

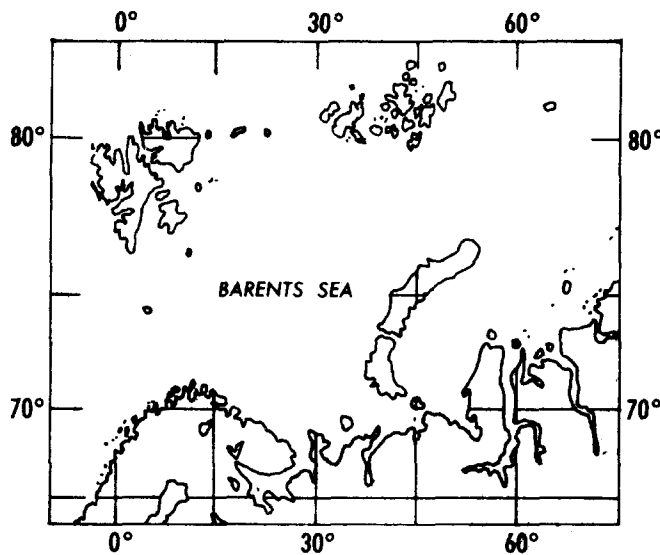
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INFORMAL REPORT

PLANKTON DISTRIBUTION
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INFORMAL REPORT

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ACKNOWLEDGMENTS

Generous assistance in the identification of many forms has been rendered by the following specialists in their respective fields: Dr. Thomas E. Bowman (Amphipoda and Copepoda), Mr. Olav Dragesund (fishes), Dr. Norman Hillman (Ostracoda), Mr. Thomas K. Newbury (Chaetognatha), Dr. I. M. Newell (mites), Dr. Marian Pettibone, (Polychaeta), and Dr. Stig Skreslet (jellyfishes, Euphausiacea, Decapoda Crustacea, Cumacea). The author wishes to thank these people for their help.

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I. INTRODUCTION

An oceanographic survey was conducted in the Barents Sea by the Naval Oceanographic Office (NAVOCEANO) aboard USS TANNER (AGS 15) from 20 July to 31 August 1963. This report presents only the results of the analyses of 44 plankton samples obtained on the survey.

A. Physical Environment.

The Barents Sea lies entirely within the Arctic Circle. The sea is delimited to the west from the Norwegian Sea by an imaginary line from North Cape, Norway, northward to Bear Island and Spitzbergen, to the north on a line from Spitzbergen to Franz Josef Land, to the east by Novaya Zemlya, and to the south by Norway and the U.S.S.R. Average depth in the Barents Sea is 220 meters, and a maximum depth of only about 600 meters occurs near the boundary of the Norwegian Sea.

Interesting oceanography results from the interaction of converging Atlantic and Arctic Waters in the Barents Sea (Fig. 1). The currents within the sea form a counterclockwise movement with a number of gyres in the central part (Demel and Rutkowicz, 1966). Atlantic waters enter the Barents Sea between Bear Island and North Cape as the North Cape Current. This current, a branch of the Gulf Stream, is deflected northeasterly as the Murman Current which moves warm, relatively high salinity water northeastward along the coast of Novaya Zemlya.

Arctic waters enter the Barents Sea mainly in the East Spitzbergen Current, which flows southwestward between Spitzbergen and Franz Josef Land, and in the Bear Island Current, which flows westward between Franz Josef Land and Novaya Zemlya. These currents move cold, relatively low salinity water.

The mixing of warm Atlantic waters with colder Arctic waters results in a nutrient enrichment and a high oxygen content throughout much of the Barents Sea.

In winter, ice covers only two-thirds of the Barents Sea; the southern part is relatively ice free except in isolated fiords along the Norwegian coast. In summer, ice mostly thaws, and only in the coldest years does it persist in the middle and northern parts of the sea and near Novaya Zemlya. The climate of the Barents Sea, as elsewhere in the Arctic, has recently shown a warming trend. The result is an extension of distribution ranges of many Atlantic marine organisms into the Barents Sea (Fig. 2).

B. Results of Previous Investigations.

Russian biologists have studied the biology of the Barents Sea for at least 30 years. Zenkovich (1963) found that the extreme annual

temperature range in the sea results in a marked seasonal variation in the plankton volume. In winter, the zooplankton and phytoplankton biomass in the surface layers is less than 20 mg/m^3 . In spring, near the ice floes, the biomass concentrations may exceed $2,000 \text{ mg/m}^3$, and in summer, the biomass averages about $1,000 \text{ mg/m}^3$.

Demel and Rutkowicz (1966) state that vertical migration of zooplankton to the surface in the Barents Sea, particularly crustaceans, ceases during the prolonged daylight of the Arctic summer. During summer, the plankton are concentrated at a depth of about 150 meters, and surface bioluminescence, as a result, is a minor consideration. During September and October, with the seasonal resumption of alternating 12-hour periods of daylight and darkness, the plankton resume a daily migration to the surface. Surface bioluminescence periodically may be important, therefore, in autumn, winter, and spring. Although winter plankton biomass is considerably less than summer biomass, there are undoubtedly times when surface bioluminescence is significant in winter.

II. METHODS OF COLLECTION AND ANALYSIS

Plankton hauls were attempted at 46 station locations in the Barents Sea, and plankton samples were obtained at 44 of the stations (samples from stations 10 and 30 were lost) (Fig. 3). Of the 44 plankton sample volumes obtained, 36 samples were taken with a #8 mesh, 1-foot diameter net, seven samples with a #5 mesh, 1/2-meter diameter net, and one sample with a #10 mesh, 1/2-meter diameter net. Forty-three samples were taken by horizontal tows at depths ranging from the surface to 350 meters with an approximate average depth of 150 meters. One sample was obtained by a vertical haul from 57 meters. The durations of the tows were 30 minutes for 41 tows and one tow each for 5, 37, and 44 minutes. In addition, a white secchi disc was lowered at most stations to obtain visibility data. All operations were performed as the ship drifted on station.

The net was not weighted, and no method was available for opening or closing the net. Therefore, varying amounts of plankton probably entered the net as it was lowered to the selected depth and as it was raised to the surface.

Since no attempt was made to determine the volume of water passing through the net or the velocities of wind and current, a quantitative statement cannot be made. However, assuming that a constant drift prevailed in the Barents Sea and by correcting, where necessary, for the durations of the tows and for the net ring diameters, the data appear appropriate as an index of relative abundance of the various plankton groups.

In the laboratory, each plankton sample was measured by the volumetric displacement method. The drained plankton sample was placed in a

graduated cylinder, and water was added to bring the total to 100 cc. The drop in the water column on removal of the sample from the cylinder indicated the volume of the sample. In samples containing 1 cc or less of plankton, all specimens were counted. Samples having a greater volume of plankton than could be conveniently counted were separated into aliquots by means of a Folsom plankton splitter. The largest specimens were removed before the sample was split. The constituents of the split were counted and identified using a 35-power microscope. From these counts, an estimate was made of the total number of each type of plankton in the entire sample.

III. PLANKTON ANALYSIS

Analyses of the plankton samples indicate at least three groups of well-defined plankton associations in the Barents Sea that are apparently related to the point of origin. Each group had characteristic organisms although some species were obtained throughout the sea. The three assemblages consisted of the following: (1) a group of organisms in the central portion of the Barents Sea which forms a semi-permanent population; (2) a group of southern affinities which is carried regularly into the sea with the North Cape Current; and (3) a group of Arctic forms which enters the northern portion of the sea with water masses between Spitzbergen and Franz Josef Land. The distribution of several indicator species in each water mass delineates to a certain extent the course and boundaries of the water masses, and the eddies between the major currents sometimes contain the largest volume of plankton. These eddies act as effective barriers which limit the distribution of indicator species from one water mass to another.

During summer in the Barents Sea, plankton are concentrated at approximately 150 meters (Demel and Rutkowitz, 1966). Figure 4 shows the temperature distribution at 150 meters as observed during this survey. Surface temperature and salinity are contoured in Figures 5 and 6, respectively. Plankton wet volume in cubic centimeters and the depth of collection in meters for each sample are shown in Figure 7. A station data summary is presented in Table I. The estimated numbers of plankton taxa at each station are listed in Table II.

Horizontal distributions of the most numerous or interesting species are presented in Figures 8 through 40. The large numerical differences in plankton counts between the almost identical locations of stations 1 and 20 occur because these stations were taken 31 days apart.

A. Protozoa.

Ceratium sp., a bioluminescent dinoflagellate, ranged in small numbers throughout most of the Barents Sea with areas of relatively high concentrations at the most northeasterly, southeasterly, and southwesterly stations. This form was most abundant above 115 meters and is considered mainly a surface species (Fig. 8).

Another bioluminescent nonflagellate, Peridinium sp., apparently of Arctic origin, was found at two stations only. Demel and Rutkowicz (1966) state that nocturnal bioluminescence in the Barents Sea is produced in part by bacteria and dinoflagellates.

Foraminifera (Globigerina sp.) also seemed to be an indicator of Arctic Water (Fig. 9). This form occurred in great numbers only in the northeast sector of the sea. Radiolaria were collected at a few stations, the greatest number being observed at station 23 near the Norwegian coast.

B. Coelenterata.

Jellyfishes were obvious indicators of Atlantic Water and were virtually confined to the North Cape Current where surface salinity exceeded 34 o/oo and surface temperatures ranged between 3° and 9°C (Fig. 10). No attempt was made to sort all the jellyfishes to species, but the following were identified: Aglantha digitale, seemingly the most numerous, and Halopsis ocelata, second in order of abundance. Also present were Ptychogene lactea and Euphysa flammea. Jellyfishes in the Barents Sea are known to be a source of bioluminescence (Demel and Rutkowicz, 1966).

The abundance of Siphonophora was determined by a nectophore count. Siphonophora were widely distributed and most numerous near the confluence of Arctic and Atlantic Waters (Spitzbergen and North Cape Currents) where they were perhaps a permanent part of the seasonal fauna of the central sea (Fig. 11). Dinophys arctica was the only species recognized although several more species likely occurred.

C. Chaetognatha.

Chaetognatha (arrow worms) are recognized as indicator species of water masses in some parts of the world. Two species of this phylum formed about 0.1 percent of the plankton. Eukrohnia hamata, a species of worldwide distribution, was transported into the Barents Sea in the tongue of 35 o/oo salinity water which forms the North Cape Current. Its numbers decreased rapidly from the southwest approaches to the central portion of the sea (Fig. 12). The other species, Sagitta elegans, was less numerous and in contrast ranged in a northwestward direction across the central portion of the sea from a concentration west of Kolguyev Island on the Russian coast (Fig. 13). Arrow worms formed about 0.25 percent of the total plankton.

D. Annelida.

Polychaete worms were numerous at stations in the southwestern approaches to the Barents Sea at surface temperatures near 9°C (Fig. 14). Among the forms collected were sponiid larvae and Tomopteris helgolandica.

The latter species appears to have been carried into the Barents Sea from the Atlantic Ocean and was scarce and limited to the central portion of the sea.

E. Arthropoda.

Crustaceans normally compose 80 to 90 percent of marine plankton by volume and outnumber all other groups in variety of species. They are the chief source of scintillating bioluminescence, and certain of the copepods and euphausiids that occur in large numbers are capable of generating significant surface illumination.

In most oceans, copepod crustaceans usually comprise the major portion of the zooplankton in volume, in total individuals, and in numbers of species. The variety of copepods decreases northward toward the pole. During the summer, the volume of copepod biomass tends to reach a maximum in polar seas. Many temperate and tropical species of copepods, like numerous other plankters, are negatively phototropic; i.e., they tend to avoid strong daylight by remaining at 150- to 200-meters depth during daylight hours and by rising to near the surface during hours of darkness. Thus, these copepods tend to form a layer of some definite thickness which undergoes a diurnal migration. Likewise, boreal and Arctic copepods and other plankton display the same negative phototropism by adjusting the frequency of their diurnal migration to the varying length of the Arctic day.

1. Copepoda. Calanus finmarchicus was the most numerous copepod in the Barents Sea and composed about 42 percent of all the Copepoda collected. This species, the main food item of young herring which follow it into the Barents Sea in the North Cape Current, sometimes occurs in dense swarms that tint the sea red. At station 8 (temperature about 2°C) at 150 meters, about 266,000 specimens of C. finmarchicus made up most of the 150 cc of plankton taken at this station (Fig. 15) which was the largest individual plankton collection.

