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NORWEGIAN INVESTIGATIONS ON THE DEEP SEA SHRIMP
(PANDALUS BOREALIS) IN THE BARENTS SEA IN APRIL -
MAY 1983 AND IN THE SPITSBERGEN AREA IN JULY 1983

by

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ABSTRACT

This report describes the results from a stratified bottom trawl survey with R/V "Michael Sars" in April - May 1983 in the Barents Sea between 71°30'N and 76°00'N, and between 16°30'E and 35°30'E. The report also describes the results from a survey with the same ship in the Spitsbergen area between 74°00'N and 80°30'N, and between 08°00'E and 18°00'E in July 1983. On the basis of the data from 107 trawl stations, the biomass of the shrimp, Pandalus borealis in the area surveyed in the Barents Sea was estimated to be approximately 368 000 tonnes. In the Spitsbergen area the biomass of the shrimp was estimated to be approximately 57 000 tonnes. The by-catches of fish in the hauls are also discussed.

INTRODUCTION

A stratified random sampling scheme was carried out during a bottom trawl survey with R/V "Michael Sars" from 25 April to 18 May 1983 in the Barents Sea (sub-area I). A similar sampling scheme was carried out during a bottom trawl survey with the same ship from 16 July to 29 July 1983 in the Spitsbergen waters (Division 2b).

The purpose of the cruises were to investigate the structure of the shrimp stock, the by-catches of fish and to estimate the abundance of shrimps.

MATERIAL AND METHODS

The cruises in 1983 covered the most important fields where commercial fishing for shrimp has been carried out in recent years in the Barents Sea. The boundaries of the strata are indicated in Fig. 1.

Due to great numbers of 1-group haddock in many shrimp fields, great areas were closed for the shrimp trawlers in the spring 1983. The main commercial fishing grounds in spring until June was only a small part of the "Nordkapeira" (strata 1-4) and the "Thor Iversen" field north of $73^{\circ}30'N$. A good fishing took also place near the Tiddly bank east of $33^{\circ}E$. The rest of the fishing grounds in strata 1-12 were closed for shrimp trawlers. Ice were not seen at all on the cruise with "Michael Sars" in the Barents Sea in 1983. As in the years before each stratum was sub-divided into rectangles of 5x5 nautical miles. Within each stratum, rectangles were given consecutive numbers starting from 1. Within each stratum the trawl stations were randomly allocated to rectangles. In the most important shrimp trawl fields 9% of the rectangles were trawled (strata 3, 4, 6, 7, 12 and 15), and in the other strata 5 - 6% were trawled. For further information on the methods see Teigsmark and Øynes 1981. The distance trawled was 3.0 nautical miles, but on some stations (station nos 4, 9, 63, 64 and 75) trawling had to be

much shorter due to rough or soft bottom. The numbers of hauls in each stratum are the same in 1983 as the year before except for the stratum 2 where only 2 stations instead of 4 could be taken due to soft bottom in these area. By-catches of fish were counted and length measurements were taken of all important species. In Table 1 the catch of shrimp (in kg) and by-catch of fish in the Barents Sea (in numbers) are listed. Fishing gear and techniques were the same as in the years before and are described by Tavares & Øynes (1980). The trawl stations in the Spitsbergen area are listed in Table 7.

The statistical treatment of the data follows Teigsmark & Øynes (1981). The width covered by the trawl is calculated to give an average width of 11.7 m.

The commercial stock, i.e. that part of the stock available to the commercially used 35 mm trawl-net, was calculated as in Teigsmark & Øynes (1981).

RESULTS AND DISCUSSION

Shrimps

Stock size estimate in the Barents Sea

Table 2 gives the estimated biomass of the total stock in each stratum in 1983. The total stock in all strata summarized is estimated to be 368 000 - 38 000 tonnes (Table 2). This corresponds to an increase of approximately 30% from 1982 for the strata investigated both years.

Table 3 gives the per cent change in biomass in the different strata from 1982 to 1983. In 1982 a decline was observed in stock size in the strata close to the Norwegian coast (Teigsmark & Øynes 1982). The same is observed in 1983. In most other strata a very marked increase in stock size has been observed, even in the very heavily fished areas (strata 6 - 7 and 10 - 12).

In the first half of the 1970'ies the Hopen area (stata 15 - 18) was the most important fishing area for shrimps in the Barents Sea. During this period the area was nearly fished out. In the last few years the shrimp stock in this area has been steadily increasing, and it has now attained a level that can sustain a profitable fishery.

