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Assessment Data for Northern Shrimp in Denmark Strait in 2000

by

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Abstract

Northern shrimp (*Pandalus borealis*) occurs off East Greenland from Cape Farewell to about 70°N in Greenlandic waters and in adjacent Icelandic waters in the Dohrn and Strede Bank area. The stock is assessed as a single population. The fishery is managed by Total Allowable Catch in the Greenlandic zone, while there is no management in the Icelandic zone.

A multinational fleet is exploiting the stock, with annual catches in the order of 10 000 tons in recent years. Before 1993 the fishery was conducted exclusively in areas between 65° and 68°N, but since then various smaller fishing grounds south to Cape Farewell have also been exploited.

A combined standardized CPUE index for the total area indicates that the stock was reduced by a factor 3 in the period 1987-1993 after which it has been rebuilding to almost the same level as observed in 1987. Shrimp samples from the commercial fishery indicate some recruitment to the female stock component in 2000 and 2001, but are not considered representative of total catch composition because of incomplete coverage over time and area.

Lack of survey data since 1996, insufficient commercial data and uncertainty on stock structure make assessment of the stock difficult.

Introduction

The fishery for shrimp in Denmark Strait started in 1978 and, up to 1993, occurred primarily in the area of Stredebank and Dohrnbank as well as on the slopes of Storfjord Deep, from approximately 65°N to 68°N and between 26°W and 34°W. In 1993 a new fishery began in the areas south of 65°N down to Cape Farewell. Availability of fishing grounds depends heavily on ice conditions at any given time.

Except for 1978, when trawlers from Iceland started the exploitation in the northern area, this fishery has been multinational.

Total catches increased rapidly to about 12 000 tons in 1987 and 1988, declined thereafter to about 7 500 tons in 1992 and 1993 and increased again to about 11 500 tons in 1997. Catches in recent years have been at a level about 9 500 tons (catch in 2000 projected). Catches in the northern area decreased from 7 500 tons in 1993 to about 3 000 tons in 1996, but increased to a level at 4 000-4 500 tons in recent years. Catches in the southern area increased from 1 500 tons in 1993 to about 7 500 tons in 1997 and have decreased since to about 5 000 tons. Nominal catches (tons) are summarized in the following table and Fig. 1, details are given in Table 1.

	1990	1991	1992	1993	1994[1]	1995[1]	1996[1]	1997[1]	1998[1]	1999[1]	2000[1,2]
North of 65°N											
Iceland EEZ	281	465	1 750	2 553	1 514	1 151	566	2 856	1 421	769	56
Greenland EEZ	9 994	8 192	5 764	3 563	3 359	4 823	2 351	1 300	3 115	3 223	3 273
Sub-total	10 275	8 657	7 514	6 116	4 873	5 974	2 917	4 156	4 536	3 992	3 329
South of 65°N											
Greenland EEZ	-	-	-	1 532	4 939	3 532	6 796	7 433	4 785	5 475	4 533
Total	10 275	8 657	7 514	7 648	9 812	9 506	9 713	11 589	9 321	9 467	7 862
Recommended TAC	10 000	10 000	8 000	5 000	5 000	5 000	5 000	5 000	5 000	9 600	9 600

[1] Provisional catches.
[2] January - November 1.

Input Data

Commercial fishery data (Carlsson and Hvingel, 2000)

Fishing effort and CPUE. Catch and effort (hours fished) from logbooks were available from Greenland, Norway, Iceland, Faroe Islands and EU-Denmark since 1980 and from EU-France for the years 1980 to 1991. Catches and corresponding effort were compiled by month and by fleet. CPUE was calculated by month and the mean weighted CPUE of two periods of the year (January to June and July to December) was then applied to the total catch of the period to estimate the total effort (Tables 2, 3 and 4).