Oithona similis was the second most abundant copepod and comprised about 25 percent of the Copepoda. O. similis was concentrated in the eddy formed northwest of the Murman Current (Fig. 16). This species apparently has established itself in this part of the Barents Sea and is augmented by an influx of additional recruits from the Norwegian Sea.

Metridia spp. composed 9 percent of the Copepoda collected. M. longa was the principal species identified. This form was most numerous in the current eddies of the central portion of the sea and in temperatures below 3°C (Fig. 17). It appeared to form a disjunct population in the central Barents Sea with little replacement from incoming currents. M. longa emits a flash of blue light so intense when disturbed that it easily can be seen in full daylight.

Microcalanus pygmaeus (Fig. 18), considered an Arctic species, was collected at 42 of the 44 stations and constituted about 6 percent of all the Copepoda.

Pseudocalanus minutus, another Arctic species, reached maximum numbers in the convection currents of the polar front west of Novaya Zemlya at temperatures below 0°C (Fig. 19). This species composed about 5 percent of the Copepoda and was collected at all but four of the stations.

Oncaea sp. also composed about 5 percent of the Copepoda collected. The species occupied an isolated position in a major gyre between the Bear Island and Murman Currents where water temperatures were between -2° and 1°C and water depth was 330 meters (Fig. 20). Oncaea is a bioluminescent genus.

Copepod nauplii (earliest stage of larvae) made up about 4 percent of all Copepoda species in these collections. The nauplii were most numerous in the convergence between the North Cape and Spitzbergen Currents (Fig. 21).

Paraeuchaeta norvegica, totaling about 0.5 percent of the Copepoda, spread across much of the Barents Sea. The main concentration was at station 16 in the northwestern part of the sea (Fig. 22).

Calanus hyperboreus composed about 0.2 percent of the Copepoda and was collected at 38 stations. Transport of this species is indicated from the northeast in the Bear Island Current. C. hyperboreus was most numerous at station 40 where temperatures varied between 8°C at the surface and 0.74°C at 145 meters (Fig. 23).

Temora stylifera, a species preferring the shallow waters of bays and estuaries, was collected only at one location (station 42) off the Russian coast at depths of not more than 45 meters (Fig. 24). This genus made up only a trace of the total Copepoda.

Microsetella norvegica was scattered in small numbers and evidently was carried into the Barents Sea from the Norwegian Sea (Fig. 25).

Tisbe sp. was present in small amounts (Fig. 26). This form was most numerous at station 31 in the north and at station 24 in the south.

Scolicithricella minor (Fig. 27) was widely distributed in small numbers throughout the sea and was most numerous in the northern and southern portions. There is evidence that this species enters the sea in the tongue of the high salinity Atlantic Water introduced by the North Cape Current.

Gaidius tenuispinus (Fig. 28) is an Arctic species which may be

carried into the Barents Sea by the Spitzbergen Current. It appeared sporadically throughout the sea. G. tenuispinus was most numerous near the central portion in the convergence between Arctic and Atlantic Waters.

Three additional species of copepods occurred in trace amounts. Pleuromamma robusta, an Atlantic species, occurred at station 21 in the southwest approaches to the Barents Sea. Heterorhabdis norvegica, a boreal and polar form, was collected at five stations in the central portion of the sea. A single specimen of Xanthocalanus borealis was collected at a northern station.

2. Cirripedia. Balanus sp. (barnacle) larvae were concentrated in the vicinity of Bear and Hope Islands. Somewhat surprisingly, these larvae also were collected at several stations in the gyres of the central portion as far as 900 miles offshore (Fig. 29).

3. Ostracoda. The ostracod Conchecia elegans appeared to have been transported from the Arctic Ocean by the Bear Island Current. This species was most abundant at the east-central stations (Fig. 30).

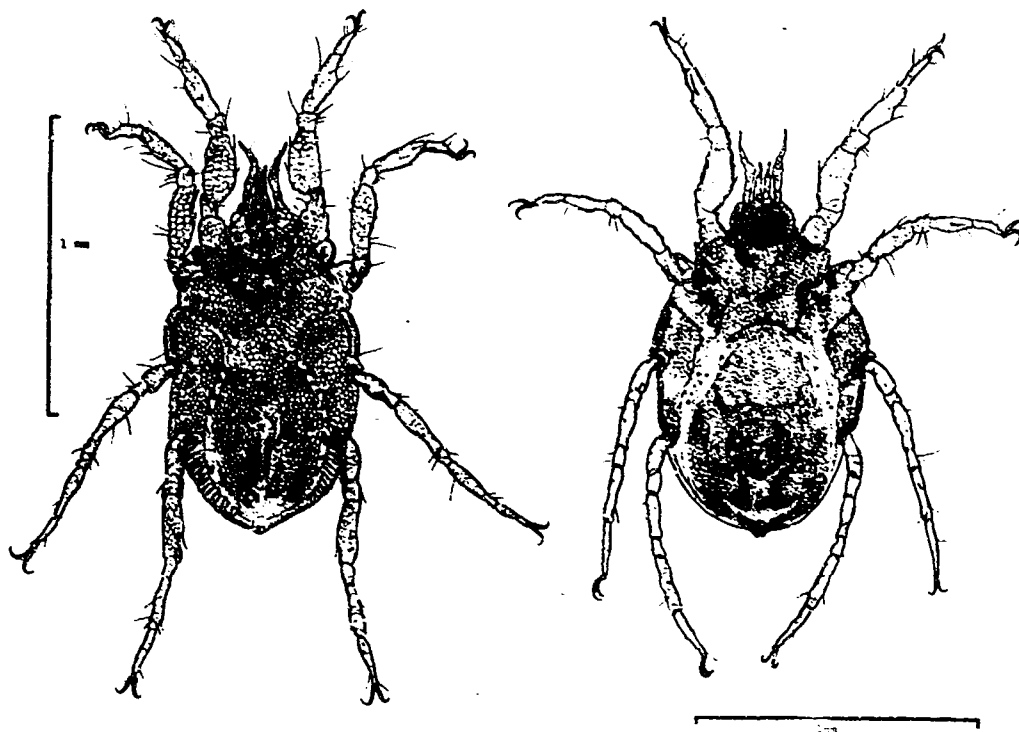
4. Euphausiacea. Euphausiids (krill) apparently were carried into the southwestern portion of the Barents Sea in the high salinity water of the North Cape Current (Fig. 31). Most of the species of Euphausiacea are bioluminescent and form the chief food of several species of baleen whales. The euphausiids composed about 0.15 percent of the crustaceans in this collection. The following species of Euphausiacea were identified from the plankton samples: Thysanoessa neglecta, Thysanoessa longicaudata, Meganctiphanes norvegica, and Rhoda inermis. M. norvegica is highly bioluminescent at the surface during polar night (Demel and Rutkowitz, 1966).

5. Amphipoda. Amphipoda (Fig. 32), present at 35 stations, reached maximum concentrations in the eddies between the North Cape and Murman Currents, the Bear Island and East Spitzbergen Currents, and the East Spitzbergen and North Cape Currents. Parathemisto was the dominant genus and was represented by at least two species: P. libellula and P. abyssorum. Hyperoche medusorum also was found. Some of the species seem to be of Arctic origin.

6. Decapoda. Decapod crustacean larvae were found in the southwestern part of the Barents Sea (Fig. 33). Caridea (Sabinea septemcarinata) and Anomura (Pagurus bernhardus) were identified in the collection as well as a megalops stage of a Brachyuran. These forms were present only in trace amounts.

7. Acarina. Two species of benthic mites were collected at three stations in the northwestern portion of the Barents Sea (stations 3, 4, and 5, Figure 34). One of the species was identified as Copidognathus thalassaracna, and the other species proved to be a species of Copidognathus new to science.

Because of the complexity of the genus Copidognathus and the great number of species, I. M. Newell estimates 1,000 (personal communication), the description of this species will be deferred until time permits a more careful study of the specimens. The drawings below, hopefully, will suffice to show diagnostic characteristics by which the species may be recognized in the meantime. The name Copidognathus spenceri will be submitted for this species, named for Dr. Warren P. Spencer, emeritus professor of biology at the College of Wooster (Ohio).



Copidognathus spenceri,
(new species, male)

Copidognathus spenceri,
(new species, female)

Type specimens of this new mite are retained in the reference collection at NAVOCEANO.

F. Mollusca.

Mollusca, mostly pteropods, made up about 5 percent of the plankton. Lamellibranchiata (bivalves) larvae were collected at five stations, being most numerous at stations 15 and 20 (Fig. 35). The boreal pteropod Clione limacina, transported from the Norwegian Sea, was collected at most of the stations. This species was most numerous in the southwestern approaches to the Barents Sea (Fig. 36). The larvae of the coiled pteropod Limacina sp. were present in large numbers in the major eddy west of the Murman Current (Fig. 37).

G. Echinodermata.

Larval echinoderms, mainly young sea stars (Asteroidea), were numerous in the Atlantic approaches to the Barents Sea. Echinoderm larvae showed an affinity for a salinity of 35 o/oo. The limit of their range extended across the southern portion of the sea (Fig. 38). These forms composed about 0.35 percent of the plankters collected.

H. Chordata.

Larvacea, represented by Oikopleura, were most abundant at the most southeastern, southwestern, and northern stations in the Barents Sea (Fig. 39). These forms are bioluminescent.

Fish larvae were collected at 5 stations. The largest concentration was 30 immature pleuronectids (flat fish) at station 43 (Fig. 40).

IV. SUMMARY

The analyses of the plankton collections indicate that certain species appear to have somewhat isolated populations in the Barents Sea. Other species are of Atlantic origin, transported by the North Cape Current, and of Arctic origin, transported by the East Spitzbergen and Bear Island Currents. The following plankton appear to fit into the respective groups:

<u>Isolated Populations</u>	<u>Atlantic Origin</u>	<u>Arctic Origin</u>
Siphonophora	All jellyfish	Peridinium sp.
<u>Oithona similis</u>	<u>Tomopteris helgolandica</u>	<u>Globigerina sp.</u>
<u>Metridia sp.</u>	<u>Calanus finmarchicus</u>	<u>Microcalanus pygmaeus</u>
	<u>Scolicithricella minor</u>	<u>Pseudocalanus minutus</u>
	<u>Eukrohnia hamata</u>	<u>Calanus hyperboreus</u>
	<u>Pleuromamma robusta</u>	<u>Gaidius tenuispinus</u>
	<u>Euphausiacea</u>	<u>Heterorhabdis norvegica</u>
		<u>Conchecia elegans</u>

A new species of benthic mite was collected on this survey in the Barents Sea. The name Copidognathus spenceri will be submitted for this species.

VI. BIBLIOGRAPHY

- Demel, K., and Rutkowicz, S. 1966. The Barents Sea. Translation of Morze Barentsa published by Wydawnictwo Morskie. Gdynia, 1958. The Scientific Publications Foreign Cooperation Center of the Central Institute for Scientific, Technical, and Economic Information, Warsaw, Poland.
- Zenkovich, L. A. 1963. Biology of the Seas of the U.S.S.R. Translation. John Wiley, New York.

