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STUDIES ON FRESHWATER ENTOMOSTRACA IN GREENLAND. I.

ARTEMIOPSIS STEFANSSONI JOHANSEN IN GREENLAND

BY

ULRIK RØEN

WITH 2 FIGURES IN THE TEXT

AN OBSERVATION ON YOUNG SPECIMENS OF *AMMODYTES DUBIUS*

BY

CHARLOTTE HOLMQUIST

WITH 1 FIGURE IN THE TEXT

KØBENHAVN
C. A. REITZELS FORLAG
BIANCO LUNOS BOGTRYKKERI A/S
1958

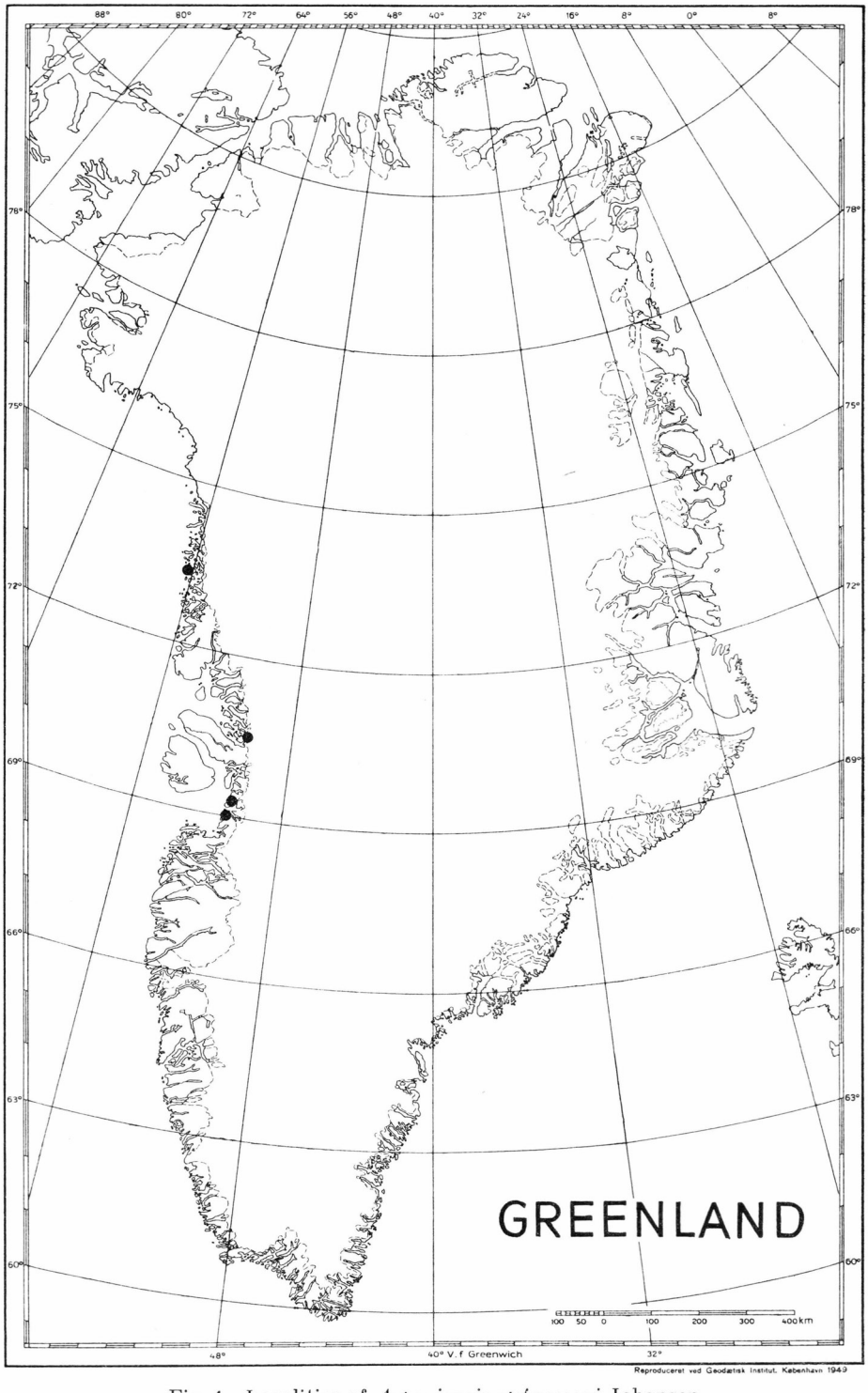

Fig. 1. Localities of *Artemiopsis stefanssoni* Johansen.

