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THE GODTHAAB EXPEDITION 1928
Leader: Eigil Riis-Carstensen

PTEROPODA

BY

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WITH 1 FIGURE IN THE TEXT
AND 1 TABLE

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INTRODUCTION

Three species of Pteropoda are known from the waters west of Greenland, and all of them were collected by the "Godthaab" Expedition in 1928. A fourth species, *Clio pyramidata*, was taken at stat. 1, southwest of Iceland, but not in Greenland waters.

In some of the papers dealing with the zoological results of the expedition, material from other collections in West Greenland waters has been included, thus giving a more comprehensive account of the distribution of the animals in this interesting area and of their occurrence in different years. A general account of the zooplankton collected by the "Dana" during several cruises to the Greenland waters in 1925 and since 1950 is, however, under preparation and will be published elsewhere. The present paper, therefore, will only contain an account of the Pteropoda in the year 1928, when the waters between the entire west coast of Greenland and the eastern coasts of Labrador and the arctic Canadian islands were examined by the "Godthaab" Expedition. I have been allowed, however, to include some remarks on the occurrence of these animals in certain years with remarkable hydrographical conditions for comparison with the occurrence as observed in 1928, and I wish to thank Mr. Vagn Hansen for this valuable information.

The distribution of Pteropoda in the Greenland waters was dealt with by Posselt in the "Conspectus Faunae Groenlandicae", 1898, and since then only a few records are given by Odhner 1907, Jespersen 1923, Dunbar 1942, and Vibe 1950. Naturally, therefore, the investigations by the "Godthaab" Expedition have augmented our knowledge of the occurrence of these animals to a considerable degree.

Details of the occurrence are given in Table I, and the distribution of each species will be only briefly discussed in the following pages. All of the species mainly belong to the upper water layers, and when a few specimens were sometimes found in deep hauls with the ringtrawl, they were presumably taken at higher levels during the setting out or hauling in of the open nets.

Clione limacina (Phipps).

There is no reason to give a map of the distribution of this species, since it was taken in almost every haul throughout the area investigated, though in varying quantities. It was always fairly rare at the Canadian coasts and in the central waters, but frequently fairly common along the entire coast of Greenland from Cape Farewell to Thule. Accordingly it mainly occurred in the Greenland coastal water and in the waters of the West Greenland Current. Though it was also found at all the stations in the Labrador Current, in Smith Sound and Jones Sound, and in the central parts of Baffin Bay, it was always in small numbers, with one exception: at stat. 132, off the mouth of Lancaster Sound, it was very abundant, and in connection with *Limacina helicina* it constituted the bulk of the plankton in the uppermost haul, about 20 m below the surface, in this locality; the haul was taken in the cold upper layer, at a temperature of $-0.5°$; in a deeper haul, about 400 m below the surface, temp. 0.7°, the plankton mainly consisted of copepods, and the pteropods were rare.

Within the whole area investigated *Clione limacina* was taken at temperatures varying between -1.7 and $+6.2°$, but in most of the hauls, whence it was noted as "fairly common" (with the signature +), the temperatures were between 2 and 5°.

Previous records from West Greenland waters: According to POSSELT (1898, p. 256) *Clione limacina* had been found in numerous localities along the Greenland coast from Cape Farewell to Upernavik. In a series of 28 stations from Disko Bay to Thule in 1916–17 it was taken at one station in Disko Bay and in several localities between Upernavik and Thule, always in small numbers. ODHNER (1907 p. 95) records it from some localities in Disko Bay and in the central part of Davis Strait, DUNBAR (1942 p. 75) from several localities at the Canadian coasts between Hebron in Labrador and Clyde River in the northern part of Baffin Land, and VIBE (1950 p. 109) from Inglefield Bay.

The cruises of the "Dana" were carried out in the month of July off the west coast of Greenland from Cape Farewell to Disko and sometimes slightly more to the north, with series of stations from the coast outwards, occasionally near the coast of Labrador, but mainly inside the region of the West Greenland Current. *Clione limacina* was usually found at almost all stations in varying numbers, rarely in great abundance. It was particularly common in July 1959, and in contradistinction to 1928 it was remarkable that in a series from Godthaab almost to the coast of Baffin Land north of Resolution Island, it was found in particularly great numbers within the region of the Labrador Current.