In the northern area, between 1981 and 1989, total unstandardized effort increased from about 20 000 hours to more than 100 000 hours, declining again to about 20 000 hours in 1999 (Fig. 1A). The projected value for 2000 is at the same level as in 1999. In the southern area, effort increased from about 11 000 hours in 1993 to 26 300 hours in 1997 and remained at about 10 000 hours in 1999 and 2000 (projected) (Fig. 1B). For the total area effort increased from 20 000 hours in 1981 to more than 100 000 hours in 1989 and declined steadily to 31 000 hours in 1999 (Fig. 1C).

Unstandardized catch rates in the northern area decreased from 1980 (about 250 kg per hour) to a level about 100 kg per hour from 1989 to 1993, but has shown an increasing trend to about 200 kg per hour in recent years (Fig 1D). Unstandardized catch rates in the southern area increased from 1993 (about 120 kg per hour) to about 500 kg per hour in 1999 and 2000. Overall unstandardized catch rates follow the same trend, increasing from 100 kg per hour in 1993 to about 300 kg per hour in recent years.

Standardized catch rates based on logbook data from Danish, Faroese and Greenlandic vessels in the northern area (Fig. 2A) show a continuous decline from 1987 to 1993 and an increasing trend in the following years (available observations from 2000 were too few to include this year in the series). A standardized catch rate series for the same fleets in the southern area shows the same increasing trend from 1993 (Fig. 2B). For both areas combined the standardized index for these fleets shows the same overall trend as in the northern area. A standardized catch rate index for the fishery of Icelandic vessels in the Icelandic zone (part of the northern area fished exclusively by Icelandic vessels) is fluctuating from 1987 to 1997, but shows an decreasing trend in recent years (Fig. 2C). A combined standardized catch-rate index for the total area, calculated from the indices for each area, shows a decrease from 1987 to 1993 and an increasing trend in the subsequent years (Fig. 3B).

Biological data. Commercial sampling of this fishery has generally been at a very low level but has improved in recent years. Available length information is however not representative of catch composition because of incomplete coverage over time and areas, but may yield some information on occurrence of size groups and recruitment.

Samples from the Greenlandic fishery in the northern area indicated that the catches in the late-1980s and during the 1990s were dominated by females except for 2000, where males were more abundant (Fig. 4A). Samples from the Greenlandic fishery in the southern area indicated a dominance of males in most years, except for 1994, when females were most numerous (Fig 4B). For the total area several year-classes of male and female shrimp were evident in sampling data in recent years, and the male component was well represented at carapace lengths between 20 and 27 mm, indicating that some recruitment to the female group will occur in 2000 and 2001.

Research survey data

No surveys have been conducted since 1996.

Assessment Results

Commercial CPUE. In the northern area standardized CPUE indices for the Greenlandic zone have increased since the minimum values in 1989-93, reaching almost the level observed during the mid-1980s, while indices for the Icelandic zone show a decreasing trend in recent years. Indices for the southern area have increased continuosly since 1993. Combined standardized CPUE indices for the total area have also increased since 1993, in recent years reaching almost the maximum value observed in 1987.

Recruitment. Based on the available data there were no immediate concerns about recruitment.

Biomass. No direct biomass estimates were available.

State of the stock. No estimate of absolute stock size can be provided. Standardized CPUE data for all areas combined indicate a general increasing trend in fishable biomass since 1993. Several year-classes of male and female shrimp are evident in the sampling data in recent years.

Insufficient commercial data and lack of survey data along with uncertainty on stock structure make assessment of this stock difficult.

References

Carlsson, D.M. and C. Hvingel, 2000. The fishery for Northern shrimp (*Pandalus borealis*) off East Greenland in 1999 and 2000. *NAFO SCR Doc.00/75, Ser. No. 4332*.

Table 1. Nominal catch (tons) of Northern shrimp in Denmark Strait.