STUDIES ON FRESHWATER ENTOMOSTRACA IN GREENLAND. I.

ARTEMIOPSIS STEFANSSONI JOHANSEN IN GREENLAND

By Ulrik Røen

When investigating some ponds in the neighbourhood of Jakobshavn, West Greenland, I found in a sample of plankton some euphyllopods which seemed to differ from the fairy-shrimp common in West Greenland, the *Branchinecta paludosa* (O. F. Müller). The animals were smaller, more slender than the latter, and in the mature female the ovisac was short and wide, not, as in *Branchinecta*, long and narrow.

Examined in the laboratory the animals were identified as *Artemiopsis stefanssoni* Johansen 1922, a species known from northern Canada.

This species had not been found in Greenland hitherto, but the literature contains some notes regarding finds of *Artemia salina* (L.).

From the Zoological Museum, University of Copenhagen, I obtained some collections of Greenland entomostraca, so as to have material for comparison during my investigations. These collections comprise specimens from the material used by Wesenberg-Lund (1894) and by Vanhöffen (1897), plus 3 samples of *Artemiopsis stefanssoni*, taken in Greenland by Frits Johansen (1931), and so far not published. In the two old samples as well as in the unpublished ones the animals were determined by Frits Johansen as *Artemiopsis stefanssoni*; the tube containing the specimens from Vanhöffen's material also contained a note to the effect that the specimens were a gift from the Zoological Museum of Berlin to the Zoological Museum, University of Copenhagen.

Thus having at my disposal the whole of Wesenberg-Lund's material as well as part of Vanhöffen's, which is no doubt typical, I have no hesitation in maintaining that *Artemia salina* (L) ought to be removed from the lists of the Greenland fauna, and replaced by *Artemiopsis stefanssoni* Johansen.

The previous records of *Artemiopsis* from Greenland, now to be considered synonymous, are:

Artemia gracilis Verrill, WESENBERG-LUND. 1894 p. 95
Artemia gracilis Verrill, VANHÖFFEN. 1897 p. 167
Artemia gracilis Verrill, STEPHENSEN. 1913 p. 286
Artemia salina (L.), HABERBOSCH. 1916 p. 137
Artemia salina (L.), HABERBOSCH. 1920 p. 31

It seems rather strange that the erroneous determination should not have been corrected at an earlier date, as apparently both Wesenberg-Lund and Vanhöffen, the only ones who have worked with material from Greenland, have their doubts as to the correctness of the determination. WESENBERG-LUND writes (1894 p. 98): "I have here dwelled in some detail on the description of this interesting species because there may be some doubt about the determination", and VANHÖFFEN (1897 pp. 167—168), comparing with the original description and that by Wesenberg-Lund: "Während bei diesen die Männchen 8—10, die Weibchen 10—12 mm lang waren, massen meine Exemplare nur 5 mm. Ausserdem ist bei ihnen das Abdomen kürzer im Verhältnis zum Vorderkörper, und die Bruttasche des Weibchens so breit, dass ich anfangs eine neue Art gefunden zu haben glaubte."

There is a 6th note on *Artemia* in connection with Greenland which should not be overlooked, as it might give the impression that the species after all does exist here. BÖCHER (1949 p. 56), writing on the zooplankton of Store Saltsø near the head of Søndre Strømfjord, states: "WESENBERG-LUND (1937) writes that *daphniae* (species of *Artemia*) play a very great part in salt lakes all over the world. They contribute to the red colouring of the water, "and it is stated that they may be found lying as red fringes along the shores". This statement thus may be corroborated by me." In September 1956 I had the opportunity, together with Professor Böcher, of paying a visit to Store Saltsø. A sample of plankton from the locality proved to consist almost exclusively of *Daphnia pulex* (de Geer). *Artemia* or *Artemiopsis* was not found.