Further distribution: *Clione limacina* has a circumpolar distribution, penetrating far up into the arctic region; it is common in the northern Atlantic, north of about 45–48° N. Outside the American coast it follows the comparatively cold currents southwards and has been recorded as far south as Cape Hatteras, 35° N. In the East Atlantic area it is common around Scotland and in the northern part of the North Sea and in the Skagerrak, occasionally penetrating into the Kattegat. According to Lebour (1931, pp. 785–791) it occurs off the entire west coast of England and is sometimes met with at Plymouth, in very different numbers in different years, and rarely further east in the English Channel.

Limacina helicina (Phipps).

As seen from Table I and the map, fig. 1 *L. helicina* was found in almost the same localities as *Clione limacina*, but from a quantitative point of view its distribution was quite different. During the first part of the expedition, from the end of May to the beginning of July, it was rare off the Greenland coast, but at stat. 186, off Arsuk between Frederikshaab and Julianehaab, it was taken in considerable numbers near the coast on October 9th. In the southernmost section of the expedition, between Cape Farewell and Hamilton Inlet, 28th May to 6th June, it was rare at the stations near the coast of Greenland, but fairly common at stat. 14 in the Labrador Current. During the northward journey in June some few specimens were taken above and inside the coastal banks off Fiskenæsset and Godthaab, but *L. helicina* (as well as *Clione limacina*, see above) was entirely lacking above Store Hellefiskebanke, stat. 33, 34 and 36, whereas some specimens were found at stat. 39 outside the bank.

In accordance with its predominantly arctic distribution, *L. helicina* was much more common in the entire area of Baffin Bay, being particularly abundant in the cold water in Jones Sound (stat. 117) and off Lancaster Sound (stat. 132); at stat. 132 it even, in connection with *Clione limacina*, constituted the bulk of the plankton in the haul near the surface (temp. $-0.5°$), whereas it was rare in the deeper haul, about 400 m below the surface, where the temperature of the water was 0.7°. A remarkably large number of this pteropod were also taken in the uppermost haul, about 50 m below the surface, at stat. 161 in the southern part of Baffin Bay; the temperature at this depth was about $-0.9°$; in the deeper haul at this station, about 300 m below the surface, the temperature of the water was 2.0°, and in this haul only some few specimens of *L. helicina* were found, and they may even have been caught at higher levels during the hauling in of the net.

Within the whole area investigated this species was found at temperatures varying between −1.7 and +5.5°, but in the majority of the hauls, where it occurred in considerable numbers, the temperatures measured were below 0°. The only exceptions are: stat. 65, N.W. of Upernavik, where it was abundant in the thin surface layer heated by the sun to 3.5°, stat. 140 in the mouth of Umanak Fjord, close by the surface, temp. 4.25, and at stat. 186 near the coast off Arsuk in September, where the temperature 50 m below the surface was measured as 2.9°. It was moderately common in six hauls with temperatures below 1°, and even in the localities, where only some few specimens were secured, the temperatures were generally below 1°. Altogether 62 % of the catches showed temperatures below 1°.

During the cruises of the "Dana" *L. helicina* was always abundant in the northern tracts, mainly in the open sea; its occurrence in the southern parts of the Greenland waters was very variable according to the temperature of the water and the extension of the current systems in the different years. In July 1956 it was particularly abundant in the entire area investigated from Disko southwards to the latitude of Frederikshaab, and also in the off-shore waters off Godthaab and Frederikshaab, but completely lacking in the waters near Cape Farewell. In 1958, which was a warmer year, it was far less common except at the westernmost stations off Egedesminde and Sukkertoppen, i. e. under the influence of the Labrador Current; it was not very abundant off Disko Bay, entirely lacking above Store Hellefiskebanke and Lille Hellefiskebanke and not very common outside the banks; off Godthaab it was fairly rare, though increasing in number westwards outside the coastal banks. A few were taken in the coastal waters off Frederikshaab and near Cape Farewell, but the species was entirely lacking in the off-shore waters outside this part of the Greenland coast.

