

MEDDELELSE R OM GRØNLAND

UDGIVNE AF

KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND

B.D. 184 · N.R. 10

STUDIES ON FRESHWATER
ENTOMOSTRACA IN GREENLAND

IV.

A COLLECTION FROM ANGMAGSSALIK,
EAST GREENLAND

BY

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WITH 6 FIGURES IN THE TEXT

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1970

Abstract

A collection of 14 samples from 10 freshwater localities from Angmagssalik district, Southeast Greenland, were placed at my disposal.

In the collection 12 species of Entomostraca were found, three of them, *Alonella nana*, *Leptodiaptomus minutus* and *Bryocamptus (Arcticocamptus) arcticus* are new to East Greenland, and *Candona rectangularis* is new to Southeast Greenland.

A comparation is made between the entomostracal fauna of Southwest Greenland, Southeast Greenland, and the Scoresby Sund area, and some zoogeographical remarks are given.

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Manuscript received May 15th, 1969

ISBN 87 421 0028 3

INTRODUCTION

The material dealt with in this paper was collected by Dr. BENT LAUGE MADSEN in the Angmagssalik district, East Greenland, during Newcastle University Exploration Society's Expedition to East Greenland in 1967.

The physiographical results of the investigation will be published in a paper by MADSEN (in preparation), and only the Entomostraca will be treated here.

The material of Entomostraca is rather small. It consists of only 14 samples from 10 localities. Nine of the samples have been taken from nine different localities, while the remaining five samples originate from one locality. Because the material is small, I would not have made a special publication on it if it had not been for two reasons.

First, entomostracans from the southern part of East Greenland are poorly known, as only eight samples and three small collections have been worked up from the area (POULSEN, 1940a; RØEN, 1962). The present material therefore doubles the number of localities.

Secondly, from the samples mentioned above, 14 species of Entomostraca have been reported from the area: *Lepidurus arcticus*, *Simocephalus vetulus*, *Bosmina coregoni obtusirostris*, *Macrothrix hirsuticornis*, *Eury cercus glacialis*, *Acroperus harpae*, *Alona intermedia*, *A. affinis*, *Alonella excisa*, *Chydorus sphaericus*, *Polyphemus pediculus*, *Cyprinotus incongruens*, *Cyclops (Cyclops) scutifer* and *Maraenobiotus brucei*. In the present material 12 species were found. Four of these, *Alonella nana*, *Candona rectangula*, *Leptodiaptomus minutus* and *Bryocamptus (Arcticocamptus) arcticus*, proved to be new to the area, and all except *Candona rectangula* are new to East Greenland.

The author wishes to thank Dr. BENT LAUGE MADSEN for making the present material available. I also wish to thank Mrs. MARY PETERSEN for correcting the manuscript and Miss J. TESCH for making the graphs.

LIST OF SAMPLES IN THE MATERIAL

G. 6. Little lake west of Maries Havn. Angmagssalik Fjord. 9.VII.1967.
 G. 7. Imertivaq, Angmagssalik Fjord. Horizontal haul. 12.VII.1967.
 G. 8. Same. Vertical haul. 20 m. 17.VII.1967.
 G. 9. Same. Vertical haul. 20 m. 18.VII.1967.
 G. 10. Same. Vertical haul. 20 m. 18.VII.1967.
 G. 16. Same. Vertical haul. 10 m. 18.VII.1967.
 G. 17. Little lake east of Imertivaq. Angmagssalik. Horizontal haul. 18.VII.1967.
 G. 24. Pond 1. Tugtilik. 26.VII.1967.
 G. 25. Pond 2. Tugtilik. 26.VII.1967.
 G. 32. Pond at high altitude. Tugtilik. 9.VIII.1967.
 G. 34. "Planariadam". Tugtilik. 11.VIII.1967.
 G. 35. Pond at Nigertuluk. (Former spelling Nigertussoq). 12.VIII.1967.
 G. 36. Lake at Nigertuluk. 12.VIII.1967.
 G. 39. Lake. Tugtilik. Surface sample. 16.VIII.1967.