The map (fig. 1) shows the localities of *Artemia stefanssoni* in Greenland. They are, from south to north: Claushavn (3/8 1890 Lundbeck leg.[1])

[1]) WesenbergLund gives the locality and date for this specimen: "Claushavn, Will. Lundbeck 1889". Johansen's label in the collection of the Zoological Museum of Copenhagen has: 3/8 1890 W. Lundbeck leg. The original label has unfortunately been lost. VANHÖFFEN (1897) writes (p. 167): "Die Weibchen allein wurden 1891 von Lundbeck, dem dänischen Entomologen, bei Claushavn gesammelt, und von Wesenberg-Lund 1894 beschrieben". Having gone through the report on Lundbeck's journey I find that the date on the label is correct. On that date Lundbeck was in Claushavn and writes: "In a lake I collected a number of Crustacea". (LUNDBECK 1891 p. 135). The year 1889, given by Wesenberg-Lund, must be a mistake. In that year Lundbeck was travelling from Holsteinsborg to Julianehåb in South Greenland. Vanhöffen's mistake no doubt results from the publication of Lundbeck's report in 1891.

(Wesenberg-Lund 1894)), Jakobshavn (22/7 1956 and 24/8 1956 author leg.), Qarajaq Nunataq (23/7 1893 Vanhöffen leg. (Vanhöffen 1897)) and Tasiussaq (20/7 and 15/8 1931 F. Johansen leg.). Besides these there are two more samples, both collected by Frits Johansen and labelled: 1. Lake on the northern part of the island of Upernavik, West Greenland, 28/7 1931, and 2. Lake, about 3 feet deep, on the ridge on the northern part of the island of Upernavik, West Greenland. The two samples are probably from the same locality, as one contains only isolated *Artemiopsis stefanssoni*, and the other contains the species together with a great many other freshwater entomostraca. I have tried to locate the place, but have not definitely succeeded. Most likely it is on the northernmost part of the island where the town of Upernavik is situated. On the other hand I have never seen this island called "island of Upernavik" on any map. The nearest island correctly called by that name, is the "Island of Upernavik" situated in the north eastern part of Umanak Fjord. Of this island the northern part, however, is very inaccessible, and considering the means of transport available in Greenland, it would be very difficult to cover the distance from Tasiussaq to there in 7 days. For this reason the locality is not given on the map.

Comments on the material.

The following must be added to the original description given by Johansen (1922 p. 26), and to the previous description of the Greenland species:

The male. The male specimens from Greenland are smaller than pointed out by Johansen, who states: "The males measured from 7 to 10 mm, and in spite of their size they were fully mature, and continually copulating with the females."

I have measured the lengths of the males from the whole of the material. In the small samples all specimens were measured, and 25 individuals out of each of the large samples, giving the following result:

	average length	largest specimen	smallest specimen
Tasiussaq 20/7 1931	4.5 mm	5.6 mm	3.8 mm
— 15/8 1931	3.4 mm	4.4 mm	3.1 mm
Island of Upernavik 28/7 1931	4.5 mm	5.6 mm	3.9 mm
Qarajaq Nunataq 23/7 1893.	3.8 mm	4.9 mm	3.0 mm
Jakobshavn 22/7 1956	5.7 mm	5.9 mm	5.5 mm
— 24/8 1956	6.8 mm	7.5 mm	6.1 mm

It must be noted that the two collections from Tasiussaq are from two different localities, and that the great difference in size must be

due to biological conditions. Only one sample contains specimens of a size larger than the minimum given by Johansen.

Only mature individuals are taken into consideration in the present investigation, each specimen having been checked and found fully developed. VANHÖFFEN (1897 p. 167) gives the length as 5 mm, though the figures show that the males of his material, which I have gone through, are somewhat smaller.