Previous records from West Greenland waters: POSSELT (1898 p. 253) mentions *L. helicina* from numerous localities between Cape Farewell and Upernavik. According to JESPERSEN (1923 p. 137) it was taken at almost all the 28 stations in the series from Disko Bay to Thule in 1916–17, usually in small numbers only, but in very great abundance at one station in Disko Bay. Recorded by ODHNER (1907 p. 92) from a number of localities off the Greenland coast between Godthaab and Prøven and off the northern part of Baffin Land, by DUNBAR (1942 p. 75) from several localities on the Canadian coast between Hebron in Labrador and Clyde River in the northern part of Baffin Land, and by VIBE (1950 p. 109) from Inglefield Bay.

Further distribution: *Limacina helicina* is a well-marked arctic species with a circumpolar distribution; it occurs almost everywhere in

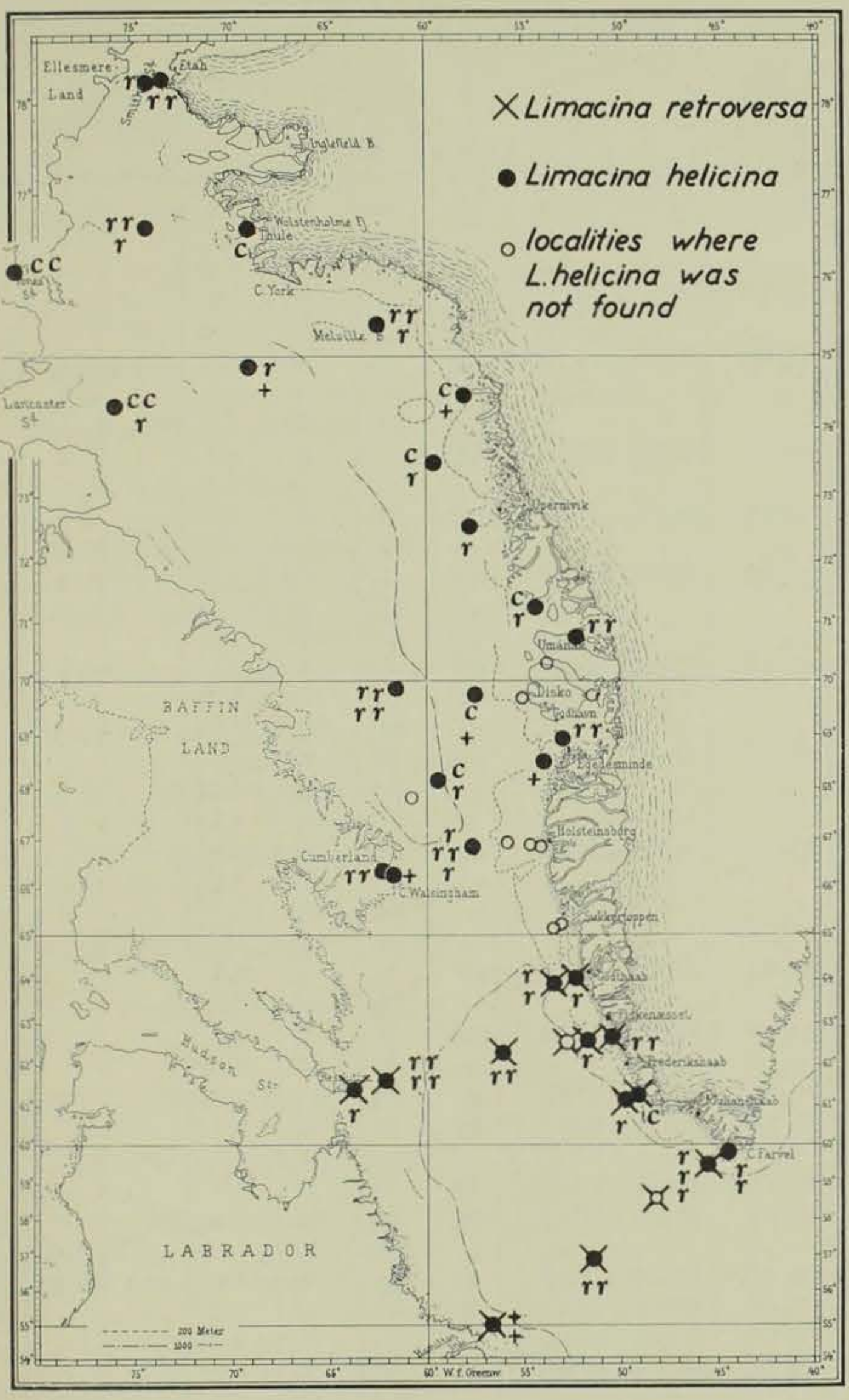

Fig. 1. Distribution of *Limacina retroversa* and *L. helicina*.
c = common. r = rare. + = neither rare nor common.