Area/Nation	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996[1]	1997[1]	1998[1]	1999[1]	2000[1,2]
North of 65°N																							
Denmark	-	-	702	581	740	204	443	353	500	555	444	366	390	358	160	111	199	242	21	68	317	630	456
Faroe Islands	-	-	4233	713	737	443	668	674	727	595	679	595	843	1007	1092	554	368	745	800	509	1002	689	717
France	-	-	50	353	414	291	500	642	780	1030	494	381	51	118	-	-	-	-	-	-	-	-	-
Greenland	-	-	200	1004	1115	1467	2250	2596	5781	6627	7456	5976	6210	4205	2012	1425	1056	1913	289	84	510	488	163
Iceland	363	485	759	125	0	43	742	1794	1150	1330	1431	1326	281	465	1750	2553	1514	1151	566	2856	1421	769	56
Norway	-	800	2461	2016	1896	1727	2128	2051	2026	2041	2052	2098	2500	2504	2500	1473	1736	1923	1241	639	1286	1416	1937
Total	363	1285	8405	4792	4902	4175	6731	8110	10964	12178	12556	10742	10275	8657	7514	6116	4873	5974	2917	4156	4536	3992	3329
South of 65°N																							
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	488	585	938	1328	1027	870	1025
Faroe Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	225	776	236	323	526	109	360	69
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	918	2870	2135	4257	3767	3120	3945	3028
Norway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	341	805	576	1278	1812	529	300	411
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1532	4939	3532	6796	7433	4785	5475	4533
Total area																							
Denmark	-	-	702	581	740	204	443	353	500	555	444	366	390	358	160	159	687	827	959	1396	1344	1500	1481
Faroe Islands	-	-	4233	713	737	443	668	674	727	595	679	595	843	1007	1092	779	1144	981	1123	1035	1111	1049	786
France	-	-	50	353	414	291	500	642	780	1030	494	381	51	118	-	-	-	-	-	-	-	-	-
Greenland	-	-	200	1004	1115	1467	2250	2596	5781	6627	7456	5976	6210	4205	2012	2343	3926	4048	4546	3851	3630	4433	3191
Iceland	363	485	759	125	0	43	742	1794	1150	1330	1431	1326	281	465	1750	2553	1514	1151	566	2856	1421	769	56
Norway	-	800	2461	2016	1896	1727	2128	2051	2026	2041	2052	2098	2500	2504	2500	1814	2541	2499	2519	2451	1815	1716	2348
Total	363	1285	8405	4792	4902	4175	6731	8110	10964	12178	12556	10742	10275	8657	7514	7648	9812	9506	9713	11589	9321	9467	7862
Total all area	363	1285	8405	4792	4902	4175	6731	8110	10964	12178	12556	10742	10275	8657	7514	7648	9812	9506	9713	11589	9321	9467	7862
Advised TAC	-	-	-	-	4200	4200	4200	5000	-	-	-	10000[3]	10000[3]	10000[3]	8000	5000	5000	5000	5000	5000	5000	9600	9600
Effective TAC[4]	-	-	-	8000	4500	5725	5245	6090	7525[5]	7525[5]	8725[5]	9025[5]	14100	14500	13000	9563	9563	9563	9563	9563	9563	10600	10600

[1] Provisional

[2] Catch in 2000 per Nov. 1.

[3] Advised for a few years as a precautionary measure

[4] For Greenland zone only

[5] Not including Greenland fishery north of 66°30'N

Table 2. North area. Catch rates (kg per hour trawling), effort (hours trawling) and catch (tons) of Northern shrimp in Denmark Strait north of 65°N, 1980-2000.