The total stock is estimated to be $(70.1 \pm 7.2) \cdot 10^9$ individuals (Table 4). This corresponds to an increase of 5.3% from 1982. The commercial stock is estimated to be $328\ 000 \pm 35\ 000$ tonnes (Table 5), corresponding to an increase of 39.2% from 1982. The commercial number of shrimps in 1983 is estimated to be $(56.3 \pm 5.9) \cdot 10^9$ individuals, i.e. an increase of 14.2% from 1982 (Table 6).

The size of the shrimp stock in the Barents Sea has been increasing during the last year and has now reached a very high level. This increase is obviously caused by the decline in the stock of Arcto-Norwegian cod during the same period. When the cod stock recovers, a very marked decline in the shrimp stock in the Barents Sea must be expected.

Stock size in the Spitsbergen area

The cruise in July 1983 covered the area from the "Kveithola" and northwards along the western slope at West-Spitsbergen up to north of Spitsbergen to $80^{\circ}30'N$. The stratified area (Fig. 2) was at depths from 200 m to 600 m. At the depth from 200 m to 400 m are used the same strata as were used in 1982 (strata 1 - 15). For the depths from 400 m to 600 m are used the numbers of strata from 16 to 22. The sampling localities are indicated in Fig. 2. Table 8 gives the estimated biomass of the shrimp stock in each stratum. For the entire area investigated this gives a total of 57 370 tonnes. For the strata investigated both years, this gives an increase of 3.9%.

The results from this cruise do confirm the main conclusions that could be drawn from the cruise in 1982 (TEIGSMARK & ØYNES

1983). Very low concentrations of small males (carapace length <16 mm) were found this year too, indicating poor prospects for a profitable shrimp fishing in this area in the years to come. Great changes in stock size have taken place from 1982 in many of the strata (Table 8). A high variability in stock size estimates between the different strata is observed this year too. This high variability, both within one stratum from one year to another, and between the strata in one single year, is one of the main difficulties in making an accurate evaluation of the state of the shrimp stock in this area.

By-catches

The Barents Sea

In Table 1 are listed by numbers the most economically important fish species for each trawl haul in the Barents Sea. Table 9 gives the by-catches (in numbers) in each stratum investigated. Here the numbers of fish are listed as mean number pr hour trawled (3 nautical miles).

In the winter 1983 there was a very high number of 1-group haddock at the shrimp fields in the Barents Sea. On some fields they could number as much as 2 to 4 thousand individuals per hour trawled. For that reason great areas were closed for the shrimp trawlers. At the time when the "Michael Sars" cruise started, the haddock at the shrimp fields had decreased much, only in the shallowest part of "Thor Iversen" bank there was still a great number of 1-group haddock (stratum 11). These 1-group haddock were present in all the strata investigated except in the area near Bjørnøya (strata 20 and 21). Cod was present in all the strata investigated. Altogether the catches of cod in the Barents Sea in 1983 were about 30% more in numbers than in 1982. Most of the cod were 1-group or other young fish. Redfish and Greenland halibut were found in approximately the same numbers as in 1982, mostly too small to be accepted for consumption in Norway. Capelin and Polar cod were less numerous in 1983 than in 1982 and was only sporadically found as by-catch in the shrimp fields in the Barents Sea.

The Spitsbergen area

In Table 7 are listed by numbers the by-catches of the most important fish species for each trawl haul. Table 10 gives the by-catches by mean number pr. hour trawled in each stratum investigated. The numbers of cod were about the same in 1983 as in the year before (TEIGSMARK & ØYNES 1983). The highest numbers of cod were found in the area near Bjørnøya. Only one single specimen of haddock was found in the investigated area and also in the area near Bjørnøya. Redfish was abundant in the deepest strata investigated with numbers from 1000 to 3300 pr. hour trawling. The Greenland halibut was present in the deepest strata investigated, but there were fewer individuals in 1983 than in 1982. The capelin was numerous only in strata 4 and 6, i.e. the most shallow part of the fields south of Spitsbergen. The by-catch of polar cod was low in 1983 compared with the numbers in the investigations in 1982.