Table I. Pteropoda collected by the "Godthaab" Expedition 1928.

Number of stations	Date 1928	Position Lat. N.	Position Long. W.	Depth, m	Length of wire, m	Approximate depth of haul	Approximate temp. °C	Clione limacina	Limacina helicina	Limacina retroversa
1	24·V	63°19′	26°50′	1130	50	25	7.7	r	..	+
					150	85	7.4	r	..	r
					1000	650	5.5	+	r	rr
3	28·V	59°48′	44°26′	223	100	50	−0.4	..	r	..
					225	150	−0.35	rr	r	..
5	29·V	59°30′	45°23′	294	35	12	2.2	+	r	+
					100	50	3.3	+	r	+
					300	160	4.7	+	r	c
8	30·V	58°35′	48°10′	3500	35–100	12	6.0	r	..	c
					100	50	4.4	+	..	c
10	3·VI	56°56′	51°17′	3500	100	50	3.8	+	..	r
					3000	2000	3.1	r	rr	rr
14	6·VI	55°00′	56°34′	314	35	12	0.1	r	+	..
					100	50	−1.15	r	+	..
					300	160	0.9	r	..	r
18	11·VI	61°28′	63°44′	475	35	12	0.1	..	r	..
					100	50	−1.15	..	..	..
					400	225	2.0	rr	..	rr
20	12·VI	61°39′	62°08′	620	35	12	0.2	rr	rr	..
					100	50	−1.25	rr	..	rr
					600	350	3.5	rr	rr	..
24	14·VI	62°19′	56°00′	2550	35	12	5.0	rr	..	r
					100	50	4.1	r	..	+
					1000	650	3.7	rr	rr	rr
					2500	800	3.5	rr	..	..
26	15·VI	62°33′	52°43′	2600	35	12	5.5	+	..	c
					100	50	5.2	+	..	+
27	16·VI	62°37′	51°40′	340	35	12	3.1	+	..	c
					100	50	3.25	+	r	c
29	16·VI	62°42′	50°27′	30	25	10	3.0	..	rr	rr
30	18·VI	64°02′	52°19′	195	35	12	3.0	+	r	c
					100	50	1.8	rr	r	r
31	18·VI	64°00′	52°41′	50	45	15	2.0	r	..	..
32	19·VI	63°57′	53°18′	680	35	12	1.1	rr	rr	rr
					100	50	0.8	rr	rr	rr
33	2·VII	66°52′5	54°09′	58	75	50	2.6	r	..	..
34	2·VII	66°54′	54°37′	36	60	20	3.25	+	..	..
36	2·VII	66°56′	55°48′	97	100	50	2.5	+	..	..
39	3·VII	66°51′	57°40′	680	35	12	−0.6	+	r	..
					100	50	−1.7	+	rr	..
					600	350	0.05	r	r	..
43	6·VII	68°56′5	52°55′	200	100	50	0.25	rr	rr	..
47	13·VII	69°41′2	55°01′	80	100	50	−0.1	..	..	..
50	13·VII	69°44′4	57°22′	215	135	60	−1.6	r	c	..
					200	100	0	r	+	..

(continued)

Table I (continued).