Year	Periods	CPUE	Effort	Catch	Year	Periods	CPUE	Effort	Catch
1980	Jan-Jun	393	15775	6198.3	1991	Jan-Jun	99	71222	7036.1
	Jul-Dec	117	18815	2206.4		Jul-Dec	63	23972	1502.7
	Mean/Total	243	34590	8404.7		Mean/Total	90	95194	8538.8
1981	Jan-Jun	260	18072	4698.0	1992	Jan-Jun	95	60268	5697.3
	Jul-Dec	62	1516	93.9		Jul-Dec	78	23398	1817.1
	Mean/Total	245	19588	4791.9		Mean/Total	90	83666	7514.4
1982	Jan-Jun	212	23072	4900.0	1993	Jan-Jun	104	55062	5729.7
	Jul-Dec		-	-		Jul-Dec	42	9110	384.8
	Mean/Total	212	23072	4900.0		Mean/Total	95	64172	6114.5
1983	Jan-Jun	203	17332	3524.1	1994	Jan-Jun	186	21177	3942.4
	Jul-Dec	103	6338	651.3		Jul-Dec	99	9370	929.6
	Mean/Total	176	23670	4175.4		Mean/Total	159	30547	4872.0
1984	Jan-Jun	247	23900	5899.2	1995	Jan-Jun	174	26145	4547.9
	Jul-Dec	103	8074	831.6		Jul-Dec	73	19481	1424.3
	Mean/Total	211	31974	6730.8		Mean/Total	131	45626	5972.2
1985	Jan-Jun	181	28959	5249.0	1996	Jan-Jun	125	14060	1761.5
	Jul-Dec	126	22779	2861.0		Jul-Dec	112	10352	1154.6
	Mean/Total	157	51738	8110.0		Mean/Total	119	24412	2916.1
1986	Jan-Jun	189	41140	7755.0	1997	Jan-Jun	231	13838	3198.1
	Jul-Dec	205	15668	3209.0		Jul-Dec	103	9269	957.8
	Mean/Total	193	56808	10964.0		Mean/Total	180	23107	4155.9
1987	Jan-Jun	235	36251	8512.0	1998	Jan-Jun	207	15932	3300.9
	Jul-Dec	99	37004	3666.0		Jul-Dec	208	5955	1236.9
	Mean/Total	166	73255	12178.0		Mean/Total	207	21887	4537.8
1988	Jan-Jun	158	51842	8190.5	1999	Jan-Jun	181	15247	2761.4
	Jul-Dec	91	47717	4352.5		Jul-Dec	221	5560	1230.6
	Mean/Total	126	99559	12543.0		Mean/Total	192	20807	3992.0
1989	Jan-Jun	155	45428	7034.6	2000	Jan-Jun	187	9369	1750.7
	Jul-Dec	59	62475	3712.5		Jul-Dec	259	6098	1578.2
	Mean/Total	100	107903	10747.1		Mean/Total	215	15466	3328.9
1990	Jan-Jun	150	52411	7844.5					
	Jul-Dec	57	41755	2379.1					
	Mean/Total	109	94165	10223.6					

Table 3. South area. Catch rates (kg per hour trawling), effort (hours trawling) and catch (tons) of Northern shrimp in Denmark Strait south of 65°N, 1993-2000.

Year	Periods	CPUE	Effort	Catch
1993	Jan-Jun	122	11233	1369
	Jul-Dec	1064	153	163
	Mean/Total	135	11386	1532
1994	Jan-Jun	258	10295	2656
	Jul-Dec	294	7753	2280
	Mean/Total	273	18048	4936
1995	Jan-Jun	210	3982	835
	Jul-Dec	293	9203	2697
	Mean/Total	268	13185	3531
1996	Jan-Jun	252	13529	3416
	Jul-Dec	294	11482	3379
	Mean/Total	272	25010	6795
1997	Jan-Jun	236	15815	3727
	Jul-Dec	354	10453	3705
	Mean/Total	283	26268	7432
1998	Jan-Jun	437	5246	2293
	Jul-Dec	426	5856	2492
	Mean/Total	431	11102	4785
1999	Jan-Jun	408	4455	1819
	Jul-Dec	660	5539	3656
	Mean/Total	548	9994	5475
2000	Jan-Jun	539	7111	3833
	Jul-Dec	319	2195	701
	Mean/Total	487	9306	4533

Table 4. Total area. Semiannual catch rates (kg per hour trawling), effort (hours trawling) and catch (tons) of Northern shrimp in Denmark Strait by all nations.