REFERENCES

- TAVARES, A.M. & ØYNES, P., 1980. Results of a stratified trawl survey for shrimps (Pandalus borealis) in the Barents Sea and the Spitsbergen area in May-June 1980. Coun. Meet. int. Coun. Explor. Sea, 1980 (K:22): 1-6, 3 tabs, 1 fig. (Mimeo).
- TEIGSMARK, G. & ØYNES, P., 1981. Results of a stratified trawl survey for shrimp (Pandalus borealis) in the Barents Sea in May - June 1981. Coun. Meet. int. Coun. Explor. Sea, 1981 (K:21): 1-9, 5 tabs, 4 figs. (Mimeo.)
- TEIGSMARK, G. & ØYNES, P., 1982. Norwegian investigations on the deep sea shrimp (Pandalus borealis) in the Barents Sea in 1982. Coun. Meet. int. Coun. Explor. Sea, 1982 (K:12): 1-8, 6 tabs, 6 figs. (Mimeo.)
- TEIGSMARK, G. & ØYNES, P., 1983. Results of a stratified bottom trawl survey for shrimps (Pandalus borealis) in the Spitsbergen area in July 1982. Coun. Meet. int. Coun. Explor. Sea, 1983 (K:17): 7 tabs, 2 figs. (Mimeo.)

Table 2. Estimated density (\bar{c}_k) and biomass in each stratum and estimated biomass in all strata summarized with the precision of the estimates.

Stratum	Area nm ²	Number of hauls	\bar{c}_k tons/nm ²	S_k^2	$V(\bar{c}_k)$	Coeff. of var. (S.E./ \bar{c}_k)	Biomass tons	S.E. of biomass
1	1200	3	5.030	4.391	1.464	0.241	6036	1451.832
2	1650	2	2.902	0.139	0.070	0.091	4788	435.299
3	1950	7	7.538	15.996	2.285	0.201	14698	2947.780
4	1800	6	8.205	12.348	2.058	0.175	14769	2582.272
5	2400	3	3.359	1.421	0.474	0.205	8062	1651.625
6	2700	10	14.415	13.557	1.356	0.081	38920	3143.694
7	1850	7	9.734	37.971	5.424	0.239	18009	4308.710
8	2400	6	4.404	7.151	1.192	0.248	10570	2620.174
9	1500	4	8.653	23.898	5.974	0.282	12980	3666.401
10	1500	4	14.257	41.626	10.407	0.226	21385	4838.883
11	1325	3	12.217	61.077	20.359	0.369	16187	5978.526
12	1375	5	16.631	66.200	13.240	0.219	22868	5003.174
13	2700	6	7.756	8.271	1.378	0.151	20942	3169.996
14	2550	6	15.433	75.799	12.633	0.230	39355	9063.500
15	2025	7	15.520	32.613	4.659	0.139	31428	4370.904
16	1575	3	10.183	59.332	19.777	0.437	16039	7004.319
17	1525	4	11.080	12.808	3.202	0.161	16898	2728.878
18	2500	4	3.219	20.262	5.065	0.699	8046	5626.650
20	1525	4	10.474	8.490	2.123	0.139	15972	2221.774
21	3300	7	2.435	8.512	1.216	0.453	8034	3638.986
22	3125	6	7.105	5.457	0.910	0.134	22205	2980.340
All strata:							368191	19489.887

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1

Table 3. Per cent change in biomass estimates in the different strata from 1982 to 1983.

Stratum	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Per cent change	-27.6	-7.6	+97.6	+6.1	+56.5	+49.5	+137.8	-45.0	-17.3	+43.1	+37.6	+36.2	+57.8	+86.1	+40.4	+122.7	+81.8	+36.3	-	+23.1	-44.6	-9.0

Table 4. Estimated number of shrimps per square nautical mile in the different strata and for all strata summarized with the precision of the estimates.

Stratum	Area nm ²	Number of hauls	$\bar{C}_k \cdot 10^{-3}$	$S_k^2 \cdot 10^{-6}$	$V(\bar{C}_k) \cdot 10^{-6}$	Coeff. of var.	Stock $\cdot 10^{-6}$	S.E. of stock $\cdot 10^{-6}$
1	1200	3	837.296	133.381	44.460	0.252	1004.755	253.027
2	1650	2	626.530	6.488	3.244	0.091	1033.775	93.980
3	1950	7	1506.299	577.486	82.498	0.191	2937.283	560.088
4	1800	6	1773.564	561.370	93.562	0.172	3192.415	550.581
5	2400	3	850.194	99.118	33.039	0.214	2040.466	436.241
6	2700	10	3061.622	645.896	64.590	0.083	8266.380	686.191
7	1850	7	1996.555	1487.122	212.446	0.231	3693.627	852.699
8	2400	6	1017.495	369.540	61.590	0.244	2441.989	595.616
9	1500	4	1546.586	763.396	190.849	0.282	2319.878	655.294
10	1500	4	2548.094	1329.720	332.430	0.226	3822.141	864.851
11	1325	3	2609.807	2787.403	929.134	0.369	3457.995	1277.189
12	1375	5	2972.462	2114.698	422.940	0.219	4087.136	894.215
13	2700	6	1342.444	249.074	41.512	0.152	3624.600	550.113
14	2550	6	2618.416	2228.719	371.453	0.233	6676.962	1554.147
15	2025	7	2038.940	448.536	64.077	0.124	4128.853	512.595
16	1575	3	1835.728	2150.398	716.799	0.461	2891.271	1333.458
17	1525	4	2365.369	294.247	73.562	0.115	3607.187	413.615
18	2500	4	649.294	727.277	181.819	0.657	1623.236	1066.007
20	1525	4	2114.819	308.266	77.067	0.131	3225.100	423.353
21	3300	7	454.746	326.363	46.623	0.475	1500.663	712.550
22	3125	6	1433.958	294.168	49.028	0.154	4481.118	691.945
All strata:							70056.829	3643.210