In a single character the specimens from Greenland diverge from the original description. On the terminal joints of the claspers (fig. 2) on the dorsal side near the basis, is a small process furnished with spinules. This process does not appear in Johansen's drawing, nor is it mentioned in the text. He has probably overlooked it. In all other characters and in the proportions of the body, the specimens from Greenland agree well with the original description.

The female. The females from Greenland are also smaller than those of the original description. Johansen mentions 8 to 11 mm. Measurements of the present material give:

	average length	largest specimen	smallest specimen
Tasiussaq 20/7 1931	5.1 mm	6.8 mm	4.1 mm
— 15/8 1931	5.2 mm	6.0 mm	4.0 mm
Island of Upernavik 28/7 1931	5.1 mm	6.1 mm	4.3 mm
Qarajaq Nunataq 23/7 1893.	4.4 mm	5.3 mm	2.9 mm
Jakobshavn 22/7 1956	5.1 mm	5.3 mm	4.9 mm
— 24/8 1956	7.8 mm	8.8 mm	6.4 mm
Claushavn 3/8 1891	4.6 mm	5.6 mm	3.4 mm

To make sure that all specimens measured were mature, only individuals with eggs in their ovisacs were taken into consideration. It will be seen that also here one sample only contains individuals of a size larger than the minimum size in the original description. The size mentioned by Vanhöffen is near enough correct. On the other hand it is very strange to read the note by WESENBERG-LUND (1894 p. 95): "*Artemia gracilis*, which is only 12 mm long ----". Wesenberg-Lund's material originally comprised 16 specimens, all females. Of this material there are now left in the tube only 8 complete individuals and 3 defective ones (head or abdomen lacking). It seems a strange thing that the 5 missing specimens should have been so much larger than those remaining, more so as the bodies of the defective specimens are no larger than the bodies of those intact. It is possible that Wesenberg-Lund has not measured his specimens himself, but just given the length stated in the original description of *Artemia gracilis* Verrill. Unfortunately the present writer has not had the opportunity of seeing this paper.

On the number of eggs JOHANSEN just writes (1922 p. 28): "These females – – – – had a great number of ripe, red-brown eggs – – – –". Wesenberg-Lund found 8 to 16 eggs, and Vanhöffen 5 to 9. In the material from Claushavn, used by Wesenberg-Lund, I only found 1 to 5 eggs, but as the animals were in a bad condition some of the eggs may have disappeared. The number in the Vanhöffen collection was as stated, and in the rest of the samples I have found every number from 1 to 25, the number increasing with the size of the animal.

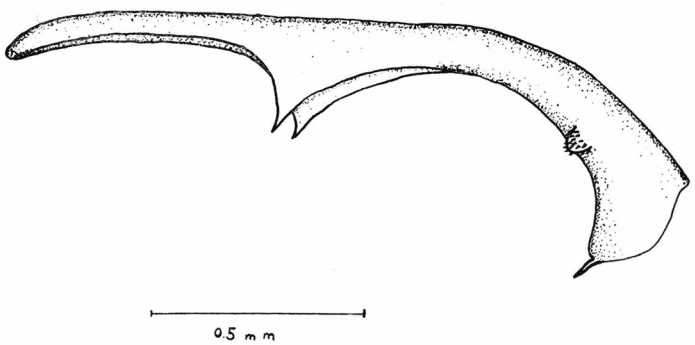

Fig. 2. Terminal joint of the claspers of *Artemiopsis stefanssoni* from Greenland.

The eggs were of a constant size of about 0.3 mm in diameter. I have measured eggs from all localities and from many specimens, but found no variation. It is not possible to find any character in which the Greenland specimens differ from the Canadian ones.