		January-June			July-September			All year		
Year	Area	CPUE	Effort	Catch	CPUE	Effort	Catch	CPUE	Effort	Catch
1993	North	104	55062	5729.7	42	9110	384.8	95	64172	6114.5
	South	122	11233	1369.0	1064	2133	162.5	135	11386	1531.5
	Total	107	66295	7098.7	49	11242	547.3	101	75558	7646.0
1994	North	186	21177	3942.4	99	9370	929.6	159	30547	4872.0
	South	258	10295	2655.6	294	9736	2280.4	273	18048	4936.0
	Total	210	31473	6598.0	168	19105	3210.0	202	48595	9808.0
1995	North	174	26145	4547.9	73	19481	1424.3	131	45626	5972.2
	South	210	3982	834.5	293	11189	2696.9	268	13185	3531.4
	Total	179	30127	5382.4	134	30670	4121.2	162	58812	9503.6
1996	North	125	14060	1761.5	112	10352	1154.6	119	24412	2916.1
	South	252	13529	3416.0	294	13471	3379.4	272	25010	6795.4
	Total	188	27589	5177.5	190	23823	4534.0	196	49423	9711.5
1997	North	231	13838	3198.1	103	9269	957.8	180	23107	4155.9
	South	236	15815	3727.2	354	12445	3704.7	283	26268	7431.9
	Total	234	29653	6925.3	215	21715	4662.5	235	49375	11587.8
1998	North	207	15932	3300.9	208	5955	1236.9	207	21887	4537.8
	South	437	5246	2292.8	426	7851	2759.9	431	11102	4784.9
	Total	264	21178	5593.7	290	13806	3996.8	283	32989	9322.7
1999	North	181	15247	2761.4	221	5560	1230.6	192	20807	3992.0
	South	408	4455	1818.6	660	7537	4087.4	548	9994	5475.0
	Total	232	19701	4580.0	406	13097	5318.0	307	30801	9467.0
2000	North	187	9369	1750.7	259	6098	1578.2	215	15466	3328.9
	South	539	7111	3832.7	319	2195	700.5	487	9306	4533.2
	Total	339	16480	5583.4	275	8293	2278.7	317	24772	7862.1