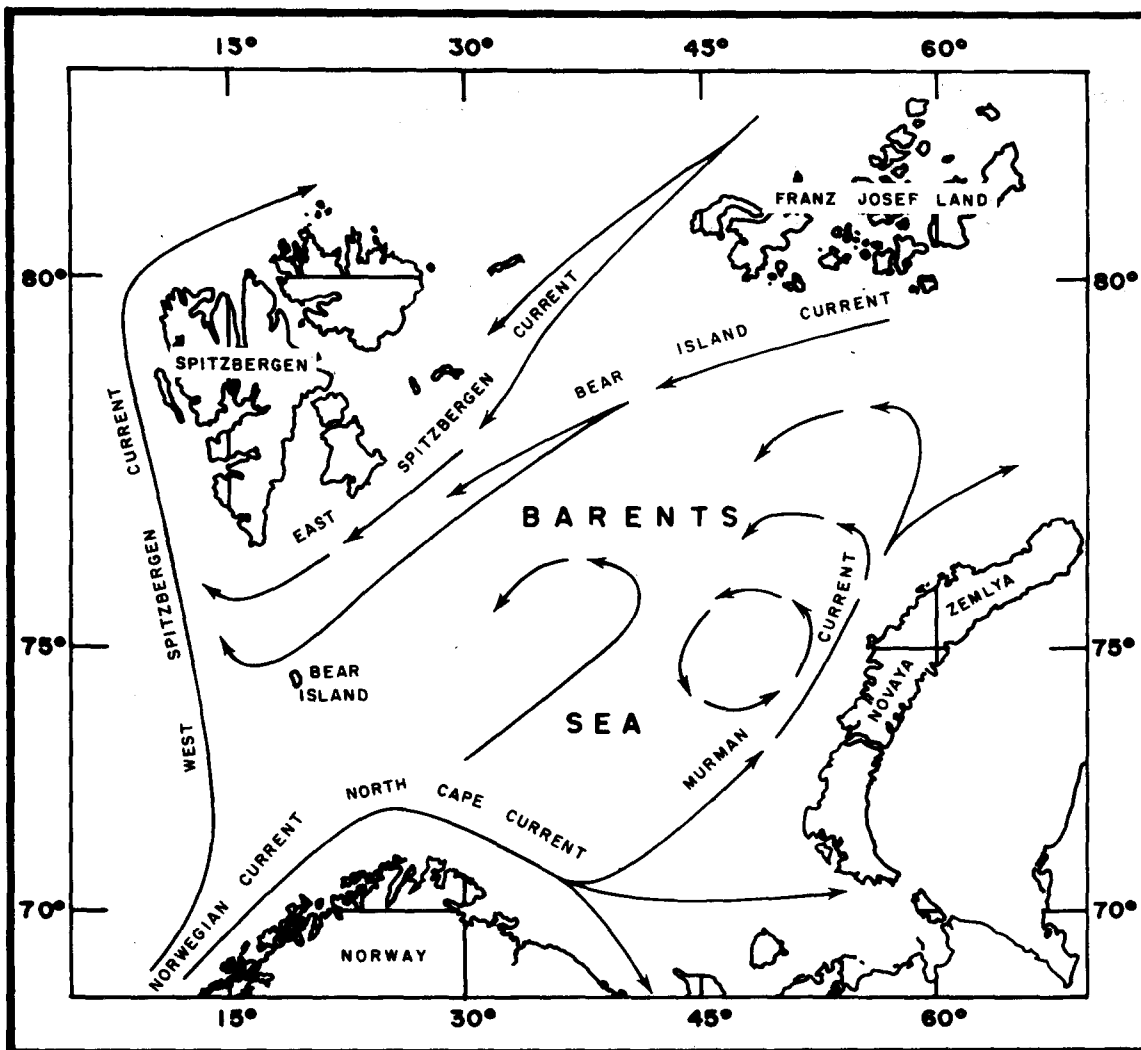


Figure 1. Major Currents in the Barents Sea

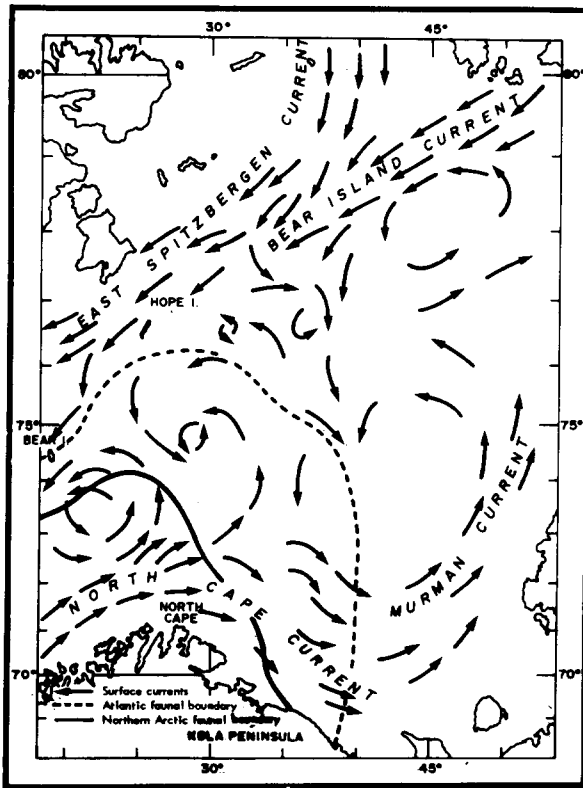


Figure 2. Boundaries of Atlantic and Northern Arctic Fauna

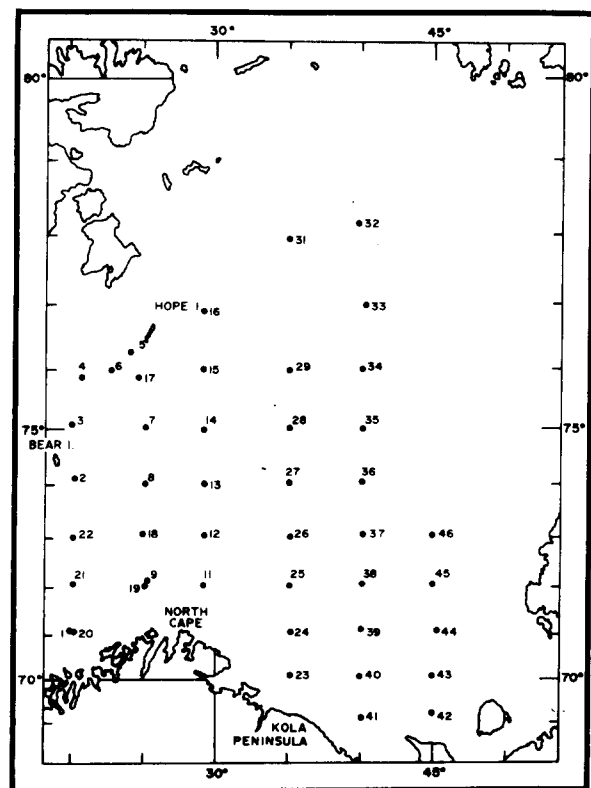


Figure 3. Station Locations

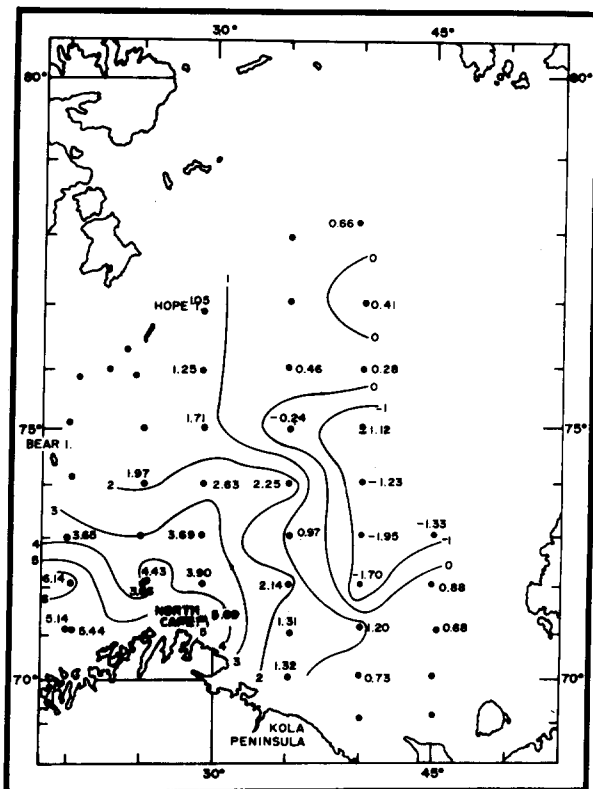


Figure 4. Temperature Distribution (°C) at 150 Meters

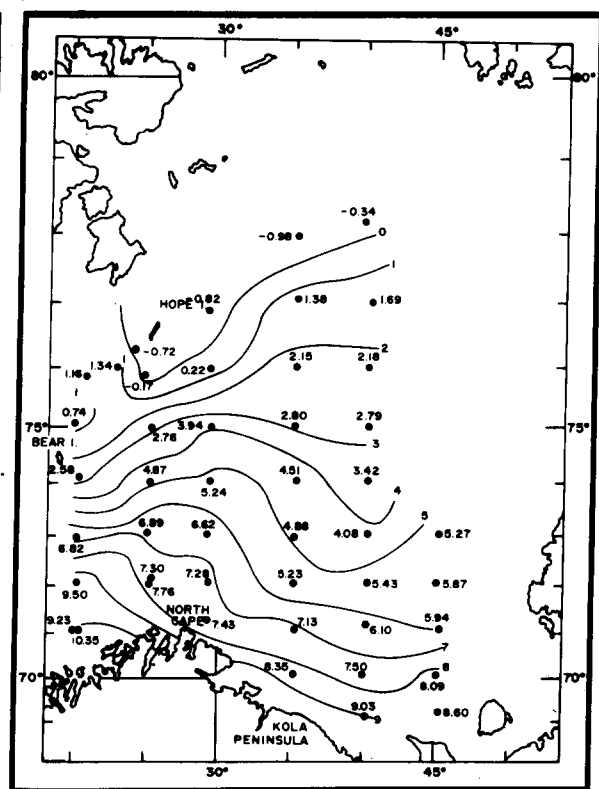


Figure 5. Temperature Distribution (°C) at Surface

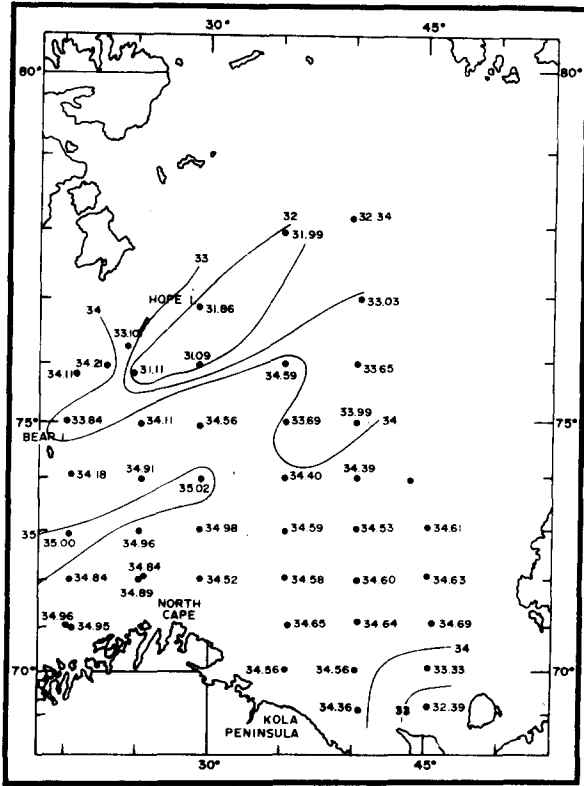


Figure 6. Salinity Distribution (‰) at Surface

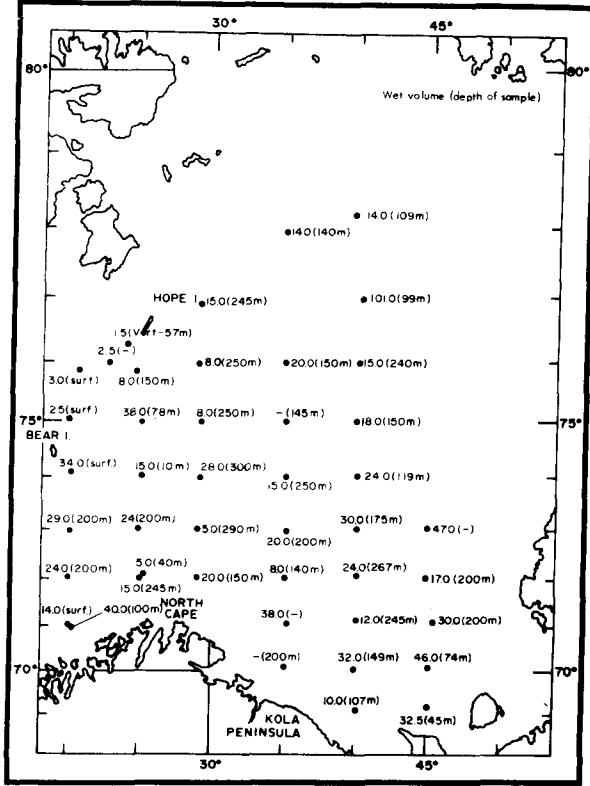


Figure 7. Plankton Wet Volume and Depth of Collection

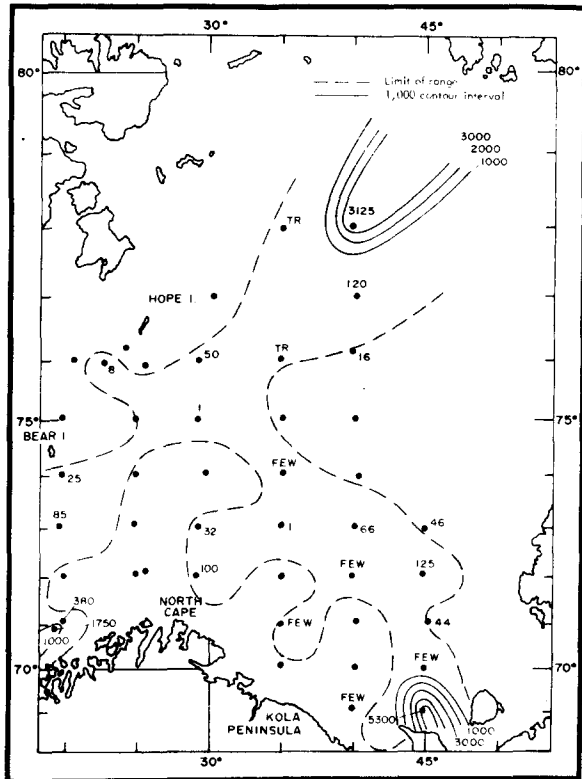


Figure 8. *Ceratium* sp.