The material of Entomostraca

In the material at hand, *i.e.*, 14 samples from 10 localities, 12 species of Entomostraca were found, six cladocerans, three ostracods and three copepods. Only from one of the localities, G. 32, the pond at high altitude at Tugtilik, were no Entomostraca found.

The distribution of the species in the localities is shown below:

	G	G	G	G	G	G	G	G	G	Number of localities
<i>Bosmina coregoni</i>	6	7-16	17	24	25	34	35	36	39	
<i>obtusirostris</i>					+					1
<i>Macrothrix hirsuticornis</i> ..						+				1
<i>Acroperus harpae</i>	+					+	+	+	+	5
<i>Alona affinis</i>	+									1
<i>Alonella nana</i>					+					1
<i>Chydorus sphaericus</i>							+	+		2

(continued)

	G	G	G	G	G	G	G	G	G	G	Number of localities
	6	7-16	17	24	25	34	35	36	39		
<i>Cyprinotus incongruens</i> . . .						+	+				2
<i>Candona rectangula</i>					+						1
<i>Candona</i> sp. juv.				+							1
<i>Leptodiaptomus minutus</i> ..	+	+	+	+					+		5
<i>Cyclops</i> (<i>Cyclops</i>) <i>scutifer</i>	+				+			+	+		5
<i>Bryocyclops</i> (<i>Arcticocamp-</i> <i>tus</i>) <i>arcticus</i>				+							1
Number of species	4	2	4	5	2	2	3	2	2		

THE SPECIES INVESTIGATED

Cladocera

***Bosmina coregoni obtusirostris* G. O. SARS, 1861**

The species has been found before in Angmagssalik, but seems to be rare in East Greenland, while it is rather common in West Greenland south of 73° N.

In the present material the species was taken in two samples from one locality:

G. 8. 1 empty ♀
G. 10. 2 empty ♀♀

***Macrothrix hirsuticornis* NORMAN and BRADY, 1867**

The species previously has been found rather frequently throughout Greenland. During the present investigation it was only taken in one locality, G. 24.

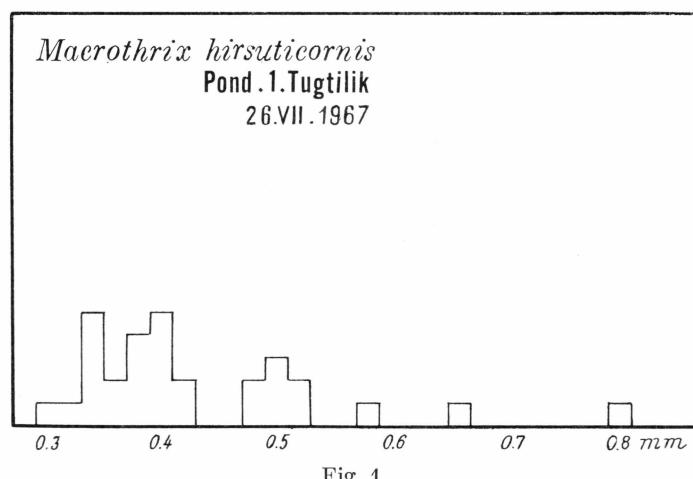


Fig. 1.

Twenty-nine specimens were found, all of them empty females or juveniles. The variation in size is shown in Fig. 1. Even though this is only one picture of the development of the population, the graph seems

