—	0.7
Gaidius tenuispinus.....	—	—	—	—	—	—	—	—	20	—	0.4
Xanthocalanus sp.	—	90	3.7	—	—	—	—	—	—	—	—
Metridia longa	70	670	30.7	290	380	530	950	11.8	520	130	12.0
Heterorhabdus norvegicus	10	—	0.4	—	—	—	—	—	20	—	0.4
Oithona similis	—	—	—	90	15	20	15	0.8	—	—	—
— atlantica	—	—	—	—	15	—	5	0.1	—	—	—
	650	1760	100.0	4790	5520	4100	3800	100.0	4000	1410	100.0

Fjord, this haul yielding the relatively considerable number of 5660 copepods per 15 minutes' haul. In 1932 a haul was taken with 700 m.w. at St. 134 in the mouth of the fjord south of Kap Tobin, and this haul yielded 3700 copepods. Judging by the few hauls, water layers corresponding to hauls with 6—700 m.w. in the Scoresby Sund Fjord system thus seem to contain considerably greater numbers of copepods in the inner waters than at the mouth of the fjord.

When proceeding to examine the relative quantity of the various copepods at the different stations, we must first look at conditions in the Kejser Franz Joseph Fjord area. We divide the stations into 3 groups, according to their situation, *viz.* 1) the interior of the fjord system, 2) the waters round Ella Ø and 3) outside the fjord area. Table 29 shows the numbers and the relative quantities of the various copepods. Not all the hauls made at the above-mentioned stations in this as in the Scoresby Sund Fjord area are indicated in the table, and this is due to the fact that representative samples of the catches made have not been preserved from all hauls.

The most striking feature regarding the relative quantity of the various copepods is the fact that in the innermost parts of the fjord area *Metridia longa* occurs in comparatively great quantities (30.7 per cent), whereas the species round Ella Ø and outside the fjord area only makes 11.8 and 12.0 per cent, respectively, of the total number of cope-

Table 30. Relative quantity of the various copepods in the deeper water layers of the interior of the Scoresby Sund Fjord area and at the mouth of the fjord (600—700 m.w.).

	Farthest into the fjord		At the mouth of the fjord	
	St. 243	%	St. 134	%
Calanus finmarchicus	2190	38.8	2340	63.3
— hyperboreus	2215	39.2	1180	31.9
— juv.	—	—	90	2.4
Pseudocalanus minutus	40	0.7	—	—
Microcalanus pygmæus	20	0.4	—	—
Chiridius obtusifrons	70	1.2	—	—
Gaidius tenuispinus	10	0.2	—	—
Metridia longa	760	13.4	70	1.9
Heterorhabdus norvegicus	130	2.3	—	—
Oithona similis	190	3.4	20	0.5
Copepod Nauplii	25	0.4	—	—
	5650	100.0	3700	100.0

pods. The fact that this species in the deep water layers occurs in relatively greatest numbers in the interior parts of the fjord area corresponds entirely with the distribution of the species in the intermediary water layers (see Table 27). As appears from Table 30, very nearly the same fact seems to apply to the Scoresby Sund Fjord area.

At St. 243 which is situated in Nordvest Fjord, *Metridia longa* thus amounts to 13.4 per cent of the total number of copepods, whereas the species at the mouth of the fjord (St. 134) only amounts to 1.9 per cent.

IV. PLANKTON TABLES

The subsequent tables give a summary of the relative frequency of the occurrence of the various copepod species in the various plankton samples. In the lists will be found detailed particulars regarding the positions of the stations, with the exception of those which have been taken in the two East Greenland fjord system: Kejser Franz Joseph Fjord and Scoresby Sund Fjord. In these investigations of fjords it is not considered necessary to give the definite positions of the individual stations, as they have often only been indicated by landfalls, and here it will presumably be sufficient to refer to the chart of stations Fig. 1 (p. 4).