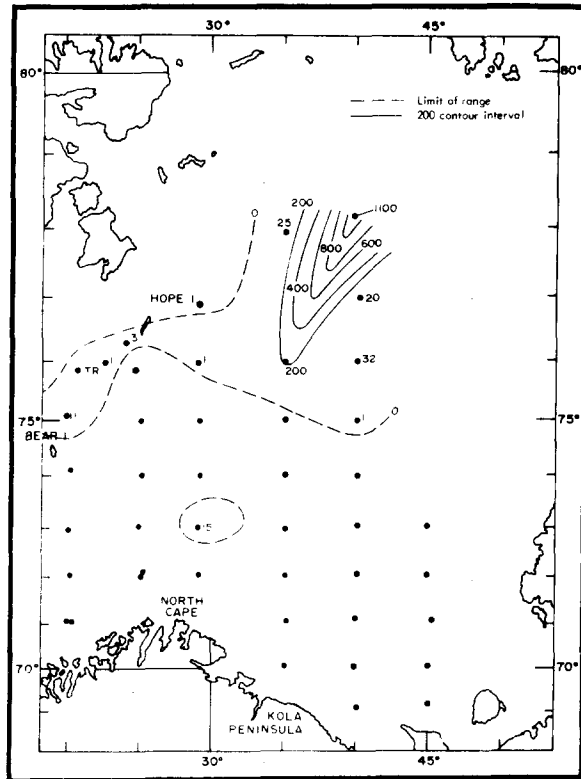


Figure 9. *Globigerina* sp.