Table 5. Estimated commercial density (\bar{C}_k) and biomass in each stratum and estimated commercial biomass in all strata summarized with the precision of the estimates.

Stratum	Area nm ²	Number of hauls	\bar{C}_k Tons/nm ²	S_k^2	$V(\bar{C}_k)$	Coeff. of var. (S.E./ \bar{C}_k)	Biomass tons	S.E. of biomass
1	1200	3	4.656	3.708	1.236	0.239	5587	1334.053
2	1650	2	2.499	0.103	0.052	0.091	4123	374.794
3	1950	7	6.641	13.019	1.860	0.205	12950	2659.295
4	1800	6	7.038	9.299	1.550	0.177	12669	2240.847
5	2400	3	2.704	0.884	0.295	0.201	6489	1302.870
6	2700	10	12.497	11.423	1.142	0.086	33743	2885.677
7	1850	7	8.550	30.574	4.368	0.244	15818	3866.358
8	2400	6	3.681	5.062	0.844	0.250	8833	2204.470
9	1500	4	7.850	19.665	4.916	0.282	11774	3325.928
10	1500	4	12.933	34.254	8.564	0.226	19399	4389.530
11	1325	3	10.545	45.505	15.168	0.369	13972	5160.390
12	1375	5	15.087	54.476	10.895	0.219	20744	4538.564
13	2700	6	7.112	7.155	1.193	0.154	19203	2948.445
14	2550	6	14.133	63.974	10.662	0.231	36039	8326.566
15	2025	7	14.946	31.371	4.482	0.142	30266	4286.867
16	1575	3	9.205	47.816	15.939	0.434	14498	6287.888
17	1525	4	9.539	13.411	3.353	0.192	14546	2792.305
18	2500	4	2.839	16.424	4.106	0.714	7098	5065.774
20	1525	4	9.214	6.645	1.661	0.140	14051	1965.592
21	3300	7	2.190	6.721	0.960	0.447	7226	3233.506
22	3125	6	6.244	3.901	0.650	0.129	19512	2519.745
All strata:							328541	17648.554

Table 6. Estimated commercial number of shrimps per square nautical mile in the different strata and for all strata summarized with the precision of the estimates.

Stratum	Area nm ²	Number of hauls	$\bar{C}_k \cdot 10^{-3}$	$S_k^2 \cdot 10^{-6}$	$V(\bar{C}_k) \cdot 10^{-6}$	Coeff. of var.	Stock $\cdot 10^{-6}$	S.E. of stock $\cdot 10^{-6}$
1	1200	3	734.012	99.381	33.127	0.248	880.814	218.410
2	1650	2	467.293	3.609	1.805	0.091	771.034	70.094
3	1950	7	1227.985	394.139	56.306	0.193	2394.571	462.711
4	1800	6	1321.843	305.612	50.935	0.171	2379.317	406.239
5	2400	3	629.625	53.119	17.706	0.211	1511.101	319.357
6	2700	10	2292.494	305.974	30.597	0.076	6189.734	472.287
7	1850	7	1522.085	867.517	123.931	0.231	2815.857	651.271
8	2400	6	782.514	218.783	36.464	0.244	1878.033	458.292
9	1500	4	1264.553	510.359	127.590	0.282	1896.829	535.796
10	1500	4	2083.428	888.968	222.242	0.226	3125.141	707.138
11	1325	3	2023.455	1675.599	558.533	0.369	2681.078	990.240
12	1375	5	2430.408	1413.755	282.751	0.219	3341.812	731.147
13	2700	6	1129.720	171.746	28.624	0.150	3050.245	456.806
14	2550	6	2223.234	1591.528	265.255	0.232	5669.248	1313.323
15	2025	7	1870.596	416.920	59.560	0.130	3787.956	494.200
16	1575	3	1546.162	1469.825	489.942	0.453	2435.205	1102.434
17	1525	4	1792.603	200.505	50.126	0.125	2733.720	341.431
18	2500	4	507.015	469.652	117.413	0.676	1267.536	856.639
20	1525	4	1654.159	229.892	57.473	0.145	2522.592	365.596
21	3300	7	390.115	232.490	33.213	0.467	1287.378	601.406
22	3125	6	1180.479	167.637	27.939	0.142	3688.998	522.347
All strata:							56308.200	2950.413