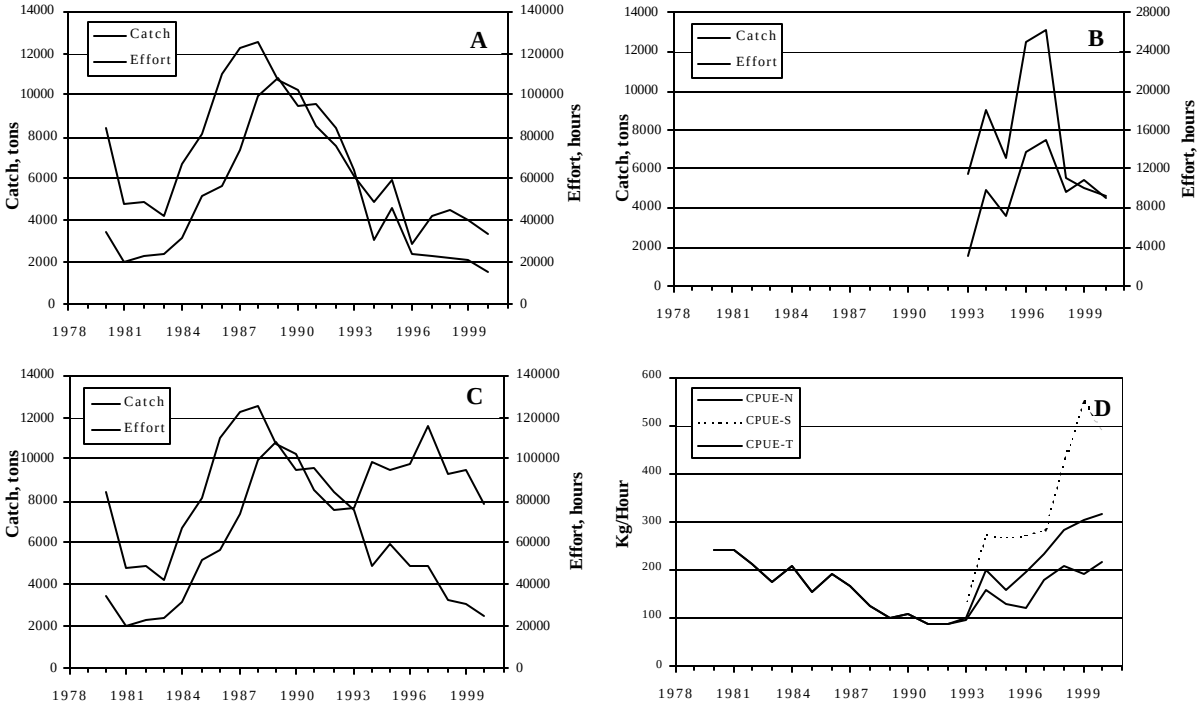

Fig. 1. Nominal catch and unstandardized effort from A. the area north of 65°N, B. the area south of 65°N and C. the total area, and overall unstandardized catch per unit effort in northern, southern and total area (D). Data for 2000 preliminary, from Jan. - Nov. 1.

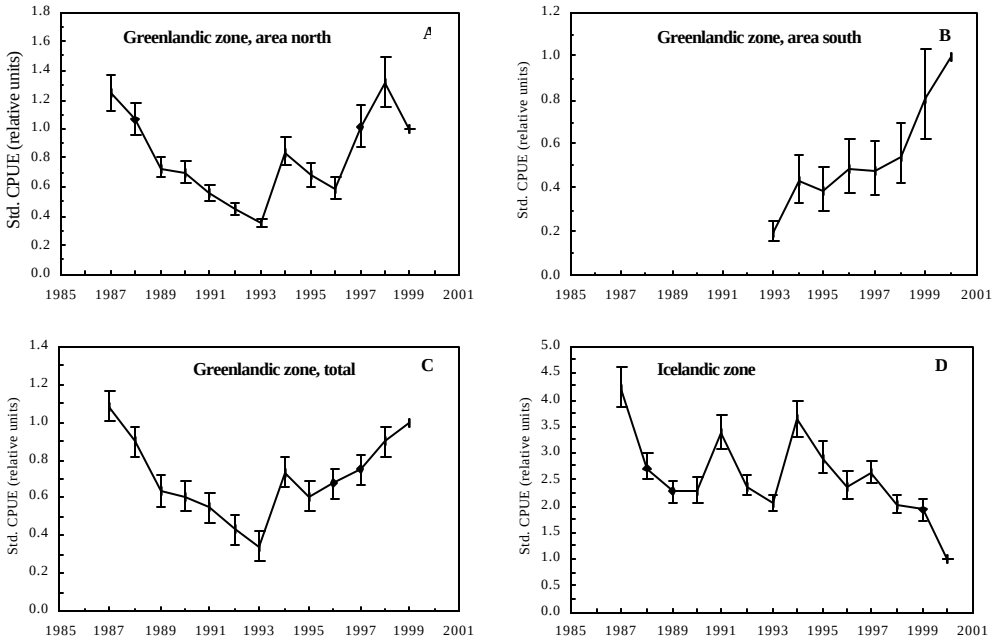

Fig. 2. Standardized CPUE indices for the Greenlandic zone (A: area north of 65ºN , B: area south of 65ºN and C: total area, based on logbook data from Danish, Faroese and Greenlandic vessels) and for the Icelandic zone (D, logbooks from Icelandic vessels).