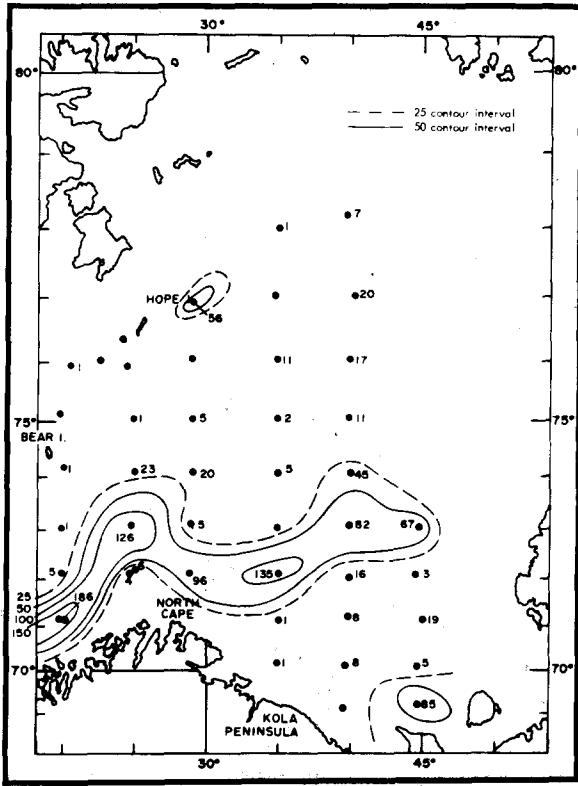


Figure 10. *Coelenterata Medusae*

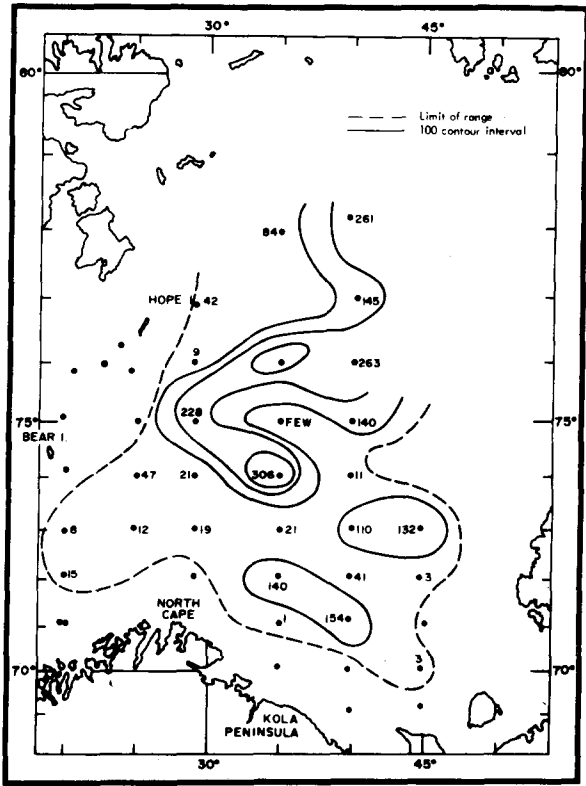


Figure 11. *Siphonophora*

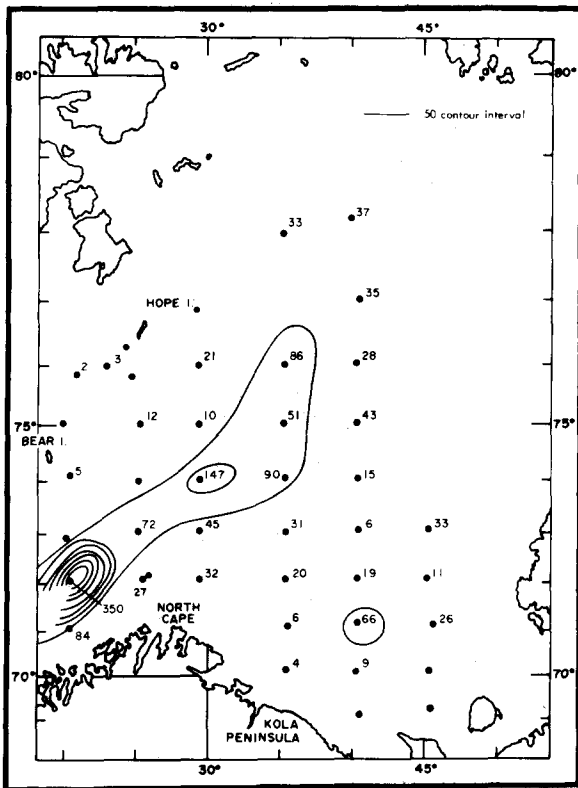


Figure 12. *Eukrohnia hamata*

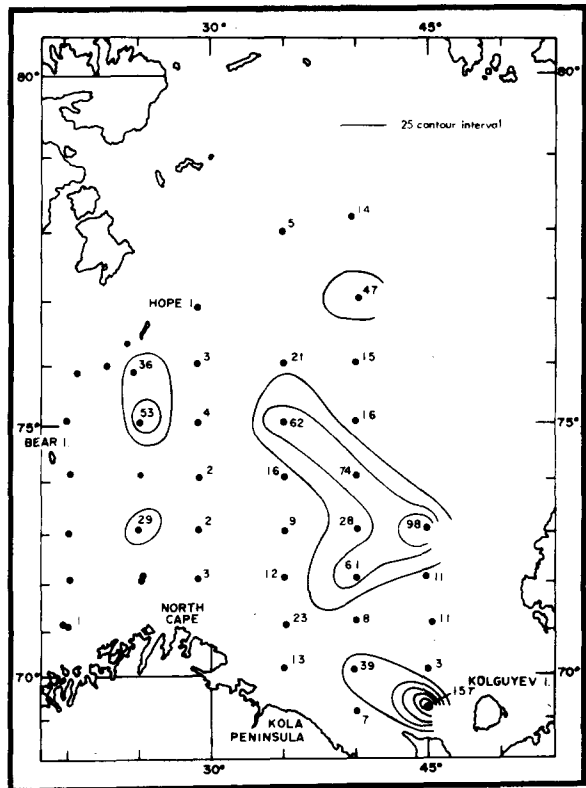


Figure 13. *Sagitta elegans*

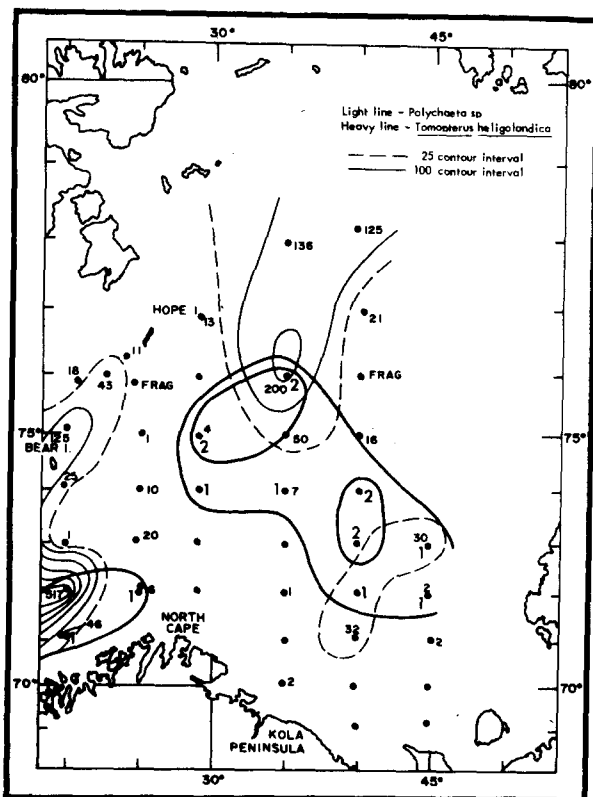


Figure 14. *Polychaeta* sp. and *Tomopteris helgolandica*

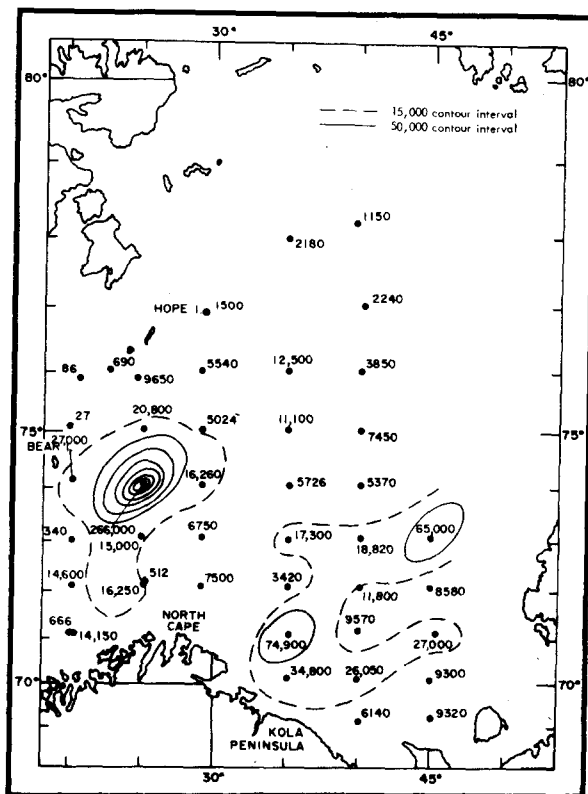


Figure 15. *Calanus finmarchicus*

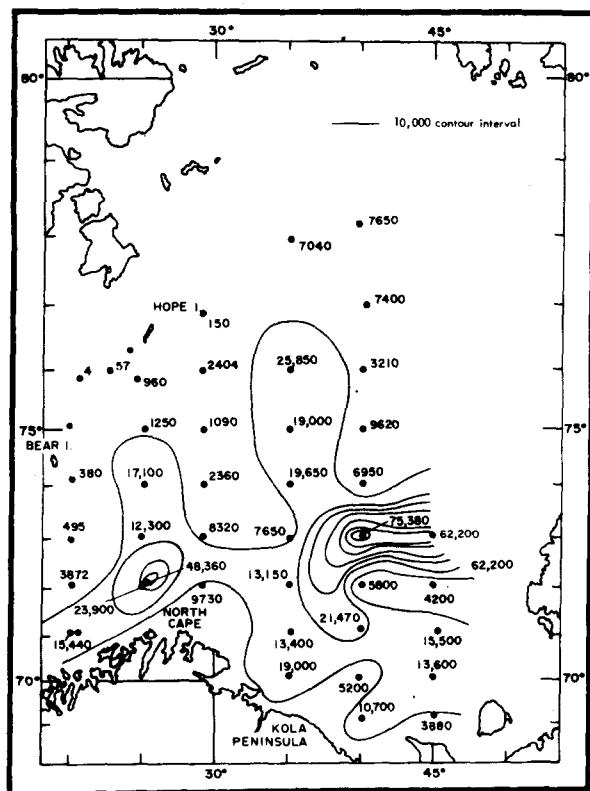


Figure 16. *Oithona similis*

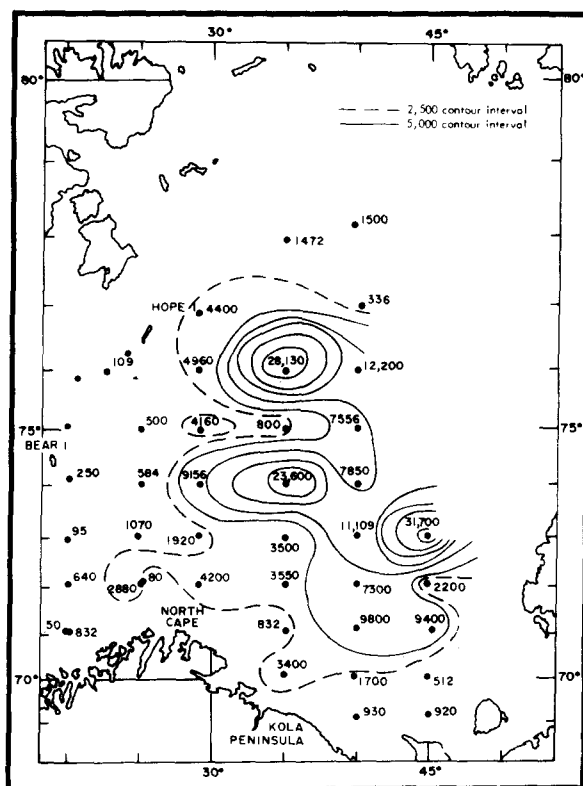


Figure 17. *Metridia* spp.

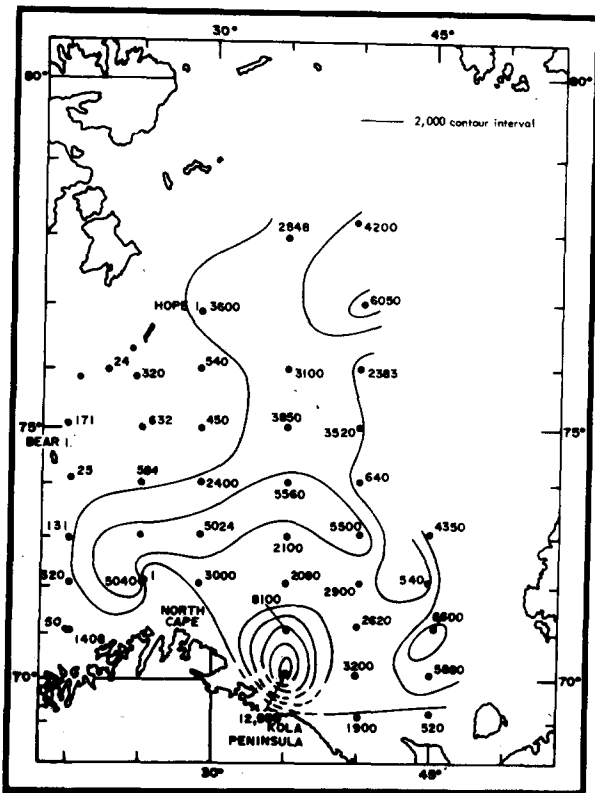


Figure 18. *Microcalanus pygmaeus*

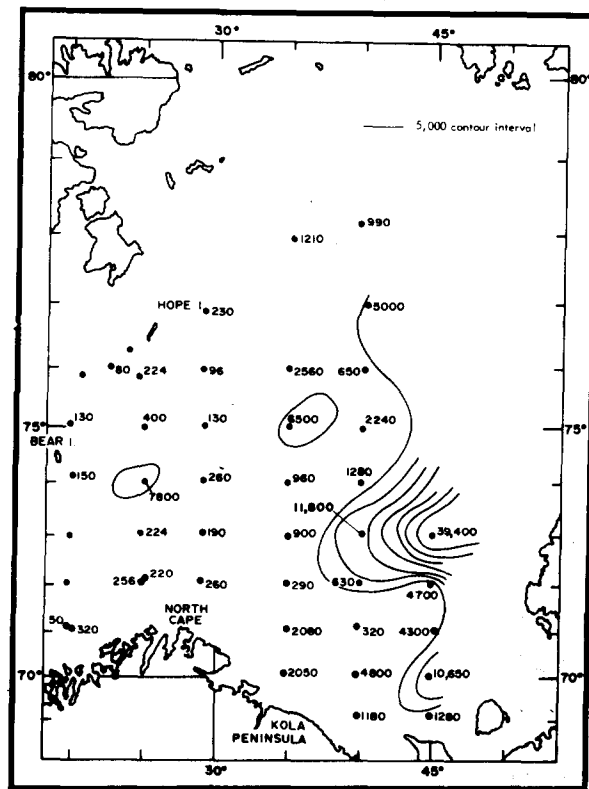


Figure 19. *Pseudocalanus minutus*

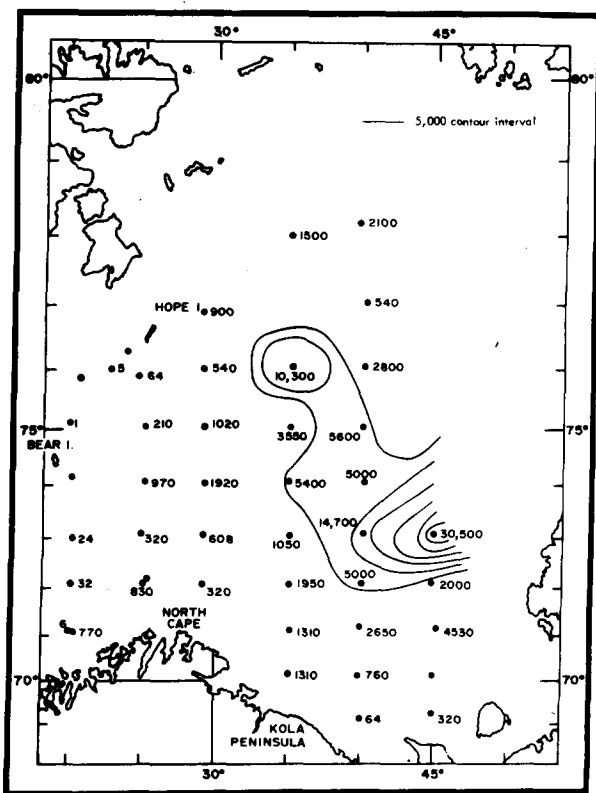


Figure 20. *Oncaea* sp.