There is a single character I want to emphazise. JOHANSEN (1922 p. 28) writes: "The ovisac is very large and oval, its transversal diameter being longer than the longitudinal", and WESENBERG-LUND (1894 p. 98) says: "– – – – the ovisac, which is at least 3 times as broad as long." The specimens investigated by the present writer show quite plainly that with the increasing number of eggs the transversal diameter increases more than the longitudinal diameter:

Number of eggs	longitudinal diameter	transversal diameter	length as % of breadth
2	0.80 mm	1.00 mm	80.0
3	0.80 mm	1.07 mm	74.8
4	1.07 mm	1.40 mm	76.4
4	0.87 mm	1.17 mm	74.4
5	0.87 mm	1.23 mm	70.7
5	0.83 mm	1.23 mm	67.5
6	1.00 mm	1.47 mm	68.0
6	0.83 mm	1.30 mm	63.8

(*continued*)

Number of eggs	longitudinal diameter	transversal diameter	length as % of breadth
6	0.83 mm	1.30 mm	63.8
7	0.83 mm	1.10 mm	75.5
8	0.93 mm	1.50 mm	62.0
9	0.93 mm	1.40 mm	66.4
9	0.87 mm	1.40 mm	62.1
9	1.07 mm	1.77 mm	60.5
10	1.07 mm	1.60 mm	66.9
11	1.07 mm	1.73 mm	61.8
11	0.97 mm	1.63 mm	59,5
13	1.00 mm	1.90 mm	52.6
17	1.17 mm	2.10 mm	55.7
18	1.20 mm	2.13 mm	56.3
20	1.00 mm	1.77 mm	56.3
20	1.00 mm	1.97 mm	50.8
20	1.20 mm	2.37 mm	50.6
22	1.07 mm	2.17 mm	49.3
25	1.27 mm	2.43 mm	52.3

This table confirms the fact that the transversal diameter is longer than the longitudinal diameter; the proportions, however, are in no case 3 : 1 as stated by Wesenberg-Lund. The Claushavn specimens were unfortunately in such bad condition that they could not be taken into consideration here; very likely Wesenberg-Lund has used the contents of the ovisacs and not the ovisacs themselves, the hindmost part of the latter being normally empty.

I wish to express my very sincere thanks to the Directors of the Arctic Station, University of Copenhagen, Professor Dr. T. W. Böcher Professor, Dr. R. Spärck, and Professor, Dr. M. Westergård for their never ceasing interest in the work at the station.

I also wish to thank Mr. T. Wolff cand. mag. for his valuable assistance in procuring the material from the Zoological Museum in Copenhagen.

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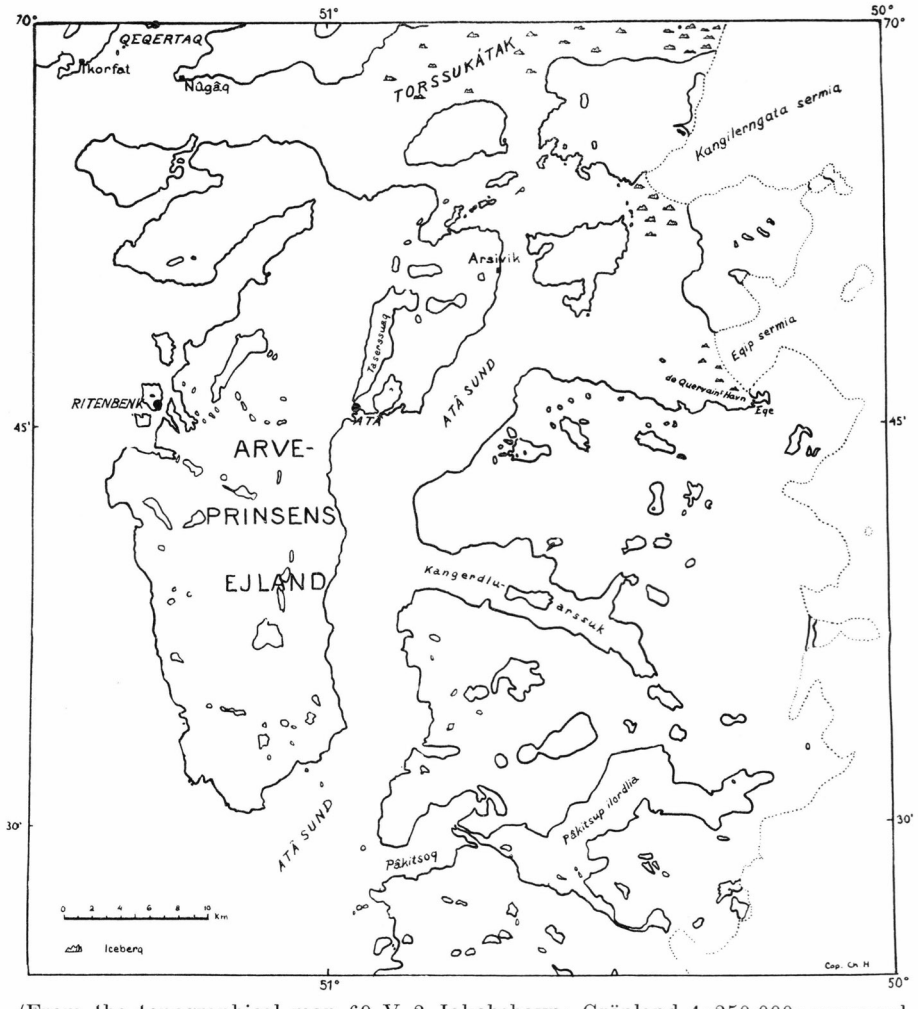