Table 7. Trawl station data from cruise with R/V "Michael Sars" on Vest-Spitsbergen and Kveithola in July 1983.

St. no.	Date	Stratum	Square	Time (hour)	Dist. (n.m.)	Position		Depth (m)	Shrimp catch (kg)	By-catches (number)						
						N	E			Cod	Haddock	Redfish	Gr.Hal.	Capelin	Polar cod	Other
3	17.7	1	3	1313	3.0	74°51'	16°06'	265	80	6		1316	13			438
2	16.7	1	7	1010	3.0	74°50'	18°28'	301	350	35		2720	1	40		1727
1	16.7	2	6	0725	3.0	74°49'	18°26'	250	50	19		9		80		875
60	29.7	2	13	0616	3.0	74°38'	16°30'	250	5	245	1	60 kg				220
61	29.7	2	16	1028	3.0	74°23'	16°41'	240	5	4		65		2		209
7	17.7	3	10	1055	3.0	75°56'	16°30'	345	5	5		+	160			647
8	17.7	3	11	1240	1.5	75°58'	16°44'	327	20	2		Stone and mud				8
54	27.7	3	15	1405	1.5	75°48'	15°10'	387	10			40	6	2	96	400
6	17.7	3	29	0834	3.0	75°43'	16°30'	362	50			+	340			1000
56	28.7	3	32	0624	3.0	75°34'	14°50'	393	286	13		5434		132	22	888
9	17.7	4	3	1445	3.0	75°56'	17°45'	280	297	2			6	378 kg	1050	3004
5	17.7	4	11	0615	3.0	75°33'	16°32'	254	740	15		1485		19635	110	942
58	28.7	4	14	1335	3.0	75°20'	15°35'	272	650	28		8000				1640
52	27.7	5	10	0828	3.0	76°16'	14°57'	335	10			224			64	308
15	18.7	5	13	1600	1.5	76°09'	15°00'	344	2			Stone and mud			40	13
14	18.7	5	16	1340	3.0	76°09'	15°47'	360	5	4		20		30	200	
50	26.7	6	2	1255	3.0	76°52'	13°10'	230	30	1		136		23000		
13	18.7	6	11	1125	3.0	76°12'	16°33'	245	2	1		Stone and mud			600	
12	18.7	7	25	0835	1.5	76°17'	18°09'	265				4			300	
11	18.7	7	28	0620	3.0	76°20'	18°53'	270								
10	17.7	7	56	1707	3.0	75°05'	18°07'	236						2080	252	2482
19	19.7	8	4	1106	1.5	77°31'	11°13'	345	256	1		408	45		48	288
18	19.7	8	6	0906	3.0	77°23'	11°22'	335	338			458	62			22
22	19.7	9	3	1625	3.0	77°47'	10°27'	230		1				50		
21	19.7	9	5	1420	3.0	77°41'	11°07'	265	98	23		10000	270	190	30	1300
49	26.7	9	19	1041	1.5	77°07'	13°33'	230	204	1		40	10		260	200
28	21.7	10	8	1250	3.0	78°15'	10°47'	345	100				80		300	3500
27	21.7	10	10	1055	3.0	78°16'	10°06'	300	144			120	204		612	1368
32	22.7	11	4	1025	1.5	78°58'	9°20'	218								85
33	22.7	11	8	1245	3.0	79°03'	10°39'	330	110				348		2400	4708
31	22.7	11	10	0849	1.5	78°50'	9°20'	215	5			53		200		1
24	20.7	11	20	0900	1.5	78°15'	12°21'	252	85			Stone and mud			255	100
26	21.7	11	24	0845	2.8	78°10'	10°03'	269	249	7		816	34	160		820
25	21.7	11	28	0620	3.0	78°08'	11°05'	235	10						150	1015
23	20.7	11	45	0616	3.0	78°03'	12°45'	255	50	1		Stone and mud			200	
38	23.7	12	1	1455	3.0	79°57'	10°42'	370	301			666	36	18	18	1692
37	23.7	13	2	1321	1.3	79°49'	10°21'	302	164			440	10	80	20	586
36	23.7	13	3	1113	3.0	79°43'	9°36'	376	454			120	60			1608
48	25.7	14	2	1625	3.0	80°13'	10°52'	318	264			288	108	12	60	648
47	25.7	14	3	1225	3.0	80°18'	11°00'	333	80			72	16	32	232	509
44	24.7	15	1	1740	1.0	80°06'	10°58'	270	224			204	126	42	6	518
45	25.7	15	4	0616	3.0	80°25'	12°25'	275	15				52		35	16
4	16.7	16	1	1625	3.0	74°58'	15°47'	450	107	22		44	29	8		171
59	28.7	16	7	1623	3.0	75°12'	15°06'	461	150	18		4390	22	1		47
55	27.7	17	2	1638	3.0	75°49'	14°08'	465	10	5		890	15			60
57	28.7	17	7	0918	3.0	75°26'	14°24'	430	25	25		2702	4		3	57
51	26.7	18	5	1703	3.0	76°26'	14°23'	505	15	6		36	25	300	20	154
16	18.7	18	9	1806	1.5	76°05'	14°22'	450	5	2		153	26	3		13
20	19.7	19	4	1235	0.8	77°34'	10°57'	480	150			Stone and mud				
17	19.7	19	7	0623	3.0	77°12'	11°33'	470	357	1		2500	85		25	225
30	22.7	20	5	0622	3.0	78°42'	9°04'	515	61			63	66			128
29	21.7	20	8	1632	3.0	78°32'	9°22'	497	130			18	23	9		135
40	24.7	21	9	0630	3.0	79°55'	8°44'	480	266			14	126	164	56	196
39	23.7	21	13	1730	3.0	79°55'	10°00'	458	152			27	162	18		459
35	23.7	21	33	0851	3.0	79°44'	9°02'	430	312			6	62	48		524
34	23.7	21	35	0625	3.0	79°36'	8°28'	500				2	10			20
46	25.7	22	2	1007	3.0	80°18'	10°40'	477	25			8	25		19	23
42	24.7	22	5	1124	3.0	80°10'	8°41'	538	15				40	37	15	15
43	24.7	22	7	1415	3.0	80°05'	10°10'	530	30			11	45	23	55	19
41	24.7	22	9	0846	3.0	80°02'	8°06'	515	20				16	14		11