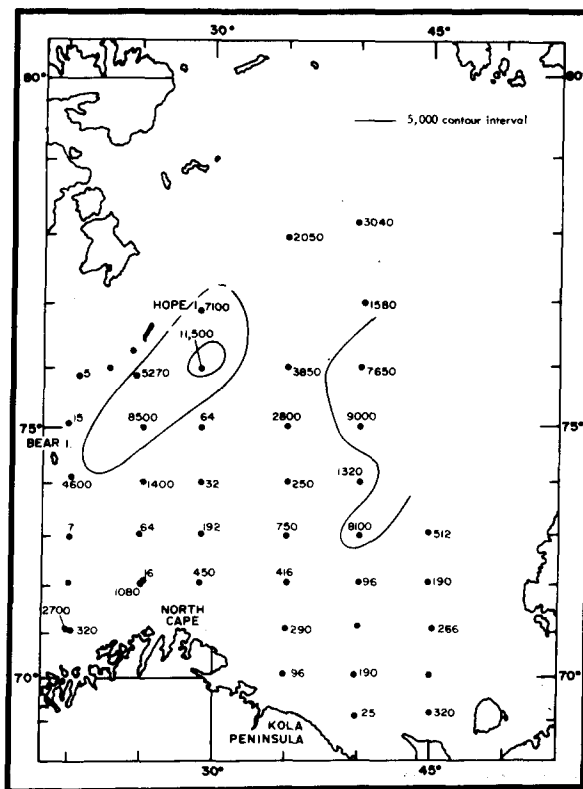


Figure 21. Copopod Nauplii

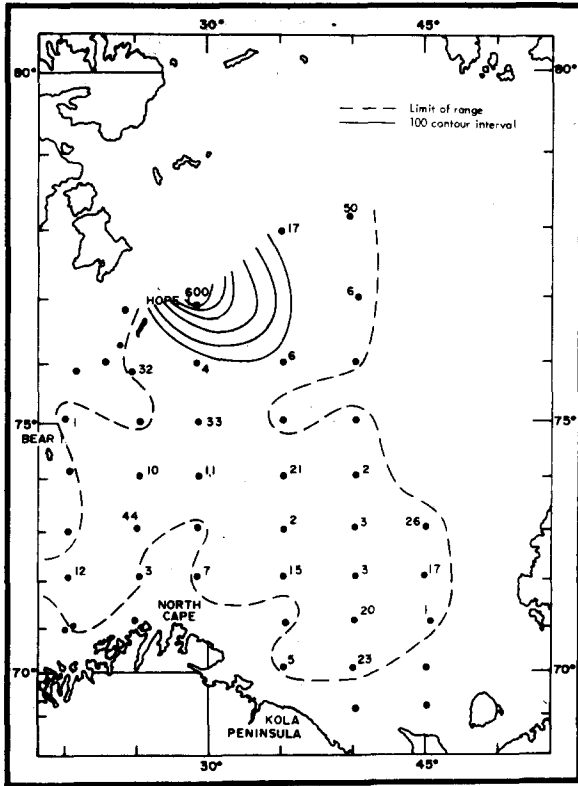


Figure 22. *Paraechasta norvegica*

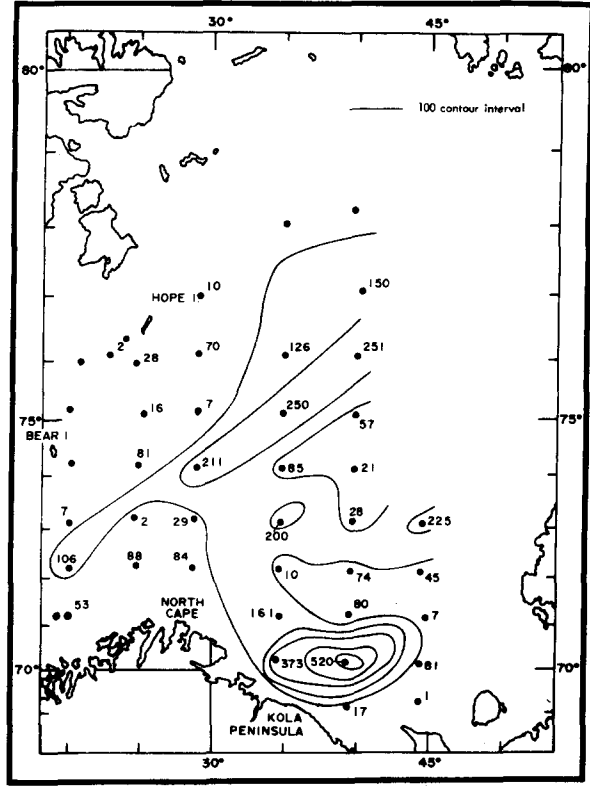


Figure 23. *Calanus hyperboreus*

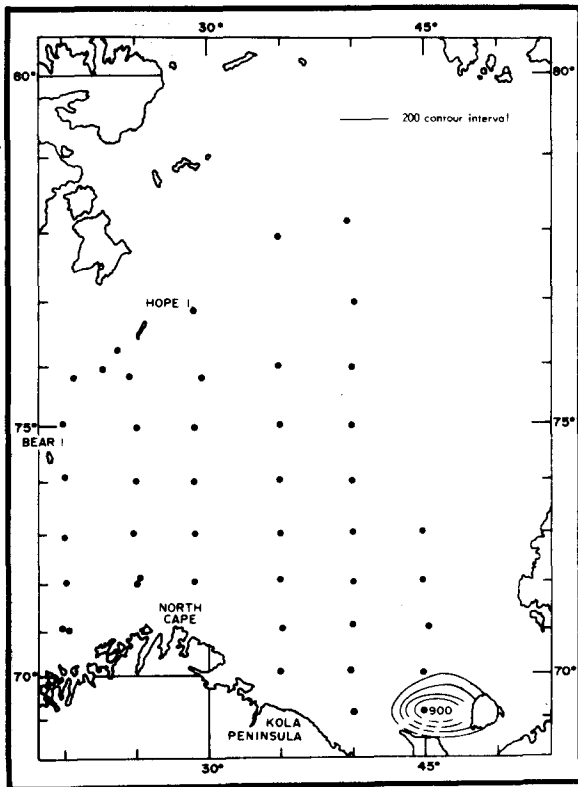


Figure 24. *Temora stylifera*

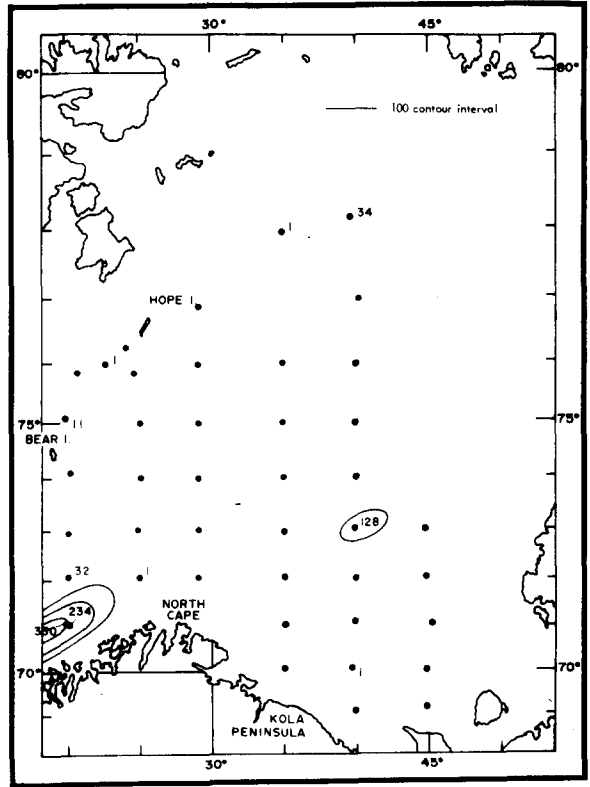


Figure 25. *Microsetella norvegica*

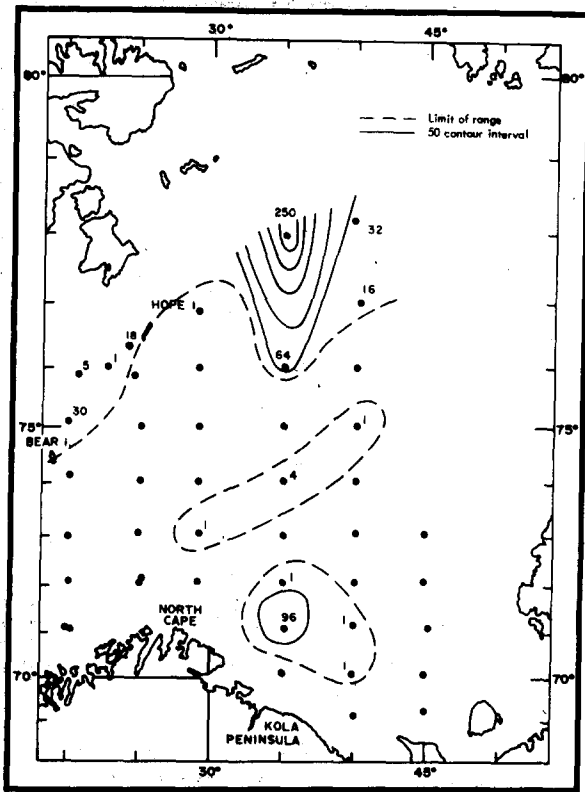


Figure 26. *Tisbe* sp.

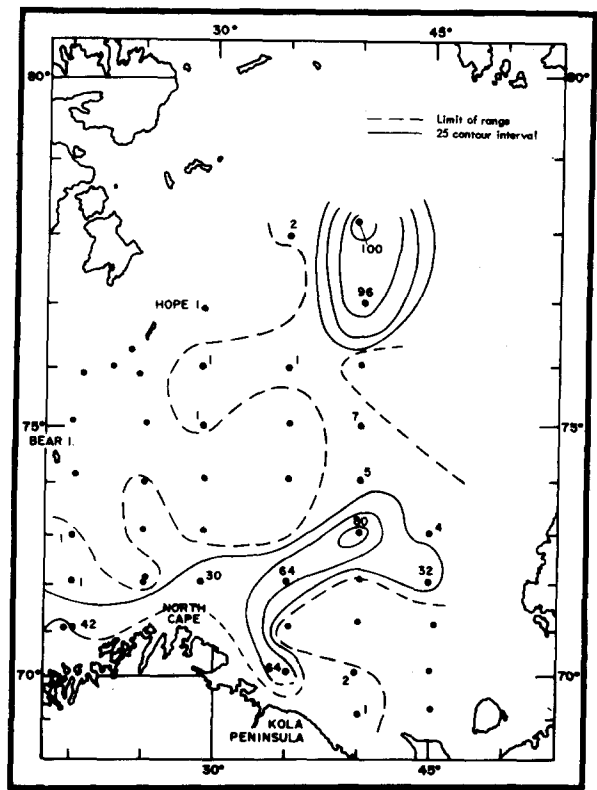


Figure 27. *Scolicithricella minor*

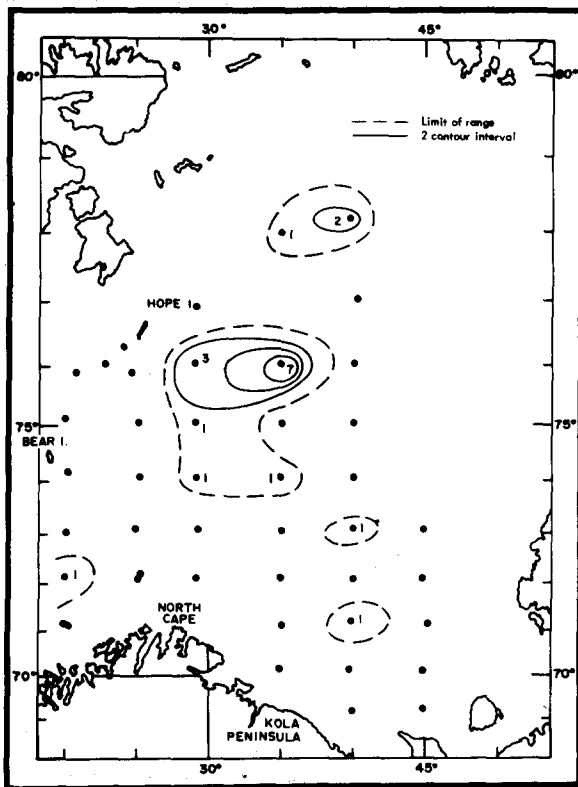


Figure 28. *Gaidius tenuispinus*

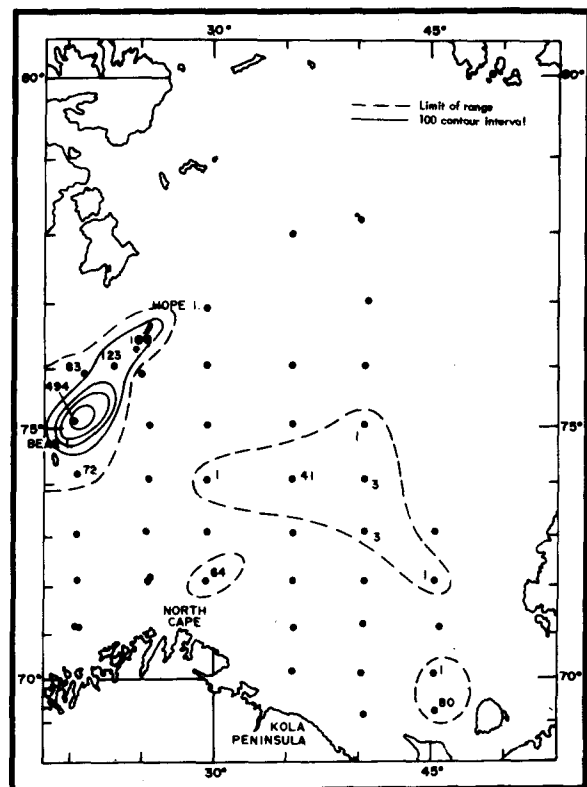


Figure 29. *Balanus* sp. (larvae)

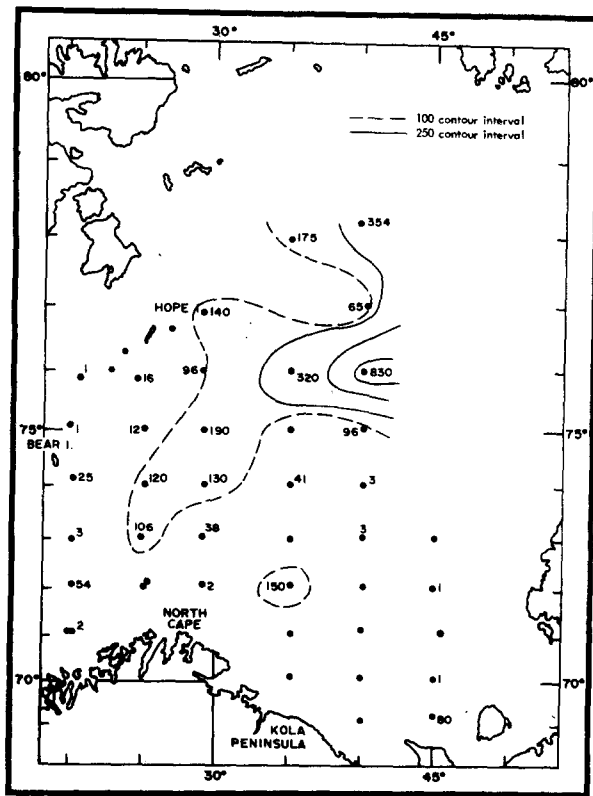


Figure 30. *Conchocia elagani*

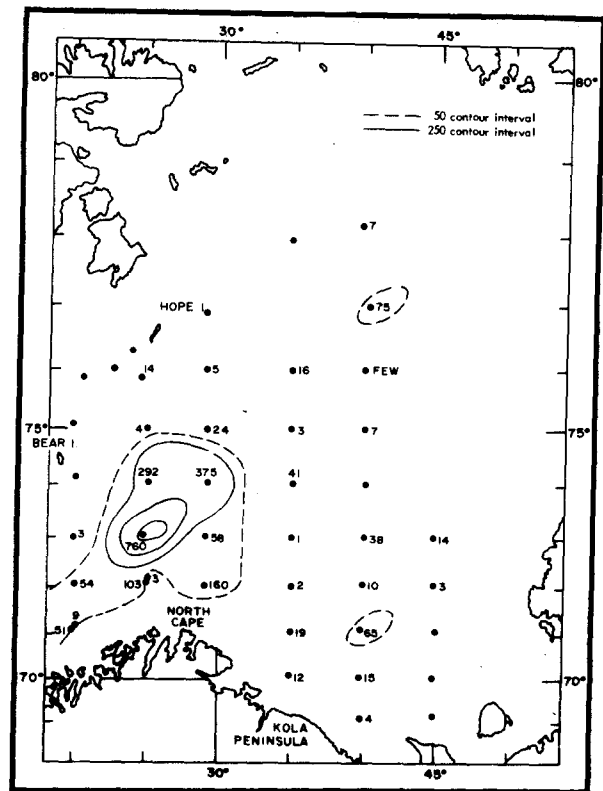


Figure 31. Euphausiacea (all species)