Number of stations	Date 1928	Position Lat. N.	Position Long. W.	Depth, m	Length of wire, m	Approximate depth of haul	Approximate temp. °C	Clione limacina	Limacina helicina	Limacina retroversa
54	14·VII	69°50′	61°36′	1880	100	50	−1.7	r	rr	..
					1200	800	0.3	rr	rr	..
					3000	2000	−0.4	r	..	..
61	21·VII	72°33′5	57°36′	190	35	12	4.0	+	..	..
					200	100	−1.1	r	r	..
65	28·VII	73°30′8	59°36′	225	35	12	3.5	+	c	..
					200	100	−0.7	r	r	..
69	29·VII	74°28′	58°04′	465	100	50	−1.1	r	c	..
					500	300	0.25	r	+	..
77	31·VII	75°26′	62°26′	820	100	50	c. 1	r	rr	..
					800	500	0.8	r	r	..
86	4·VIII	76°36′	68°54′	210	80	40	−1	+	c	..
97	8·VIII	78°15′5	73°29′	290	200	100	−1.4	r	rr	..
99	8·VIII	78°14′	74°10′	672	65	40	−1.4	r	..	..
					675	440	−1.2	r	r	..
112	16·VIII	76°37′4	74°18′	580	60	30	1.4	rr	rr	..
					460	250	−1.0	rr	r	..
117	17·VIII	76°04′5	80°56′	690	50	20	0	r	cc	..
					670	450	−0.7	r	..	..
132	22·VIII	74°20′	75°56′	685	50	20	−0.5	c	cc	..
					650	400	0.7	rr	r	..
136	23·VIII	74°50′	69°00′	1500	100	50	−1.7	r	r	..
					500	300	0.7	..	..	..
					1500	1000	0.05	..	+	..
140	3·IX	71°14′2	54°24′	80	15	5	4.25	r	c	..
					80	35	3.5	+	r	..
146	4·IX	70°44′3	52°16′5	570	35	12	4.7	rr	..	..
					250	125	−0.5	rr	rr	..
					600	350	1.0	..	rr	..
148	6·IX	70°19′8	53°50′	575	50	20	3.0	rr	..	..
					350	200	0.35	..	..	..
153	7·IX	69°44′1	51°29′5	480	50	20	5.0	..	..	..
					350	200	0.3	..	..	..
156	9·IX	68°58′	52°53′	185	100	50	4.5	r	..	..
158	11·IX	68°31′	53°57′	520	50	20	4.8	+	+	..
161	13·IX	68°07′	59°27′	1250	100	50	−0.9	+	c	..
					500	300	2.0	rr	r	..
162	14·IX	67°48′5	60°48′	1500	1800	1200	−0.2	..	..	..
166	17·IX	66°19′	62°18′	207	100	50	−0.7	rr	rr	..
167	17·IX	66°16′	61°53′	127	130	60	−0.9	r	+	..
176	2·X	65°10′7	53°05′	315	100	50	4.4	..	..	..
177	2·X	65°07′5	53°29′	78	60	25	4.4	r	..	..
185	9·X	61°11′	49°38′5	290	50	20	4.0	+	r	+
					250	125	6.0	r	..	+
186	9·X	61°17′	49°11′	120	100	50	2.9	+	c	r

c = common, r = rare, + = neither rare nor common.

true arctic water and also in areas where this is mixed with Atlantic water. Off the west coast of Norway it may occasionally occur as far south as 64° N. Along the American coast it penetrates rather far southwards, according to MEISSENHEIMER even as far as 38° N., outside Delaware Bay. Very peculiar is an isolated record by MEISSENHEIMER from a locality, 35°30′ N. 43°30′ W., in the central part of the North Atlantic.

Limacina retroversa Fleming.

In her report on the Pteropoda of the "Michael Sars" North Atlantic Expedition in 1910 professor BONNEVIE discussed the relation between *L. retroversa* Fleming and the northern form *L. balea* Møller. The paper was written in 1913, but owing to the great fire at Bergen in 1915 its publication was delayed; it was issued in 1933. BONNEVIE has thoroughly compared the two forms (pp. 12–16, figs. 9–17), and she concluded that they should be kept separate as two distinct species. Most other recent authors, however, regard them as belonging to one species, *L. retroversa*, the individuals growing to a slightly larger size in the northern than in the southern parts of its area of distribution. MEISSENHEIMER (1903 p. 10 and 1905 p. 419) united them, and so did LENZ (1906 p. 2), but he applied the name *balea* to both of them. It is a predominantly boreal species, and its occurrence in Greenland waters is, therefore, of particular interest.

During the "Godthaab" Expedition in 1928 *L. retroversa* was taken at almost all the stations south of the latitude of Godthaab (about 64° N.), but never further north, which is rather remarkable, since the temperature conditions in this particular year might seem to be favourable for a northward extension of the distribution of this boreal species.