The material from the investigations in the two above-mentioned fjord systems will be found in tables I—VI, seeing that tables I—IV show the material which has been caught in vertical hauls with Nansen net, vertical hauls 100—0 m with Hensen net, horizontal hauls 100—300 m.w. with 1 m stramin net and horizontal hauls 400—800 m.w. with 1 m stramin net. All the hauls mentioned have been taken in 1932 in the Kejser Franz Joseph Fjord area, with the exception of St. 134 which is situated at the mouth of Scoresby Sund Fjord. The tables V—VI show the material caught in Scoresby Sund Fjord 1933, in vertical hauls with Hensen net and horizontal hauls with 1 m stramin net.

Table VII shows various plankton samples taken in 1932 along the coast of Christian IX's Land, on the distance from Barclay Bugt to Angmagssalik.

Tables VIII—XI finally give a summary of the occurrence of the various copepod species in plankton samples collected by the research ship "Dana" in the western part of the Danmarksstræde, only such stations being included as are situated west of 30° W. long. Table VIII shows a couple of plankton samples taken in 1925 at a single station off the coast of East Greenland (St. 2436), and tables IX—XI show plankton samples collected in vertical hauls in these waters in the years 1931, 1932 and 1933. The positions of the respective stations are indicated on the charts Figs. 2—3 (pp. 5—6).

Table I. Kejser Franz Joseph Fjord, July 12th—August 12th, 1932. Vertical hauls with Nansen net.

St:	3		6		9	23		29	48	58	86
m.	50-0	100-0	50-0	100-0	50-0	50-0	100-0	50-0	50-0	50-0	50-0
Calanus finmarchicus	c	cc	c	c	c	c	cc	+	cc	+	+
Calanus hyperboreus	+	c	..	rr	rr	r	r	r	rr	rr	r
Pseudocalanus minutus	r	..	r	r	r	cc	cc	cc	c	+	cc
Microcalanus pygmæus	rr	..	..	rr	rr	rr	rr	rr	+	r	rr
Metridia longa	..	..	..	rr	..	rr	rr	r	rr	r	..
Microsetella norvegica	..	rr	..	rr	..	..	..	rr	..	..	..
Idyaea sp	..	..	..	..	..	..	..	rr	..	..	..
Oithona similis	+	+	rr	r	c	+	+	c	+	rr	c
Oncaea borealis	..	rr	..	rr	r	..	rr	..	r	rr	rr

Table II. Kejser Franz Joseph Fjord, August 13th—25th, 1932. Vertical hauls with Hensen net 100—0 m.

St:	95	97	98	101	102	103	107	110	114	115	116	117	120	121	126	129
Calanus finmarchicus	cc	c	+	c	c	+	+	+	c	+	c	+	r	c	r	+
Calanus hyperboreus	c	+	r	+	r	c	r	rr	+	r	r	r	..	+	..	rr
Pseudocalanus minutus	cc	cc	cc	cc	cc	cc	cc	cc	r	+	+	r	c	cc	cc	cc
Microcalanus pygmæus	r	c	rr	c	cc	c	r	+	rr	rr	rr	..	r	+	rr	rr
Spinocalanus abyssalis	..	..	..	rr	..	..	..	..	..	..	..	..	..	..	..	..
Pareuchaeta norvegica	..	rr	..	..	..	..	..	..	..	..	rr	..	..	rr	..	..
Pareuchaeta glacialis	rr	..	rr	rr	rr	rr	rr	..	..	..	rr	..	..	..	..	..
Metridia longa	+	r	+	c	+	r	rr	rr	..	..	rr	..	rr	rr	..	rr
Acartia longiremis	..	..	..	..	..	..	..	rr	..	..	..	..	..	..	..	..
Oithona atlantica	..	..	..	..	..	..	r	r	..	..	rr	..	..	r	..	..
Oithona similis	rr	+	+	r	+	+	+	cc	r	rr	+	+	r	c	+	+
Oncaea borealis	..	rr	..	..	rr	..	..	rr	..	..	rr	..	..	..	..	..

Table III. Kejser Franz Joseph Fjord, August 3rd—25th, 1932.
Horizontal hauls with 1 m stramin net, 100—300 m.w.