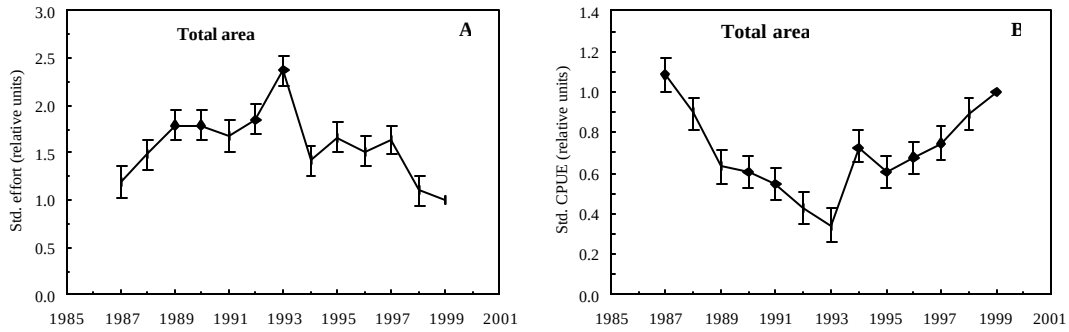

Fig. 3. Combined standardized effort (A) and standardized CPUE-index (B) for total area, calculated from the indices for the three areas (Greenland zone north of 65°N, Greenland zone south of 65°N and Icelandic zone).