As seen from Table I and the map, fig. 1, it was abundant at stat. 5 and 8 in section I, south-west of Cape Farewell, especially in the warmest water layers, and also at stat. 27 and 26 in section III off Frederikshaab Isblink and at stat. 30 off Godthaab; in all these sections it decreased in number westwards towards Labrador and Hudson Strait; at stat. 14 off Hamilton Inlet and stat. 18 near Resolution Island very few specimens were found, and only in the deepest hauls in comparatively warm water. It was entirely lacking at stat. 3 and 29 near the Greenland coast. During this part of the expedition, 28th May to 19th June, it had its principal occurrence in the water of the West Greenland Current. During the home voyage in October young specimens were taken in fair number at stat. 185 and 186 near the coast off Arsuk, about 61° N.

With the exception of one catch of a few specimens, which may possibly have belonged to another water layer (stat. 20, 100 m wire, temp.

– 1.25°) the temperature of the water in which *L. retroversa* was collected by the expedition varied between 0.9 and 6.0°, and it was abundant only when the temperature was above 3°.

The cruises by the "Dana" were always carried out in the month of July, when the temperature of the upper water layers off the southern part of the Greenland coast has increased, and the bodies of warm water move northwards with increased velocity. During these investigations *L. retroversa* was always found considerably farther north than observed by the "Godthaab" Expedition, which had left these waters at the beginning of July to proceed into the northern areas. By the "Dana" the species was taken: in 1950 as far north as 66°41′ N., in 1954 to 68°49′ N., in 1955 to 68°49′ N., in 1957 to 68°30′ N.

The distribution and multitude of *L. retroversa* in the different parts of the area investigated presented remarkable differences in the two years 1956 and 1958. As mentioned above *Limacina helicina* was abundant in 1956 even as far south as off Frederikshaab, which was in accordance with the comparatively low temperatures of the water. The southern species, *L. retroversa* was, however, likewise particularly common in July 1956, especially between Frederikshaab and Godthaab and in the coastal water further north until Sukkertoppen; it was also fairly common outside Lille and Store Hellefiskebanke, but lacking above these banks. In July 1958 there was a broad belt of comparatively warm water off the southern part of the Greenland coast, and in accordance herewith *L. retroversa* was very abundant in the series of stations south-west of Cape Farewell. Further north the temperature of the water was likewise somewhat higher in 1958 than in 1956, and nevertheless the species occurred in remarkably small numbers as compared with 1956. It was not merely lacking above Store Hellefiskebanke and Lille Hellefiskebanke, but it was also rare or entirely lacking above the southern banks and near the coast, and even outside the banks it was taken in much smaller numbers than in 1956. Some few specimens were found as far north as off the southern part of Disko, about 69°20′ N. Other reasons than direct influence of the temperature must have been responsible for the relative scarceness of this boreal species in the comparatively warm summer of 1958 and its abundance in the comparatively cold summer of 1956.

Further distribution: Posselt (1898 p. 254) records this species from a few off-shore localities off the southern part of the west coast of Greenland between 60° and 64°20′ N. *L. retroversa* is a boreal species, common across the northern Atlantic north of about 40° N. Near the American coast it is recorded from off Cape Hatteras, about 34° N., and it has occasionally been met with in the Sargasso Sea. In the eastern

Atlantic area it is common in the North Sea and Skagerrak, penetrating into the Kattegat, occasionally even into the western Baltic. It is still common across the ocean around 60° N., whence it follows the current along the west coast of Norway, sometimes even as far north as off North Cape, 73° N. TESCH (1946 pp. 6–7) designates it as "a useful indicator of Atlantic water in the North Sea and adjacent regions". It also occurs in temperate waters in the southern hemisphere.

Clio (Euclio) pyramidata L.

A few specimens of this species were taken by the "Godthaab" Expedition south-west of Iceland, stat. 1, 63°19′ N. 26°50′ W., in a haul with 1000 m wire out.

Further distribution: According to POSSELT (1898 p. 255, quoted by MEISSENHEIMER, 1905 p. 423) *Clio pyramidata* has been found in a few localities at the mouth of the Davis Strait. It is widely distributed in the warm parts of all the oceans, common in the Atlantic between 40° S. and 60° N. and in the Mediterranean. In the eastern Atlantic it follows the currents into the northern part of the North Sea and to the west coast of Norway at about 61° N.

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