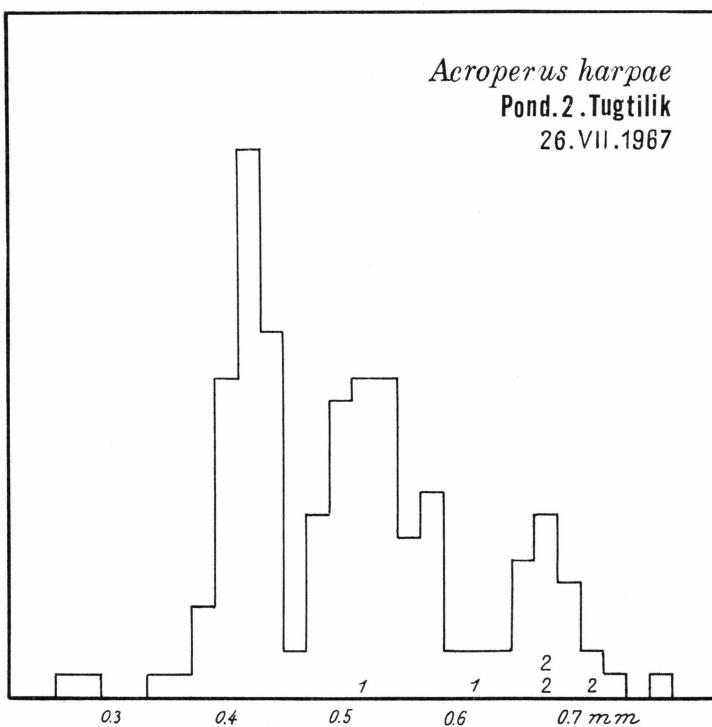


Fig. 2.

to indicate that we are dealing with two generations; a few adults, over 0.5 mm in length, and a larger number of juveniles. Compared to the measurements given by RØEN (1968, p. 35) the composition of the population seems to be nearly the same as on 25.VII.1964 and 3.VIII. 1964 in the pond on Flaghøjsletten, Peary Land, apart from that in the present material no females with eggs were found.

Although it is impossible to judge how many generations occur in a summer it is most likely that there are more than the two indicated here.

***Acroperus harpae* (BAIRD, 1835)**

The species has previously been found in the Angmagssalik district and seems to be rather common on the west coast south of 75° N and on the east coast south of 72° N.

In the present material the species was taken from five localities:

- G. 6. 2 empty ♀♀
- G. 24. Many specimens. All empty ♀♀ and juveniles
- G. 25. Many specimens, a few with eggs
- G. 34. 3 ♀♀, 1 of them with 1 parthenogenetic egg, the other empty
- G. 36. 1 ♀ with 1 parthenogenetic egg

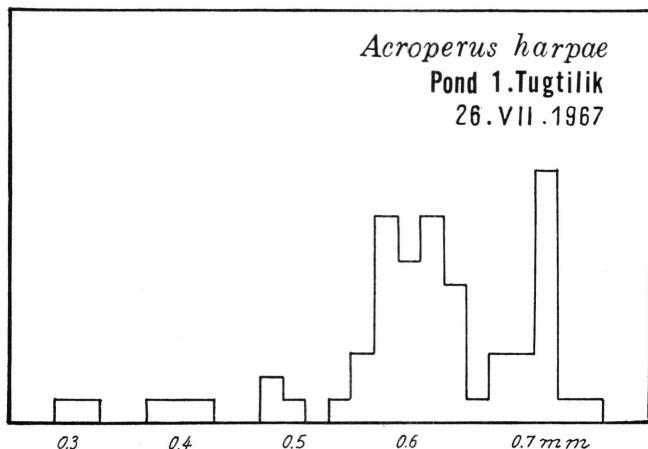


Fig. 3.

The populations from the two ponds at Tugtilik (G. 24, G. 25) where many specimens have been found, are very different as regards the size of the animals. The maximum and minimum size is nearly the same in the two populations (Figs. 2 and 3), but the population from G. 25 is dominated by animals of medium size, approximately 0.5 mm, and contains among the larger animals some individuals with parthenogenetic eggs, while the population from G. 24 is dominated by larger animals, 0.6–0.7 mm, and contains no females with eggs.

From the present material it is impossible to judge the reason for this great difference between two populations taken on the same day in two neighbouring ponds.

Alona affinis (LEYDIG, 1860)

This species has previously been found rather commonly in West Greenland and in East Greenland in a few localities, all south of 73° N. One of the localities from East Greenland is at Angmagssalik.

In the present material the species was taken in only one locality:
G. 6. 2 empty ♀♀, 0.75 and 0.80 mm.

Alonella nana (BAIRD, 1854)

New to East Greenland, but in West Greenland found from the southernmost part to 73° N.

The species was taken in one locality:
G. 17. 2 empty ♀♀, 0.24 and 0.26 mm.