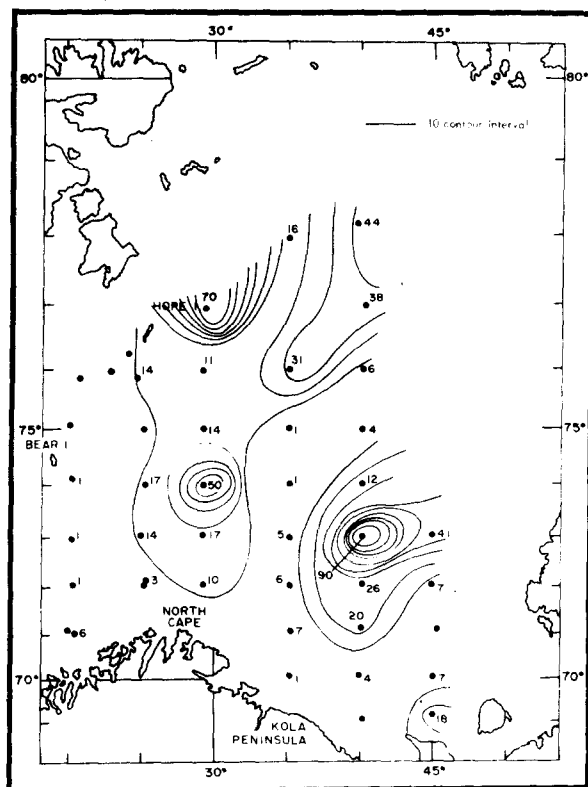


Figure 32. Amphipoda (all species)

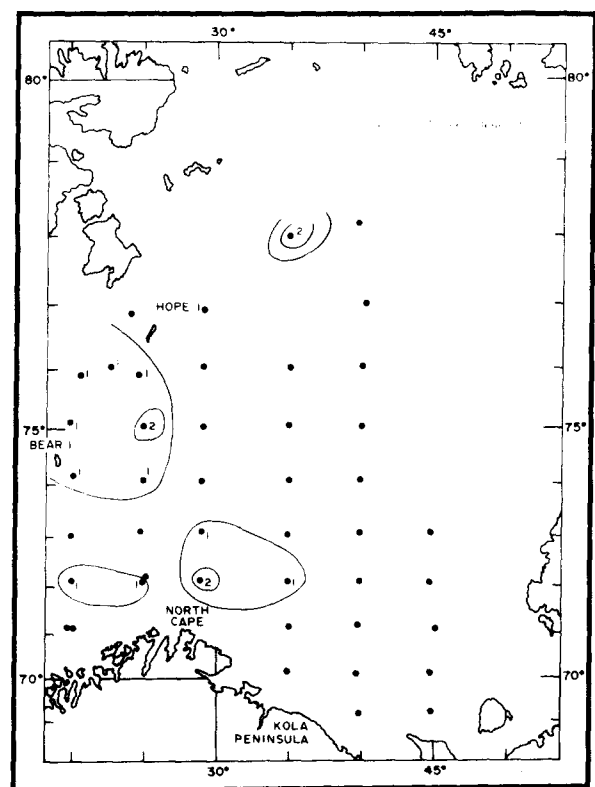


Figure 33. Decapoda Larvae

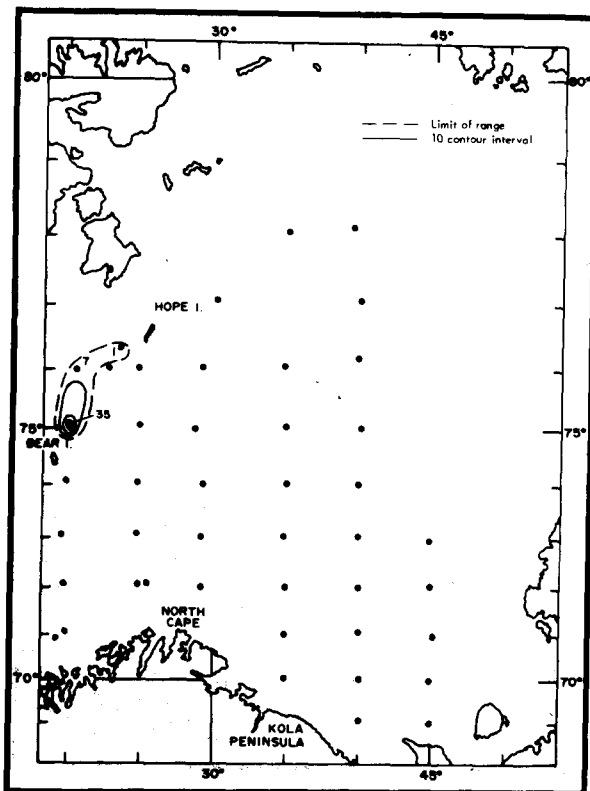


Figure 34. *Copidognethus* spp.

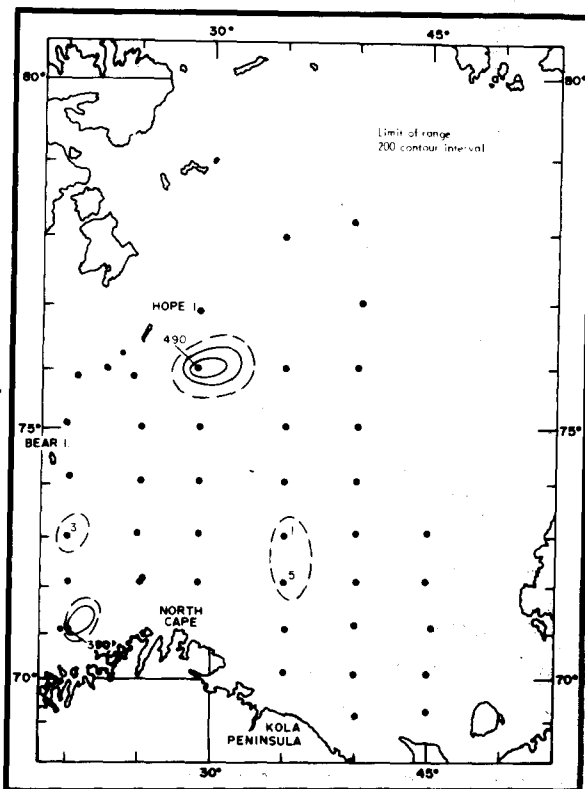


Figure 35. Lamellibranchiata Larvae

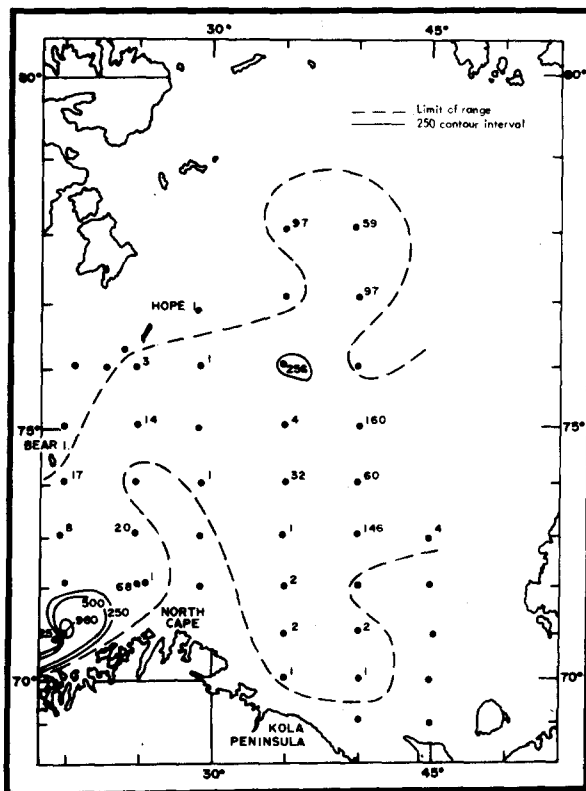


Figure 36. *Clione limacina*

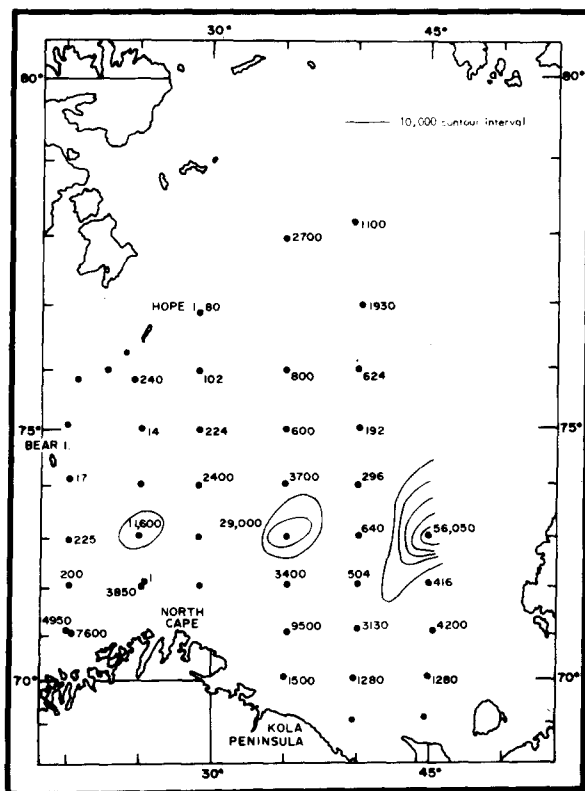


Figure 37. *Limacina* sp.

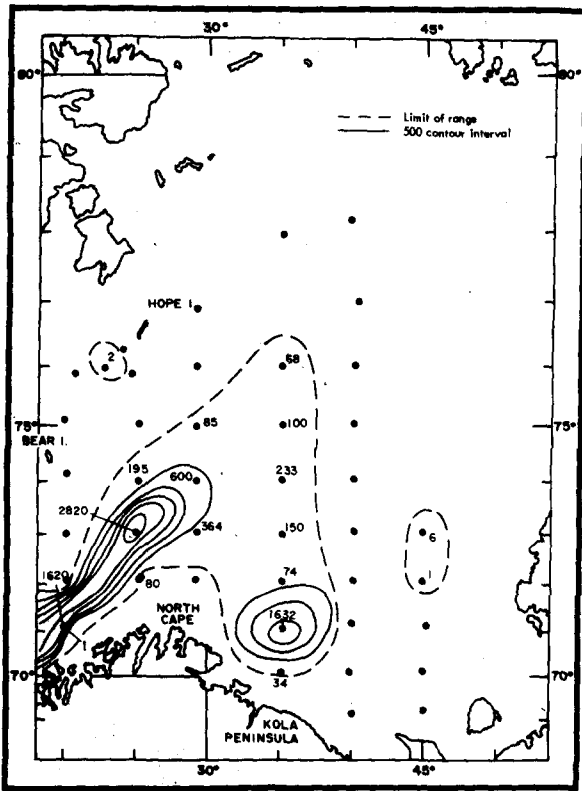


Figure 38. Asteroidea (immature)

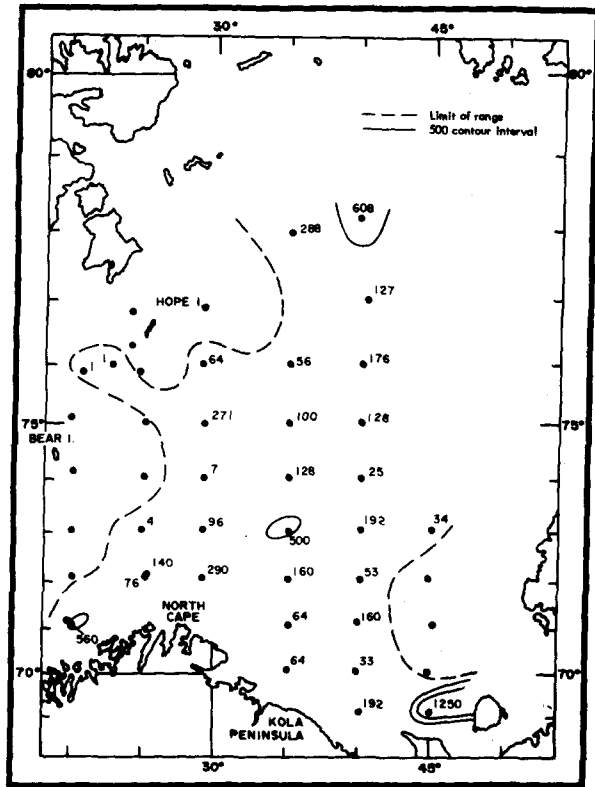


Figure 39. Larvacea

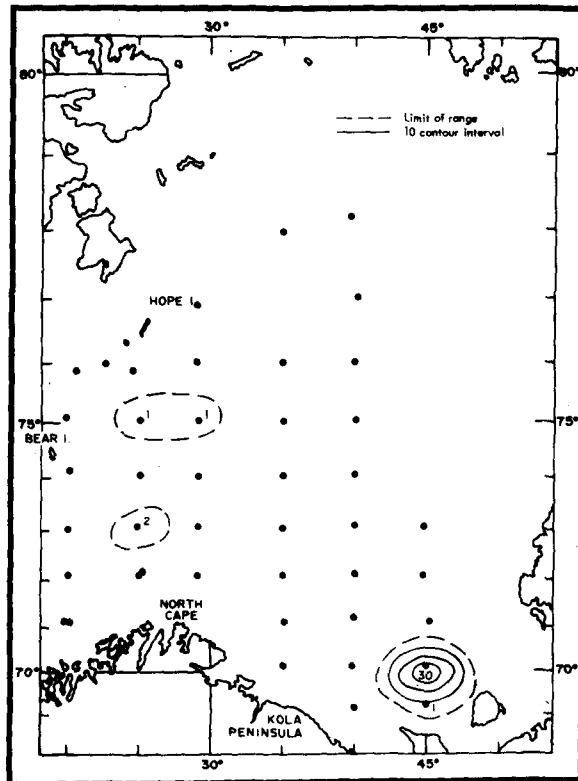


Figure 40. Pisces (immature or larval)