St:	23	29	84	86	95	97	98	101	105	107	110	114	116	120	124		126	129	
m.w.:	200	200	200	200	300	300	300	300	300	300	300	150	300	300	100	300	200	200	300
Calanus finmarchicus....	cc	cc	cc	c	cc	cc	cc	c	cc	cc	cc	cc	cc	c	cc	cc	cc	cc	cc
Calanus hyperboreus....	c	+	c	cc	cc	c	c	c	c	c	c	cc	c	cc	c	c	cc	c	cc
Pseudocalanus minutus	..	..	..	..	rr	..	..	..	rr	rr	rr	rr	..	rr	rr	r	r	..	r
Microcalanus pygmæus	..	rr	..	..	..	..	..	..	..	..	..	rr	rr	..	..	..	..	..	..
Chiridius obtusifrons	..	..	..	..	..	..	..	..	rr	..	..	..	..	..	..	..	..	..	..
Gaidius tenuispinus	..	..	..	..	..	rr	..	..	..	..	..	..	..	..	..	..	..	..	..
Pareuchaeta norvegica	..	..	..	..	rr	..	rr	..	..	..	..	..	..	rr	..	..	..	..	rr
Pareuchaeta glacialis	r	rr	..	..	r	..	rr	+	r	r	rr	rr	r	r	rr	r	..	rr	..
Metridia longa	c	+	rr	rr	+	+	c	cc	c	+	+	rr	+	+	r	+	+	rr	+
Heterorhabdus norvegicus	..	..	..	..	..	..	..	..	..	rr	..	..	..	..	..	..	..	..	..
Acartia longiremis.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr	..	..	..	..
Oithona atlantica .	..	..	..	..	..	..	..	..	..	rr	..	..	rr	..	..	..	..	..	r
Oithona similis ...	..	rr	..	..	..	..	rr	..	..	rr	rr	..	rr	r	..	r	..	..	r
Oncaea borealis...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr	..

Table IV. Kejser Franz Joseph Fjord and Scoresby Sund Fjord, August 7th—29th, 1932. Horizontal hauls with 1 m stramin net, 400—800 m.w.

St:	58	72	94	95	97	100	101	105	107	110	117	118	121	126	129	134
m.w.:	700	400	400	700	700	800	700	700	700	400	400	500	800	650	500	700
Calanus finmarchicus..	cc	cc	c	cc	cc	c	cc	c	c	cc	cc	cc	cc	cc	cc	cc
Calanus hyperboreus ..	c	c	cc	cc	cc	cc	c	c	cc	c	cc	c	cc	cc	cc	c
Eucalanus elongatus...	..	..	..	rr	..	..	..	..	..	..	..	..	..	..	..	..
Pseudocalanus minutus.	rr	..	rr	..	rr	..	..	..	rr	rr	..	..	..	rr	rr	..
Microcalanus pygmæus.	rr	..	..	..	rr	..	..	..	..	..	..	..	..	..	..	..
Chiridius armatus.....	rr	..	..	..	..	..	rr	..	..	..	..	..	..	..	..	..
Chiridius obtusifrons ..	r	rr	..	r	..	..	r	rr	..	..	..	..	..	..	..	..
Gaidius tenuispinus ...	..	..	rr	rr	rr	..	..	rr	..	..	..	..	..	..	..	..
Pareuchaeta norvegica.	..	rr	rr	rr	rr	rr	..	rr	rr	rr	rr	..	rr	rr	rr	rr
Pareuchaeta glacialis..	r	r	r	rr	r	rr	r	r	r	rr	..	rr	r	r	rr	rr
Xanthocalanus fallax..	..	..	..	..	..	..	rr	..	..	..	..	..	..	..	..	..
Xanthocalanus borealis.	..	..	..	..	..	..	rr	..	..	..	..	..	..	..	..	..
Metridia longa.....	c	+	+	c	c	c	cc	+	+	r	r	+	+	c	cc	r
?Metridia Boecki	..	..	..	..	..	..	..	..	..	..	..	..	..	rr	..	..
Heterorhabdus norvegicus	rr	rr	..	rr	r	..	..	rr	rr	..	..	..	..	..	..	..
Oithona atlantica.....	..	..	..	..	..	..	..	..	..	rr	..	..	rr	..	rr	..
Oithona similis	..	..	..	..	..	..	..	..	r	rr	..	..	rr	rr	rr	rr
Oncaea borealis.....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	rr	..