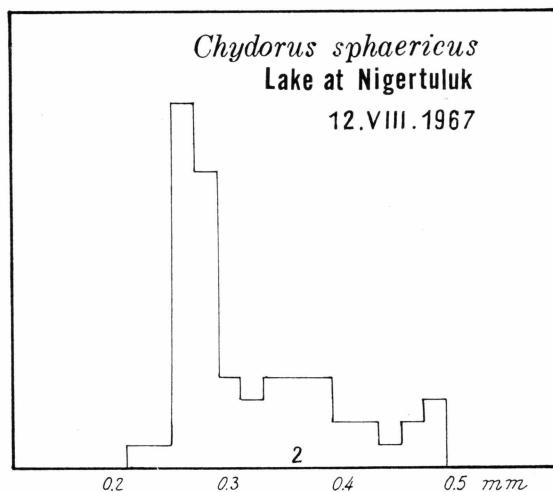


Fig. 4.

***Chydorus sphaericus* (O. F. MÜLLER, 1785)**

The species is distributed all over Greenland, and is the most common Greenlandic entomostracan.

In the collection at hand, the species was taken from two localities:

G. 35. 1 empty ♀, 0.3 mm long

G. 36. Many specimens

The size variation of specimens from G. 36 is shown in Fig. 4. There seem to be two generations in the sample, and the general picture is rather like that from 13.VIII.1964, from the pond 500 m west of Klaresø-Lersø, Peary Land (RØEN, 1968, p. 38). It is, however, very unlikely that the species in Southeast Greenland has the same type of life cycle (*i.e.*, with two generations a year) as in Peary Land, as according to POUlsen (1940b, pp. 41–49) the life cycle in the Kejser Franz Joseph Fjord area consists of three generations.

Ostracoda

***Cyprinotus incongruens* (RAMDOHR, 1808)**

The species has previously been taken from three localities in Southeast Greenland, and except for Peary Land, occurs throughout Greenland, even though it seems to be very rare in some of the areas.

In the present material the species was taken in two localities:

G. 25. Many specimens, mainly juveniles, a few adults

G. 34. Many specimens, mainly adults

Cyprinotus incongruens
Pond 2. Tugtilik
26.VII.1967

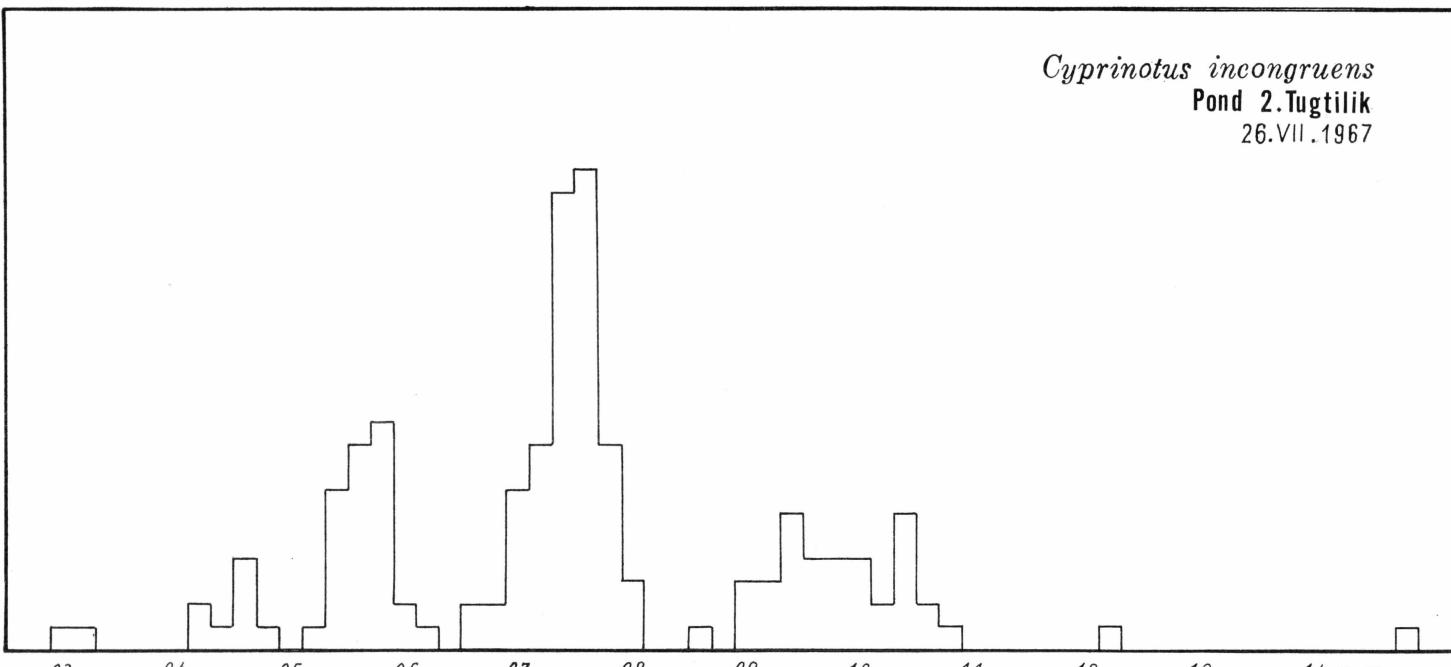


Fig. 5.

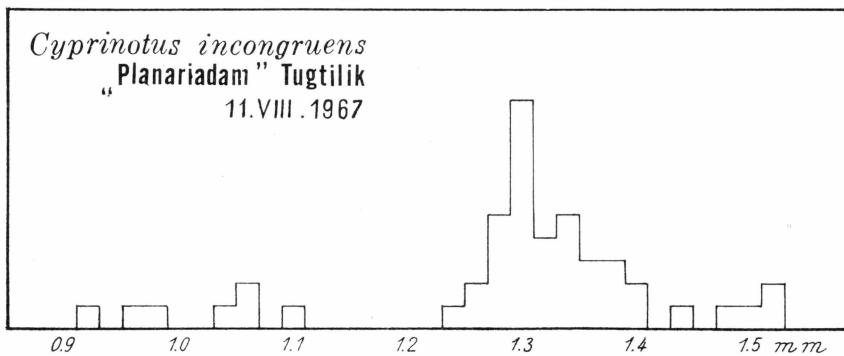


Fig. 6.

As can be seen from Figs. 5 and 6, it is obvious that the composition of the two samples is very different. Although the two samples are not from the same locality, and as shown with *Acroperus harpae* (p. 8) even though two populations in neighbouring localities may be very different at any given time, the graphs seem to indicate that there is one generation a year in the localities.

***Candonia rectangula* ALM, 1914**

The species has not previously been found on the Southeast Coast, and in the rest of Greenland it has only been found in three localities on the middle part of the west coast and three on the middle east coast.

In the present material the species was taken only once:

G. 24. 2 ♀♀, 0.71 and 0.98 mm.

***Candonia* sp.**

An indeterminable species of *Candonia* was taken from one locality: G. 17. 2 juvenile specimens, both 0.34 mm long

It is most likely that the specimens belong to *Candonia candida*, but as they were juveniles an exact determination was not possible.

Copepoda

***Leptodiaptomus minutus* (LILLJEBORG, 1889)**

In Greenland the species is common on the west coast south of 74° N. Further, there is a very doubtful record from Northeast Greenland (BREHM, 1911, p. 313; JOHANSEN, 1911, p. 325; RØEN, 1962, p. 208–210). The specimens at hand represent the first certain occurrence in East Greenland.

The species was found in five localities:

- G. 6. Many specimens, all stages, ♀♀ and ♂♂ in even numbers. Many ♀♀ with eggsacks containing 3–6 eggs (most often 4)
- G. 7. Many adult ♂♂, and ♀♀ without eggsacks; many metanauplii and very few copepodites III–V
- G. 8–10, 16. Many specimens from metanauplii (0.26 mm) to adult ♀♀ without eggsacks. Few adult ♂♂
- G. 17. Many metanauplii (0.28–0.38 mm)
- G. 24. Many adult ♂♂ and ♀♀; 1/3 of ♀♀ with eggsacks containing 1–6 eggs (most often 4)
- G. 39. Many adult ♂♂ and ♀♀; 1/2 of ♀♀ with eggsacks containing 5–10 eggs (most often 8 or 9)

This species was absolutely dominating in all the localities where it was found. The change in the composition of the population in Imertivaq (G. 7, G. 8–10, G. 16) within a week seems to indicate a rapid development.