TABLE 8 - ESTIMATED DENSITY (\bar{C}_R) AND BIOMASS IN EACH STRATUM IN THE SPITSBERGEN AREA.

Stratum	Area (nm) ²	Number of hauls	\bar{C}_K Tons/(nm) ²	Biomass (tons)	Per cent change in stock size from 1982 to 1983
1	284	2	11,344	3222	+ 4197
2	842	3	1,055	889	- 38
3	1189	5	4,231	5031	- 39
4	486	2	27,357	13296	+ 225
5	611	3	0,334	204	- 95
6	353	2	0,844	298	- 36
7	1530	3	0,422	646	
8	109	2	22,425	2444	+ 120
9	539	3	8,899	4797	+ 43
10	201	2	6,437	1294	- 69
11	815	7	4,649	3789	- 40
12	155	1	15,882	2462	+ 14
13	89	2	21,961	1955	+ 136
14	56	2	9,075	508	- 77
15	95	2	18,124	1722	+ 15
16	200	2	2,823	565	
17	357	2	0,923	330	
18	246	2	0,660	163	
19	249	2	24,258	6040	
20	269	2	5,039	1355	
21	570	4	9,629	5489	
22	734	4	1,187	871	

All strata: 57370

TABLE 9 - CATCH OF SHRIMPS AND BY-CATCH COMPOSITION IN THE DIFFERENT STRATA IN THE BARENTS SEA

Stratum number	Number of hauls	Shrimps pr 3.nm (kg)	By-catch of fish in numbers pr 3.nm. trawled							
			COD	HADDOCK	REDFISH	GR.HAL	CAPELIN	POLARCOD	LONG ROUGH DAB	OTHERS
1	3	95	32	27	496	1	36		19	71
2	2	55	-	Stone and mud	-	-	-	-	-	-
3	7	143	14	31	284	2	27		64	36
4	6	156	11	11	387		12	2	115	35
5	3	64	27	59	287		25		183	46
6	10	273	13	31	448	1	51	68	225	177
7	7	183	2	1	125		193	191	258	305
8	6	84	20	122	676	1	15		103	52
9	4	157	3	86	1238	13	3		188	45
10	4	261	20	41	2337	14	12		187	716
11	3	231	31	224	1720	1	50		180	232