Table V. Scoresby Sund Fjord, July 9th—August 24th, 1933. Vertical hauls with Hensen net, 100—0 m and 200—0 m.

St:	141	142	207	243	299	328	333
m:	100—0	90—0	100—0	100—0	200—0	200—0	200—0
Calanus finmarchicus	c	c	c	cc	c	c	c
Calanus hyperboreus	rr	r	r	+	+	r	r
Pseudocalanus minutus	r	+	cc	c	cc	+	+
Microcalanus pygmæus	rr	rr	r	..	+	r	r
Chiridius obtusifrons	..	..	..	..	..	rr	rr
Gaidius tenuispinus	..	..	..	..	..	..	rr
Pareuchaeta norvegica	..	..	..	..	rr	..	rr
Pareuchaeta glacialis	..	..	rr	rr	rr	rr	rr
Scolecithricella minor	..	..	..	rr	rr	rr	..
Metridia longa	rr	..	rr	+	+	+	+
Heterorhabdus norvegicus	..	..	rr	rr	..	rr	..
Harpacticus superflexus	..	rr	..	..	..	..	..
Oithona atlantica	..	..	..	..	..	rr	r
Oithona similis	r	c	+	rr	c	+	+
Oncaea borealis	..	..	..	rr	..	rr	rr

Table VI. Scoresby Sund Fjord, June 28th—August 24th, 1933. Horizontal hauls with 1 m stramin net.

St:	11	12	141	142	243		327	328	333
m.w.:	200	75	100	100	200	600	200	50	200
Calanus finmarchicus	cc	cc	cc	cc	c	cc	cc	cc	cc
Calanus hyperboreus	cc	c	+	r	cc	cc	cc	+	cc
Pseudocalanus minutus	..	..	rr	r	..	rr	..	rr	..
Microcalanus pygmæus	..	..	..	..	..	rr	..	..	rr
Chiridius obtusifrons	..	..	..	..	..	r	..	..	..
Gaidius tenuispinus	..	..	..	..	..	rr	..	..	..
Pareuchaeta norvegica	..	..	..	..	..	r	rr	..	..
Pareuchaeta glacialis	rr	..	..	..	r	r	+	rr	r
Metridia longa	r	+	rr	..	rr	c	cc	+	..
Heterorhabdus norvegicus	..	rr	..	..	..	r	rr	rr	..
Oithona similis	..	r	r	+	..	r	rr	r	..
Oncaea borealis	..	..	..	..	..	rr	..	rr	..

Table VII. The Scoresby Sund Committee's 2nd East Greenland Expedition in 1932 to Kong Christian IX's Land. Hauls with Hensen net and 1 m stramin net. July 14th—September 8th, 1932.

	Barclay Bugt	D'Aunay Bugt	Off Kap Stephensen	Ravns Fjord			Kangerdlugssuaq		Angmagssalik
	69°15′ N 24°50′ W	c. 69° N 25°25′ W	68°33′ N 28°33′W	68°30′ N 28°15′ W			c. 68°30′ N 32°30′ W		c. 65°30′ N 38°00′ W
	Surface	Surface	Surface	Surface	100 m. w.	200 m. w.	Surface	250 m. w.	Surface
Calanus finmarchicus..	c	+	cc	+	c	cc	+	cc	r
Calanus hyperboreus ..	..	..	r	..	..	+	..	c	..
Pseudocalanus minutus.	r	rr	r	+	r	r	+	..	r
Microcalanus pygmæus.	..	..	rr	..	..	r	..	..	..
Pareuchaeta norvegica.	..	..	..	..	..	..	..	rr	..
Pareuchaeta glacialis ..	..	..	rr	..	..	..	..	rr	..
Metridia longa.....	..	..	rr	..	..	rr	..	r	..
Centropages hamatus..	..	..	..	..	..	..	..	..	rr
Heterorhabdus norvegicus	..	..	..	..	..	..	..	rr	..
Acartia longiremis	..	rr	..	..	..	..	..	..	cc
Danielssenia Stefanssoni	rr	..	..	..	..	..	..	..	..
Harpacticus uniremis..	+	..	..	r	..	..	..	..	..
Idyaea furcata	rr	..	..	rr	..	..	..	..	rr
Parathalestris Jacksoni.	rr	..	..	..	..	..	..	..	..
Amphiascus nasutus...	..	..	..	..	..	..	..	..	+
Oithona atlantica.....	..	..	rr	..	..	..	..	..	..
Oithona similis	r	+	r	r	+	r	r	..	c
Oncaea borealis.....	..	..	..	..	..	..	..	..	rr