The females in all populations were 0.84–0.92 mm long while the males were somewhat larger, 0.90–0.98 mm.

***Cyclops (Cyclops) scutifer* G. O. SARS, 1863**

This species has previously been taken in the Angmagssalik area, and is common throughout Greenland except for the northernmost parts.

The species was taken from five localities:

- G. 6. 2 ♂♂, 1.38 mm and 1.30 mm; 1 copepodite IV, 1.02 mm
- G. 24. 1 ♀ without eggs, 1.86 mm; 1 ♀ with 18 eggs, 9 in each eggsack, 1.90 mm; 1 copepodite V, 1.16 mm; 4 copepodites V, each 1.20 mm; 1 copepodite III, 0.80 mm
- G. 35. Many juveniles from the smallest nauplius (0.18 mm) to copepodite IV
- G. 36. Many juveniles, all stages. Smallest nauplius 0.16 mm. 3 adult ♀♀ without eggsacks, 1.54 mm, 1.56 mm and 1.64 mm 1 ♀ with eggsacks, containing 1 and 3 eggs respectively
- G. 39. 3 ♂♂, 1.18 mm, 1.28 mm and 1.30 mm; 2 copepodites (II–III?) 0.72 mm and 0.64 mm

It is impossible from the above information to decide whether the species in this area has one generation a year, as is the case in the Disko Bugt area (RØEN, 1958) or whether it requires two years to complete a generation, as shown for Ellesmere Island (MC LAREN, 1964).

***Bryocamptus (Arcticocamptus) arcticus* (LILLJEBORG, 1902)**

This species seems to be rather rare in Greenland, as it has previously been found only a few times in Upernivik district, the Disko Bugt area and the Holsteinsborg area on the west coast. The present material extends the species' recorded distribution to East Greenland; it is, however, only found from one locality:

G. 17. 1 ♂, 0.42 mm; 2 ♀♀, 0.72 mm and 0.82 mm.

Zoogeographic Remarks

A survey of the distribution of the Southeast Greenlandic species outside Greenland is given in the following table:

	Nearctic			Palaearctic	
	non-Arctic	Arctic	Iceland	N. Scandinavia	Other
<i>Lepidurus arcticus</i>		+	+	+	+
<i>Simocephalus vetulus</i> ...	+		+	+	+
<i>Bosmina coregoni</i>					
<i>obtusirostris</i>	+	+	+	+	+
<i>Macrothrix hirsuticornis</i>	+	+	+		+
<i>Eury cercus glacialis</i>		+	+		+
<i>Acroperus harpae</i>	+	+	+	+	+
<i>Alona intermedia</i>	+		+	+	+
<i>A. affinis</i>	+	+	+	+	+
<i>Alonella nana</i>	+	+	+	+	+
<i>A. excisa</i>	+	+	+	+	+
<i>Chydorus sphaericus</i>	+	+	+	+	+
<i>Polyphemus pediculus</i> ..	+	+	+	+	+
<i>Cyprinotus incongruens</i>	+	+	+	+	+
<i>Candona rectangula</i>					+
<i>Leptodiaptomus minutus</i>	+	+	+		
<i>Cyclops scutifer</i>	+	+	+	+	+
<i>Bryocamptus arcticus</i> ...		+		+	+
<i>Maraenobiotus brucei</i> ...	+				+

To judge from this table, 17 of the species found in the area are distributed holarctically, while one species, *Candona rectangula*, has a palaearctic distribution. This is, however, not entirely true, as apart from the occurrence in Iceland *Leptodiaptomus minutus* is never found outside the nearctic region and thus must be regarded as a nearctic

species. In an earlier paper (RØEN, 1962, p. 184) I suggested the possibility of finding *Candonia rectangula* in North America, but even though three ostracods, *Prionocypris glacialis*, *Candonia lapponica* and *C. groenlandica*, never before reported from North America, in 1965 were found in Ellesmere Island (RØEN, 1968, p. 54), *C. rectangula* outside Greenland is still only known from the Palaearctic.