TABLE I. STATION DATA SUMMARY

STA. NO.	DATE 1963	TIME GMT	LAT. (°N)	LONG. (°E)	MESH NO.	MOUTH DIAM.	WATER DEPTH (M)	DEPTH OF TOW (M)	DURATION OF TOW (MINUTES)	WET VOLUME OF PLANKTON (CCS)	T°C TOW DEPTH	S (‰) TOW DEPTH	SECCHI DISC WHITE (M)
1	20 Jul	1800	71°00'	19°54'	10	1/2 m	190	surf	30	14.0	9.23	34.95	18
2	23 Jul	1415	74°04'	20°02'	5	1/2 m	128	surf	30	34.0	2.58	34.18	-
3	23 Jul	1300	75°03'	19°49'	5	1/2 m	37	surf	30	2.5	0.74	33.84	12
4	24 Jul	0200	75°52.5'	20°32'	5	1/2 m	44	surf	30	3.0	1.16	34.10	12
5	25 Jul	1145	76°17.5'	24°02'	5	1/2 m	58	vert(57)	5	1.5	0.02	34.00	18
6	25 Jul	1800	76°00.5'	22°40'	5	1/2 m	64	30	30	2.5	1.03	34.25	-
7	26 Jul	1800	75°00'	25°00'	5	1/2 m	119	78	30	38.0	-1.80	34.76	-
8	28 Jul	1900	74°00'	25°00'	5	1/2 m	444	11	30	150.0	4.85	34.91	-
9	30 Jul	1130	72°03'	25°06'	8	1 ft	258	43	30	5.0	5.73	34.88	11
11	31 Jul	2130	72°00'	29°00'	8	1 ft	284	130	30	20.0	3.92	34.96	-
12	1 Aug	1400	73°00'	29°00'	8	1 ft	298	244	30	5.0	3.00	35.05	12.5
13	2 Aug	0610	74°00'	29°02'	8	1 ft	375	282	30	28.0	1.75	35.06	12
14	2 Aug	2040	75°00'	29°00'	8	1 ft	358	251	30	8.0	1.66	35.05	15.5
15	3 Aug	1530	76°00'	29°00'	8	1 ft	270	231	30	8.0	0.70	34.99	20.5
16	4 Aug	1130	76°54'	29°04'	8	1 ft	252	235	30	15.0	0.93	35.00	20
17	9 Aug	1500	75°52'	24°31'	8	1 ft	101	90	30	17.0	-1.81	34.58	19
18	10 Aug	1045	73°00'	24°46'	8	1 ft	422	159	30	24.0	3.44	35.10	-
19	11 Aug	0720	72°00'	25°00'	8	1 ft	247	200	30	29.0	3.13	35.04	11
20	18 Aug	1730	70°59'	20°02'	8	1 ft	179	160	30	22.0	5.44	35.04	18.5
21	19 Aug	0300	72°00'	20°00'	8	1 ft	307	280	30	20.0	4.78	35.14	13
22	19 Aug	1330	72°56'	19°54'	8	1 ft	417	350	30	5.0	2.65	35.06	10
23	21 Aug	1210	70°00'	35°00'	8	1 ft	243	228	30	44.0	0.78	34.74	14
24	21 Aug	2145	70°59'	35°05'	8	1 ft	174	150	30	45.0	1.31	34.79	dark
25	22 Aug	0730	72°00'	35°00'	8	1 ft	243	165	30	8.0	1.72	34.97	14.5
26	22 Aug	1700	72°58'	35°02'	8	1 ft	221	190	30	20.0	0.42	34.94	-
27	23 Aug	0255	74°00'	35°00'	8	1 ft	291	236	30	15.0	0.20	-	-
28	23 Aug	1300	75°00'	35°00'	8	1 ft	170	145	30	-	-0.24	34.92	25
29	23 Aug	2050	76°00'	35°00'	8	1 ft	203	142	30	20.0	0.63	34.97	-
31	24 Aug	2000	78°00'	35°00'	8	1 ft	174	143	30	14.0	-0.60	34.62	15
32	25 Aug	1030	78°12'	39°42'	8	1 ft	225	115	30	14.0	-0.27	34.62	-
33	26 Aug	0020	77°02'	40°10'	8	1 ft	192	103	30	101.0	-1.07	34.67	19.5
34	26 Aug	1159	76°00'	40°00'	8	1 ft	284	240	30	15.0	-0.88	34.93	20
35	26 Aug	2120	75°00'	40°00'	8	1 ft	182	162	30	18.0	-1.25	34.92	-
36	27 Aug	0710	74°00'	40°00'	8	1 ft	212	192	30	24.0	-0.85	34.92	13.5
37	27 Aug	1650	73°00'	40°00'	8	1 ft	333	160	30	30.0	-1.40	34.88	-
38	28 Aug	0249	72°00'	40°00'	8	1 ft	331	258	30	24.0	-1.07	34.93	-
39	28 Aug	1400	71°03'	39°54'	8	1 ft	271	261	30	15.0	0.01	34.92	17.5
40	29 Aug	0030	69°59'	39°52'	8	1 ft	161	140	30	34.0	0.73	34.78	-
41	29 Aug	0936	69°00'	40°00'	8	1 ft	128	113	44	10.0	2.04	34.60	15
42	29 Aug	2250	69°04'	45°00'	8	1 ft	60	45	30	32.5	2.86	34.28	-
43	30 Aug	0622	69°58'	44°57'	8	1 ft	86	74	37	46.0	0.25	34.69	16
44	30 Aug	1539	71°02'	45°12'	8	1 ft	216	200	30	30.0	-0.04	34.86	-
45	31 Aug	0034	72°01'	44°52'	8	1 ft	234	220	30	17.0	-0.37	34.86	-
46	31 Aug	1035	73°01'	44°49'	8	1 ft	327	210	30	47.0	-1.64	-	10

PLANKTON TAXA AT EACH STATION

22	23	24	25	26	27	28	29	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	TOTAL COUNT	
				50	FEW				300	4					16	40		1			1			412	
85		FEW		1	FEW		TR	TR	3,125	120	16				66	FEW		FEW	5,300	FEW		125		11,250	
	232						200	25	1,100	20	32	1				48								1,410	
8	1	1	140	21	306	FEW	372	84	261	145	263	140	11	110	41	154				3	3	3	132	2,589	
			135		5	2	11	1	7	20	17	11	45	82	16	8			85	5	19	3	67	1,085	
	4						1																	8	
																				2				12	
																							6	12	
20	4	6	20	31	90	51	86	33	37	35	28	43	15	6	19	66	9					26	11	33	1,459
	13	23	12	9	16	62	21	5	14	47	15	16	74	28	61	8	39	7	157	3	11	11	33	98	883
	2				1		4	2	10	15	5	3	4	3	21	3	11		7	7	8	3	30	424	
1	2				1		2				FRAG	1	2	2	1								1	1	17
					7	50	200	136	125	21		16				32						2	2	30	1,454
3			150		41		320	175	354	65	830	96	220	50	6	7							5	14	145
					41							1	3	3									1		276
340	34,800	74,900	3,420	17,300	5,726	11,100	12,500	2,180	1,150	2,240	3,850	7,450	5,370	18,820	11,800	9,570	26,050	6,140	9,320	93,000	27,000	8,580	65,000	885,611	
7	373	161	10	200	85	250	126	96	55	130	251	57	21	28	74	80	520	17	1	81	7	45	225	3,687	
					1		7	1	2										2					4	4
95	3,400	832	3,550	3,500	23,600	800	28,130	1,472	1,500	336	12,200	7,550	7,850	11,109	7,300	9,800	1,700	930	920	512	9,400	2,200	31,700	206,177	
131	12,500	8,100	2,080	2,100	5,560	3,850	3,100	2,848	4,200	6,050	2,380	3,520	640	5,900	2,900	2,620	3,200	1,900	520	5,880	6,600	540	4,350	119,308	
																									4
495	19,000	13,400	13,150	7,650	19,650	19,000	25,850	7,040	7,650	7,400	3,210	9,620	6,950	75,380	5,800	21,470	5,200	10,700	3,880	13,600	15,500	4,200	62,200	525,672	
24	1,310	1,310	1,930	1,650	5,400	3,550	10,300	1,500	2,100	540	2,800	5,600	5,000	14,700	5,000	2,650	760	64	320	4,530	2,000	30,500	26	1,009	
																									5
1	2,050	2,080	290	900	960	6,500	2,560	1,210	990	5,000	650	2,240	1,280	11,800	6,030	320	4,800	1,180	1,280	10,650	4,300	4,700	39,400	122,190	
																									535
																									901
																									521
7	96	290	416	750	250	2,800	3,850	2,050	3,040	1,580	7,650	9,000	1,320	8,100	96		190	25	320		266	190	512	86,106	
																									775
																									2
																									6
3	12	19	2	1	41	3	16	7	75	FEW	7			38	10	65	15	4	4			3	14	2,260	
1	1	6		5	1	1	30	39	31	1	5			90	26	20	4		8	7		7	41	542	
																									6
																									28
																									44
																									22
																									17
																									43
225	1,500	9,500	3,400	29,000	3,700	600	800	2,700	1,100	1,930	624	192	256	640	584	3,130	1,280			1,280	4,200	416	56,050	113,950	
8	1	2	2	1	32	4	256	97	59	47		160	60	146		2	1					4	4	2,000	
3																									889
	34	1,632	74	150	233	100	68	56																	8,065
							176	756																	410
																									1,938
	64	64	160	500	128	100	56	288	608	127	176	128	25	192	53	160	33	192	1250					34	5,848
																				1					35

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)		2a. REPORT SECURITY CLASSIFICATION	
U.S. NAVAL OCEANOGRAPHIC OFFICE		UNCLASSIFIED	
		2b. GROUP	
3. REPORT TITLE			
PLANKTON DISTRIBUTION IN THE BARENTS SEA, JULY - AUGUST 1963			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
Informal Report 20 July to 31 August 1963			
5. AUTHOR(S) (First name, middle initial, last name)			
JAMES A. BRUCE			
6. REPORT DATE		7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
June 1969		25	2
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S)	
b. PROJECT NO. 102-01		IR NO. 69-45	
c.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.			
10. DISTRIBUTION STATEMENT			
RESTRICTED			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
		U.S. Naval Oceanographic Office	
13. ABSTRACT			
<p>A total of 44 plankton samples was collected in the Barents Sea during a 1963 NAVOCEANO survey aboard USS TANNER (AGS 15). At least three groups of well-defined plankton associations in the Barents Sea are indicated from analysis of the samples. The three assemblages consist of the following:</p> <ol style="list-style-type: none"> (1) A permanent resident assemblage in the central portion of the sea. (2) Species from Atlantic origins that were carried into the sea by the North Cape Current. (3) Species from Arctic origins that were carried into the sea by the East Spitzbergen and Bear Island Currents. <p>A new species of benthic mite, genus <u>Copidognathus</u>, was discovered in the Barents Sea plankton samples. The name <u>Copidognathus spenceri</u> will be submitted for this species.</p>			

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
PLANKTON BARENTS SEA <u>COPIDOGNATHUS SPENCERI</u>						