(From the topographical map 69 V. 2 Jakobshavn; Grönland 1:250 000; surveyed 1931—32, Geodetic Institute, Copenhagen 1953).

AN OBSERVATION ON YOUNG SPECIMENS OF *AMMODYTES DUBIUS*

By Charlotte Holmquist

In the summer of 1956 I paid a visit to the Danish Arctic Station at Godhavn, Greenland, for some zoological investigations. On the 26th of July a survey was undertaken of the waters off Atâ on the eastcoast of Arveprinsens Ejland, 69°46′ N, 50°57′ W (see map). During the investigation of the boat-harbour, a bay to the south-west of Atâ, the tide was coming in, driving a great many larger and smaller pieces of icebergs into the bay. One of these lumps of ice came alongside our rowing-boat and, looking on it, I saw something that was rather interesting.

The little piece of ice, one metre or a little more in diameter, had some excavations, two of which were about half a metre in diameter and formed something like diminutive lagoons. In these ice-lagoons some small creatures were swimming around or resting on the bottom. None of these animals were found outside the lagoons, none of them made any efforts to get out into the open water, and if one was put to the mouth of the lagoon it immediately went inwards again. When swimming about they were very lively. They proved to be some young fish, a few centimetres in length, very transparent, with black eyes and with some distinct pigment rows. I took some of them and preserved them for identification later on.

On examination the fish were found to belong to the genus *Ammodytes*. They are elongate, and of the paired fins the pelvic ones are lacking. Ten of the specimens were more thoroughly examined and, for counting of the vertebrae, made transparent by benzyl benzoate. In these specimens, 25—29 mm in length, the number of vertebrae is 74—78; the number of pectoral fin rays = 13—14; dorsal fin rays = 63—68; anal fin rays = 32—35. These figures quite agree with those given in the literature for *Ammodytes dubius* Reinhardt 1838 (Jensen, 1941, p. 26). According to Jensen, who tried to solve the problem, it should, however, be considered as a subspecies of *Ammodytes lancea* Cuvier and thus in reality be called *A. lancea dubius* Reinhardt (1941, p. 29). Other sub-

species of *A. lancea* should be *A. lancea lancea* Cuvier and *A. lancea marinus* Raitt.