Only two of the species, *Lepidurus arcticus* and *Bryocamptus arcticus* have a exclusively arctic distribution. *Eury cercus glacialis* has its main distribution in the Arctic, while the rest of the species are widely distributed in temperate areas or are even cosmopolitan.

Considering the distribution of the species in Greenland (RØEN, 1962, p. 215 ff., 1968, p. 55), we find that representatives of three of the four types of distribution are to be found in Southeast Greenland, viz., the faunal element found throughout Greenland, the northwestern element and the southern element. No species belonging to the brackish-water element are found.

The faunal element found in the whole of Greenland comprises four species, viz., *Macrothrix hirsuticornis*, *Chydorus sphaericus*, *Cyprinotus incongruens* and *Maraenobiotus brucei*. All of these have a wide geographical distribution outside Greenland.

Of species from the northwestern faunal element only one, *Lepidurus arcticus*, is found in the area.

The rest of the species in the Southeast Greenland area belong to the southern faunal element. Of these *Simocephalus vetulus*, *Bosmina coregoni obtusirostris*, *Eury cercus glacialis*, *Acroperus harpae*, *Alona intermedia*, *A. affinis*, *Alonella excisa*, *Polyphemus pediculus*, *Candonia rectangula* and *Cyclops* (*Cyclops*) *scutifer* are previously recorded from East Greenland, while *Alonella nana*, *Leptodiaptomus minutus* and *Bryocamptus* (*Arcticocamptus*) *arcticus* have previously been known only from the west coast.

A comparison with the two adjoining areas, Southwest Greenland and the Scoresby Sund area, showing all the species found and the frequency of their occurrence, is given in the following table:

	Southwest Greenland	Southeast Greenland	Scoresby Sund area
Number of localities	20	15	53
<i>Lepidurus arcticus</i>		+	11.3
<i>Latona setifera</i>	55.0		
<i>Holopedium gibberum</i>			3.8
<i>Daphnia pulex</i>	30.0		58.5

(continued)

	Southwest Greenland	Southeast Greenland	Scoresby Sund area
<i>D. longispina</i>	+		
<i>Simocephalus vetulus</i>	15.0	13.3	32.0
<i>Scapholeberis mucronata</i>	25.0		37.7
<i>Ceriodaphnia quadrangula</i>	35.0		
<i>Bosmina longirostris</i>			3.8
<i>B. coregoni obtusirostris</i>	40.0	13.3	+
<i>Macrothrix hirsuticornis</i>	5.0	13.3	24.5
<i>Eurycerus glacialis</i>	55.0	13.3	+
<i>Acroperus harpae</i>	40.0	53.3	54.7
<i>Alona guttata</i>	5.0		1.9
<i>A. intermedia</i>		6.7	
<i>A. rectangula</i>	5.0		4.9
<i>A. quadrangularis</i>	10.0		3.8
<i>A. affinis</i>	20.0	13.3	1.9
<i>Alonella nana</i>	10.0	6.7	
<i>A. excisa</i>	15.0	13.3	3.8
<i>Graptolebris testudinaria</i>	5.0		
<i>Chydorus sphaericus</i>	70.0	33.3	81.1
<i>Polypheus pediculus</i>	45.0	13.3	50.9
<i>Eucypris affinis hirsuta</i>	25.0		11.3
<i>E. virens</i>			1.9
<i>Cyprinotus incongruens</i>	5.0	33.3	11.3
<i>Prionocypris glacialis</i>	5.0		7.5
<i>Candonia candida</i>	5.0		17.0
<i>C. rectangula</i>		6.7	3.8
<i>C. laponica</i>			3.8
<i>Limnocythere sanctipatrici</i>			3.8
<i>Diaptomus castor</i>	20.0		
<i>Leptodiaptomus minutus</i>	65.0	33.3	
<i>Cyclops scutifer</i>	40.0	53.3	21.2
<i>C. vernalis</i>	15.0		
<i>Bryocamptus tikchikensis</i>	5.0		26.4
<i>B. arcticus</i>		6.7	
<i>Maraenobiotus brucei</i>		6.7	13.2
<i>M. insignipes</i>	5.0		
<i>Moraria mrazekii</i>	5.0		
Total number of species	30	18	28
Average no. of species/loc.....	6.9	3.4	4.8