12	5	314	29	39	6346	2	20	1070	384	327
13	6	147	3	20	996	11	34		217	309
14	6	293	2	3	549	2	34	4	243	289
15	7	294	19	39	459	8	57	58	198	402
16	3	193	6	8	330	1	9	564	225	59
17	4	210	5	3	1903		3	239	247	477
18	4	61	9	10	13800	3		275		869
20	4	199	2		96	2	4	1	199	200
21	7	46	4		261	9	3		232	10
22	6	135	2	4	148	9	10		141	46

TABLE 10 - CATCH OF SHRIMPS AND BY-CATCH COMPOSITION IN THE DIFFERENT STRATA IN THE SPITSBERGEN AREA IN JULY 1983.

Stratum number	Number of hauls	Shrimps pr 3.nm (kg)	By-catch of fish in numbers pr 3.nm. trawled.						
			COD	REDFISH	GR.HAL.	CAPELIN	POLAR COD	LONG ROUGH DAB	OTHERS
1	2	215	21	2018	14	20		225	858
2	3	20	89	37		27		314	121
3	5	80	4	2757	128	34	54	346	324
4	3	562	15	3162	2	9818	387	719	1143
5	3	6	2	122		15	115	83	28
6	2	16	1	136		23000	300		
7	3	8		3		693	284	132	695
8	2	425	1	637	76		48	20	279
9	3	169	9	3360	97	80	183	143	424
10	2	122		60	142		456	90	2344
11	7	88	1	196	77	114	432	41	955
12	7	301		666	36	18	18	378	1314
13	2	416		568	42	92	23	330	1150
14	2	172		180	62	22	146	88	491
15	2	344		306	215	63	27	126	659
16	2	129	20	2217	26	5		30	79
17	2	18	15	1796	10		2	3	56
18	2	13	6	171	39	153	10		90
19	2	460	1	2500	85		25		113
20	2	96		41	89	5		18	114
21	4	183		12	65	55	14	15	285
22	4	23		5	32	19	22	1	16

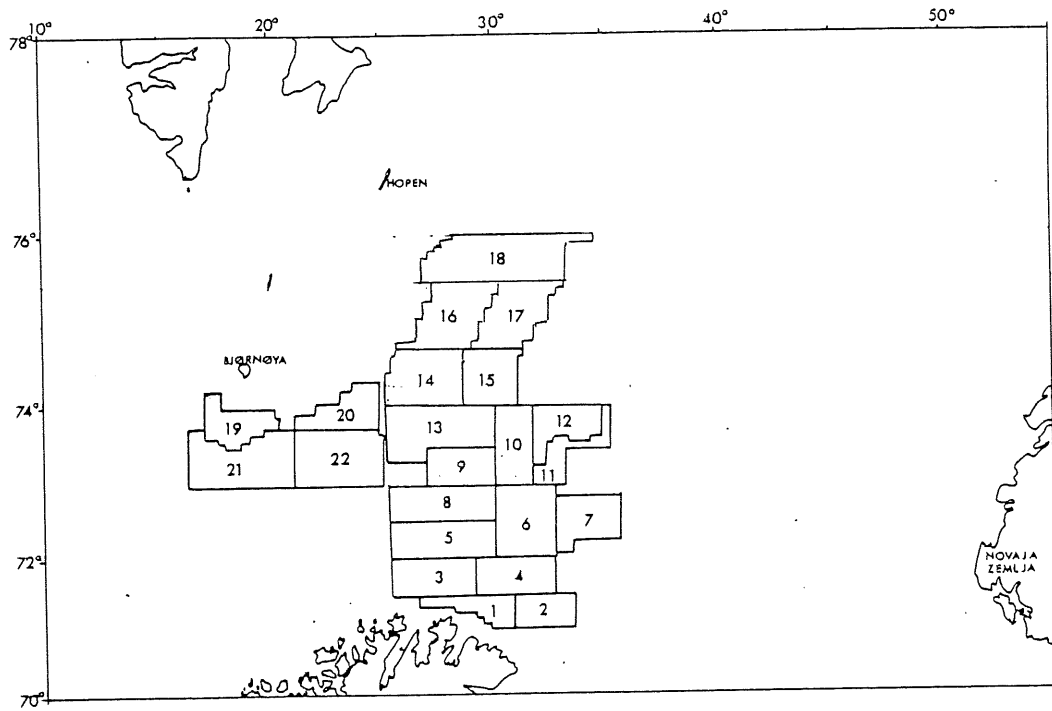


Fig. 1. Sampling strata used in April-May 1983 in the Barents Sea for the shrimp survey with R/V "Michael Sars".