In his paper of 1941 (p. 24) JENSEN gives a "chart sketch of West Greenland showing localities where *A. marinus* and *A. dubius* have been taken". From this map and from the list on p. 22 it is seen that in the Disko Bugt area *A. dubius* is taken at four localities, i. e. Egedesminde and a locality near to it (Manîtsoq ?), Ikamiut and Christianshaab, which are all situated in the southern part of the Bay; *A. marinus* is taken at two localities: Godhavn and Jakobshavn. Furthermore JENSEN says (p. 25): "Among the Greenland specimens of *Ammodytes* there is one . . . sent down in 1911 by Mr. M. PORSILD, the leader of the arctic station in Godhavn. . . . is referable to *A. lancea*. It is hardly accidental that *A. lancea* occurs, though evidently rarely, just at Godhavn, since among the 13 specimens examined from this place there is no *A. dubius* ,but only 12 *A. marinus* . . .". The differences in the distribution in the Disko Bugt area, as apparent from these records, may be due to differences in sampling at the various localities. I quote once more from JENSEN (1941, p. 30 and 31): "As regards the vertical distribution there is thus on the whole a distinct difference between *A. lancea* and *A. marinus*, the former being found in fiords and near the coasts in shallow water, while the latter occurs away from the coast in deeper water. . . . Finally, *A. dubius* is a pronounced arctic subspecies, since it occurs at Greenland, being the predominant form there." The collecting may have been done in shallower water in some localities, in deeper water in others. Without such a supposition the geographical distribution of these animals in the Disko Bugt area seems to me rather curious.

The present record of *A. dubius* from the sea off Atâ adds to our knowledge of its distribution in the area. It is, however, not easy to say from where the piece of ice came, with the specimens in the ice-lagoons. *A. dubius* may be found in the open water off Atâ though I did not notice it. Some icebergs were seen in the Atâ Sund. They came from the waters and from the glaciers to the north-east of Atâ Sund (see map). One of the larger ones had run ashore just off Atâ at the time for the visit. Now and then smaller and larger pieces were broken off from the icebergs. If the piece of ice with *Ammodytes dubius* in its lagoons came from such an iceberg in the vicinity, or if it had drifted all the way from the glaciers, I do not know. It is, however, noteworthy that the small animals seemed to have adopted this curious locality as a quite natural dwelling-place, since they did not even try to escape into the open water but immediately went back into the ice-lagoon when put to the mouth of it. They may have drifted like that a good way.

There seems to be very little known on the ecology of *Ammodytes dubius*. JENSEN says (1941) on the species *Ammodytrs lancea* s. l. (p. 31):

"The general impression is, in my opinion, that the different conditions under which the species *Ammodytes lancea* lives, e. g. depth, temperature and salinity of the water, spawning time, contribute towards the formation of subspecies and races, which in this respect can be considered as ecologically conditioned." But as far as I can see nothing is mentioned about the depth, the temperature and the salinity of the water etc. in the different localities. JENSEN only states that "most of them are from fiords or near the coast; some from banks . . ." (p. 7). Some notes are given by DUNBAR & HILDEBRAND (1952, p. 112) according to *A. dubius:* ". . . taken in plankton nets . . ., in quite shallow water (five to six metres). The bottom was a muddy glacial sand." Otherwise the ecology of these animals seems to be quite unknown. It seems as if the taxonomy of the different species or subspecies has been the main interest of the investigators of the genus *Ammodytes.*

In the boat-harbour at Atâ the salinity of the surface water proved to be 27.9 ‰ at the time for the investigation (26/7 1956; tide setting in); 1.5 m depth — 30.1 ‰; 5 m — 31.7 ‰ (bottom). The temperature measured was: 1.5 m — 5. 25° C; 5 m — about 4.75° C. However, these conditions may have differed considerably from those in the ice-lagoons where the young *Ammodytes dubius* were found. Unfortunately, the particular conditions of the lagoons were not investigated because of shortage of time, but on account of melting of the ice the water in the lagoons may have been of a lesser salinity. Anyhow, it must have been considerably colder within the lagoons than in the water of the boat-harbour. The fish also rested for long periods just on the ice, i. e. at the bottom of the lagoons, which must have been rather cold. Perhaps the fact that the young *A. dubius* may prefer a fairly low temperature will explain why these animals did not turn outside the ice-lagoons and why they immediately went inside when put to the mouth of the lagoon. It may be that they also were protected from predators on these extreme localities and thus were retained. So far as I can discover, there is nothing known on the spawning of *A. dubius.* This may take place in shallow water near to the glaciers or else near to ice where the surface water on account of melting of the ice is of a lesser salinity than the general sea-water and has a lower temperature. Perhaps it would be worth while investigating.

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