From this table it is rather evident that the number of species found in Southeast Greenland is rather small in comparison with the two adjacent areas. Since about ten more species can be expected to occur here, the low number actually found is probably an artifact caused by insufficient collecting in too restricted an area, a supposition supported by the fact that of the 15 localities sampled, only four were situated outside Angmagssalik.

That our knowledge of the entomostracan fauna of Southeast Greenland still leaves much to be desired is reflected in the average number of species per locality: only 3.4, as compared with 6.9 in Southwest Greenland and 4.8 in the Scoresby Sund area. It should be noted that the average number of species in the last area is actually rather high in consideration of its much more northern location.

The species which I expect to be found by later investigations in Southeast Greenland belong partly to the faunal element found all over Greenland and partly to the southern faunal element. From the faunal element found all over Greenland I especially miss *Candona candida* (but see *Candona* sp., p. 11). *Bosmina longirostris* is not likely to be found as the area does not contain localities characterized by continental climate, and the rest of the species in this group, *Candona lapponica*, *Limnocythere sanctipatrici* and *Moraria mrazekii*, are very rarely found in Greenland. From the southern element, however, there are a number of species which should be present: *Holopedium gibberum*, *Scapholeberis mucronata*, *Alona guttata*, *A. rectangula*, *A. quadrangularis*, *Eucypris affinis hirsuta* and *E. virens*, all species which are already known from both West Greenland and East Greenland.

On the other hand, it is not impossible that a number of species of the southern faunal element, up till now known only from the west coast, might be found in Southeast Greenland. The number of species with a southwestern distribution in Greenland has been strongly reduced during more recent investigations. Prior to 1940, 18 species were thought to have this distribution. PØULSEN (1940a) then reduced the number to 16, RØEN (1962) reduced it to 13, and now there are only ten species left. Of these, four: *Latona setifera*, *Ceriodaphnia quadrangula*, *Diaptomus castor* and *Cyclops (Acanthocyclops) vernalis*, are very common to frequent in Southwest Greenland and there might therefore be a possibility of finding them in Southeast Greenland, especially on the southernmost part of the east coast.

Finally, if we look at the composition of the entomostracan fauna in the three areas, we can set up the following table in which the figures give the number of species in question. The figures in parentheses are the total number of species known for each faunal element.

	Southwest Greenland	Southeast Coast	Scoresby- sund area
Species found all over Greenland			
(9).....	5	4	8
The northwestern element (12) ..	3	1	4
The southern element (31).....	22	13	16

It is rather natural that the faunal element found all over Greenland is best represented in the Scoresby Sund area, as most of the samples have been taken from this area. It is also natural that more species of the northwestern faunal element are found in the Scoresby Sund area than on the Southeast Coast, but it is rather surprising that three species from this element are found in Southwest Greenland but not on the Southeast Coast, where the northern border has a much higher altitude than the northern border of Southwest Greenland.

As mentioned above, a number of species from the southern element seem to be missing on the Southeast Coast. Therefore, from the samples treated in this paper we cannot at present draw any new conclusions as to the zoogeographical affinities of species on the Southeast Coast or in Greenland in general.

An important result, however, is that *Leptodiaptomus minutus* has been found in East Greenland but only in the vicinity of Angmagssalik Fjord. This finding fills up the gap between West Greenland and Iceland in the distribution of this nearctic species.

It could have been expected that the entomostracan fauna of the Southeast Coast would have shown a greater affinity to the Icelandic fauna, but it is quite obvious that new collections in the area are necessary before any final conclusions can be drawn.

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