Table VIII. "Dana" St. 2436, July 25th, 1925, 61°13′ N. lat., 40°57′ W. long. Horizontal hauls with 2 m stramin net.

	600 m. w.	1000 m. w.		600 m. w.	1000 m. w.
Calanus finmarchicus	c	cc	Scolecithricella minor.....	rr	..
Calanus hyperboreus.....	rr	r	Scolecithricella ovata	..	rr
Neocalanus gracilis	..	rr	Metridia longa	+	rr
Rhincalanus nasutus.....	..	rr	Metridia lucens	rr	..
Gaidius tenuispinus.....	rr	r	Pleuromamma robusta.....	rr	rr
Euchirella rostrata	rr	..	Heterorhabdus norvegicus..	r	rr
Pareuchaeta norvegica.....	+	rr	Oithona atlantica	r	+
Pareuchaeta glacialis	rr	..	Oithona similis.....	+	rr

Table IX. "Dana" 1931. Sts. 4223—4235, July 16th—19th, 1931. Vertical hauls with Hensen net, 25—0 m.

	4223	4226	4227	4228	4229	4230	4231	4234	4235
	65°33′ N 30°50′ W	65°16′ N 34°08′ W	64°45′ N 36°30′ W	64°49′ N 37°59′ W	64°12′ N 38°12′ W	63°27′ N 39°38′ W	62°41′ N 40°30′ W	63°32′ N 35°57′ W	63°51′ N 33°51′ W
Calanus finmarchicus	+	cc	cc	r	rr	cc	cc	rr	rr
Calanus hyperboreus	rr	..	..	..	..	..	..	..	..
Pseudocalanus minutus	rr	rr	rr	rr	..	rr	..	..	..
Temora longicornis	rr	rr	..	..	..	..	..	..	..
Microsetella norvegica	..	rr	..	..	..	..	..	rr	..
Halithalestris Croni	..	..	rr	..	..	..	..	rr	rr
Oithona atlantica	rr	..	..	..	..	..	..	..	..
Oithona similis	..	..	r	..	..	r	r	rr	..
Oncaea borealis	..	..	..	rr	..	..	rr	..	..

Table X. "Dana" 1932. Sts. 4432—4447, July 9th—14th, 1932. Vertical hauls with Nansen net (silk no. 3), 50—0 m.

	4432	4433	4434	4435	4436	4437	4438	4440	4441	4442	4443	4445	4447
	66°17′ N 31°00′ W	65°58′ N 31°50′ W	65°23′ N 32°14′ W	65°25′ N 33°50′ W	65°13′ N 35°15′ W	64°48′ N 36°55′ W	64°13′ N 38°15′ W	63°32′ N 40°00′ W	62°40′ N 40°40′ W	62°40′ N 41°20′ W	63°11′ N 39°03′ W	64°09′ N 34°25′ W	64°38′ N 30°10′ W
Calanus finmarchicus	r	+	cc	c	r	+	c	cc	+	cc	+	r	r
Calanus hyperboreus	rr	rr	rr	rr	..	..	..	rr	..	rr	..	..	..
Pseudocalanus minutus	rr	r	rr	r	rr	r	rr	rr	..	..	..	..	..
Microcalanus pygmæus	..	..	..	rr	..	..	..	..	..	..	..	..	..
Pareuchaeta juv.	..	rr	rr	..	..	..	rr	..	..	..	..	..	..
Acartia longiremis	..	..	rr	..	..	..	..	..	..	..	..	..	..
Microsetella norvegica	rr	..	rr	..	+	r	rr	r	+	+	rr	c	+
Oithona atlantica	..	..	..	..	..	..	..	..	..	..	..	rr	rr
Oithona similis	+	+	+	+	c	+	c	cc	c	c	+	c	c
Oncaea borealis	rr	r	r	rr	+	rr	rr	rr	r	r	rr	rr	..