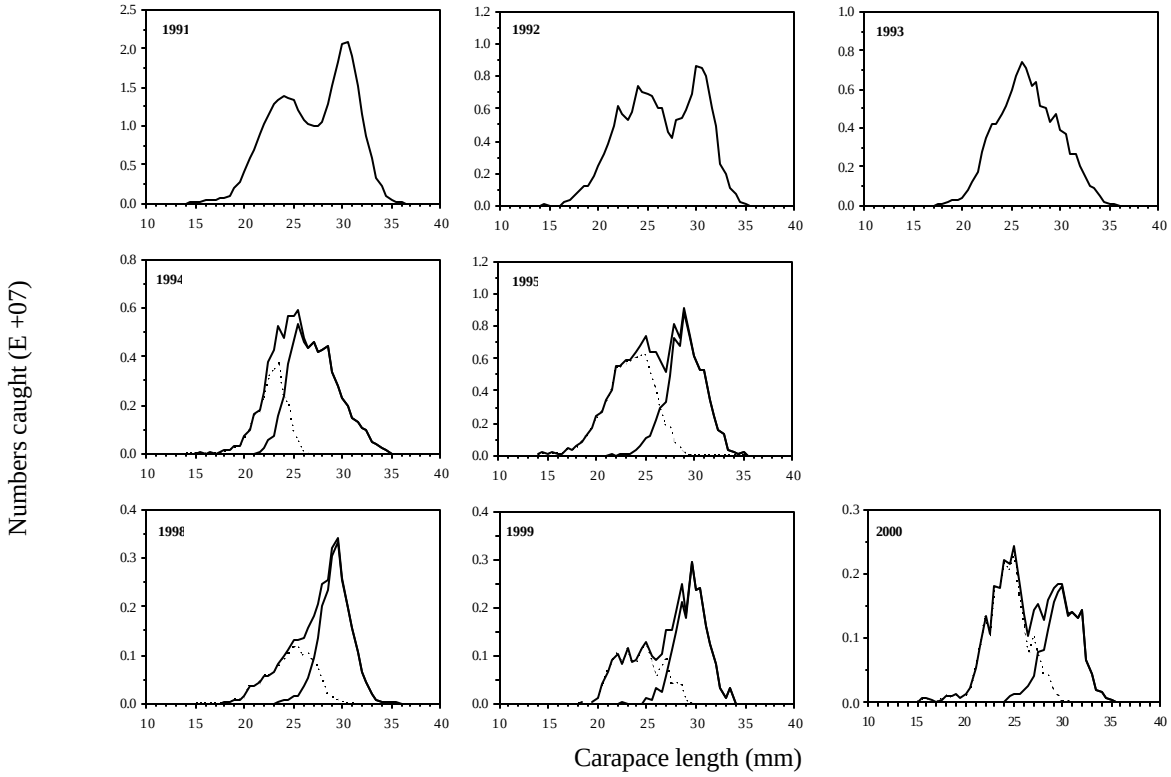

Fig. 4A. Length frequency distributions of Greenlandic commercial shrimp catches off East Greenland north of 65°N, 1991 - 2000 (no data available for 1996-1997). The distribution of male shrimp is shown by a dotted line, females by a thin line and overall distribution by a bold line. Data for 2000 preliminary.

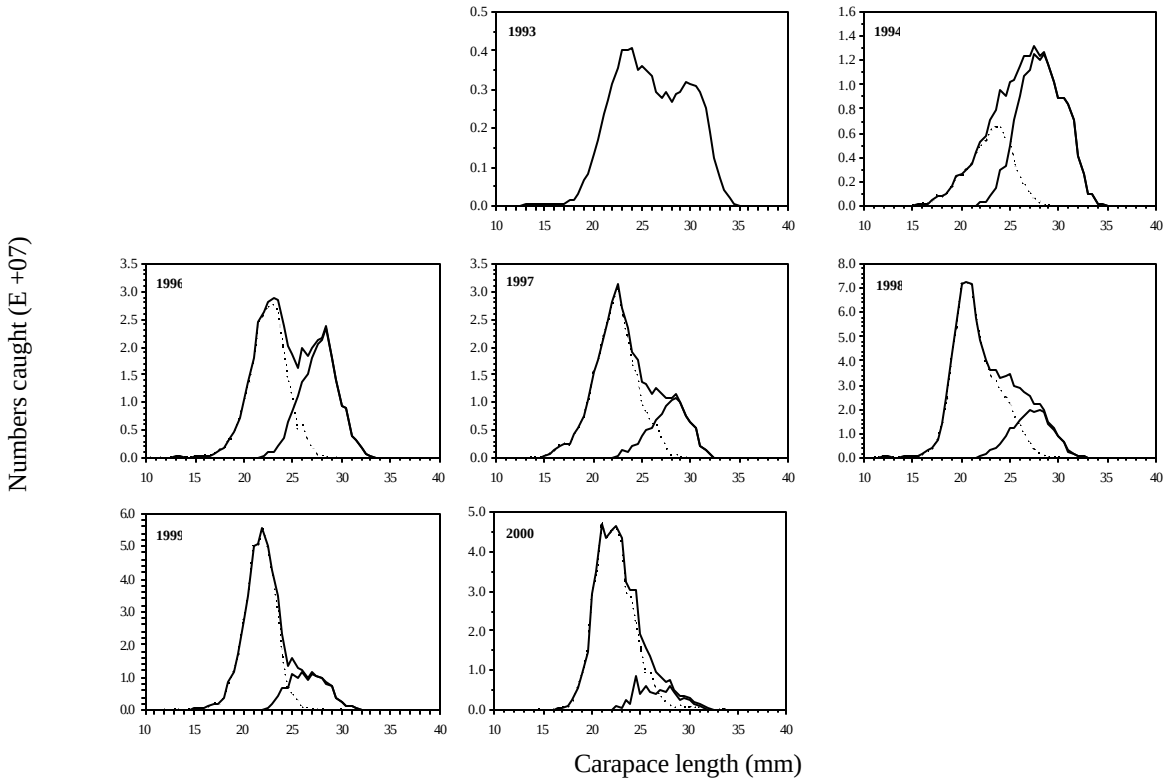

Fig. 4B. Length frequency distributions of Greenlandic commercial shrimp catches off East Greenland South of 65°N, 1993-2000 (no data available for 1995). The distribution of male shrimp is shown by a dotted line, females by a thin line and overall distribution by a bold line. Data for 2000 preliminary.