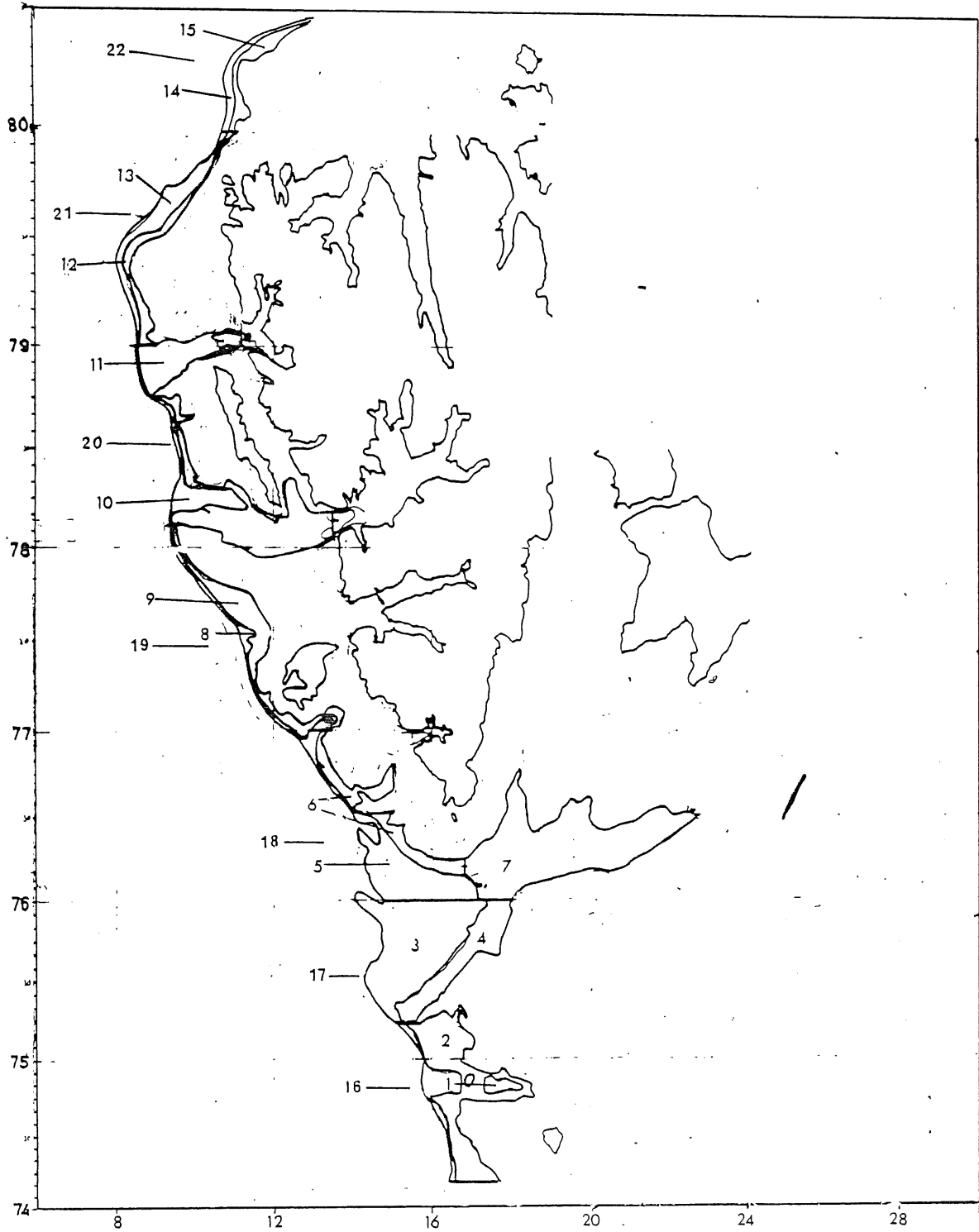


Fig. 2. Sampling strata used in July 1983 in the Spitsbergen area for the shrimp survey with R/V "Michael Sars".