Table XI. "Dana" 1933. Sts. 4660—4687, August 9th—16th,

	4660	4661	4662	4663	4664	4665	4666	4667	4669	4670	4671
	65°37′ N 30°07′ W	65°58′ N 31°00′ W	65°29′ N 32°30′ W	64°55′ N 33°47′ W	65°04′ N 35°50′ W	64°39′ N 38°07′ W	64°12′ N 39°15′ W	63°38′ N 40°13′ W	63°27′ N 39°45′ W	62°47′ N 40°35′ W	62°13′ N 42°04′ W
Calanus finmarchicus	rr	r	rr	+	rr	r	r	+	+	rr	+
Calanus hyperboreus	..	..	rr	rr	..	..	..	..	..	..	..
Pseudocalanus minutus	rr	rr	rr	rr	..	rr	rr	r	rr	..	+
Microcalanus pygmæus	..	..	..	..	rr	..	..	..	..	..	..
Pareuchaeta juv.	..	..	..	..	..	..	..	..	..	..	..
Scolecithricella minor	rr	..	rr	rr	..	..	..	..	..	..	..
Temora longicornis	..	..	..	rr	..	..	..	..	..	..	..
Metridia longa	..	..	..	..	..	..	..	..	rr	..	..
? Ectinosoma finmarchicum	..	..	..	..	..	..	..	..	..	..	..
Microsetella norvegica	c	r	cc	cc	c	c	c	r	c	cc	r
Oithona atlantica	rr	..	rr	..	rr	rr	..	..	..	..	..
Oithona similis	c	r	+	c	+	cc	cc	c	c	+	c
Oncaea borealis	..	..	rr	rr	rr	rr	r	+	rr	r	+

1933. Vertical hauls with $^1/_3$ m silk net (silk no. 3), 50—0 m.

4672	4673	4674	4675	4676	4677	4678	4679	4680	4683	4684	4685	4686	4687
62°10′ N 41°45′ W	62°09′ N 41°30′ W	62°06′ N 41°10′ W	61°57′ N 40°41′ W	61°25′ N 41°35 W	60°47′ N 42°34′ W	60°43′ N 42°15′ W	60°40′ N 42°03′ W	60°39′ N 41°53′ W	59°53′ N 42°50′ W	59°49′ N 42°37′ W	59°47′ N 42°30′ W	61°52′ N 35°30′ W	62°36 N′ 32°48′ W
+	+	rr	rr	rr	c	c	rr	rr	rr	rr	rr	+	rr
..	rr	..	..	..	rr	rr	..	..	..	..	..	..	..
r	rr	..	..	rr	r	r	rr	..	rr	r	..	..	..
..	..	rr	r	..	..	..	..	..	..	..	..	rr	..
..	..	..	rr	..	..	..	..	..	..	..	..	rr	..
..	..	..	rr	..	..	..	..	..	..	..	..	rr	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	rr	..	..	..	..	..	rr	..	..	..	..	..
..	..	..	..	..	rr	..	..	..	..	..	..	..	..
r	c	c	r	cc	r	r	r	c	r	r	cc	cc	cc
..	..	rr	rr	..	..	..	..	rr	..	..	rr	..	..
c	c	+	+	+	c	c	c	c	c	c	c	+	+
+	+	r	r	+	+	+	+	+	r	r	..	..	rr

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