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Preliminary assessment of Shrimp in the Denmark Strait in 1996

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1. INTRODUCTION

The fishery was initiated in 1978 with a catch of about 360 tons and subsequently increased rapidly to about 12 500 tons in 1988. In 1989 and 1990 the nominal catch decreased to less than 11,000 tons and in 1991 and 1992 declined further to 8 600 and 7 500 tons respectively. The annual catches have continued to fall in the traditional (northern area), to 6 500 in 1993 and finally to 4 900 tons in 1994. In 1995 the provisional figure is about 5 200 tons. At the same time there has been a new fishery starting in 1993 in two areas found further south (Fig. 1) where some 3 000 to 6 060 tons were taken in the middle and south area combined in the years 1993 to 1995. In 1996 the catch is already 4 400 tons in this so-called southern area.

The fishery takes place primarily in the area of Stred Bank and Dohrn Bank as well as on the slopes of Storfjord Deep. Two new areas were discovered in 1989 by Greenland (Lehmann, 1990), but not found profitable at the time have now been fished for three years. The new areas lie south of 65°N and are shown on Fig. 1 along with the traditional north and east area. The traditional fishing area extends from approximately 65°20'N to 67°30'N and between 26°W and 34°W. For the sake of comparison and because of the uncertainty of whether the shrimp of the southern area belong to the same stock, the catch and effort data are kept separate from those of the northern area. Throughout this paper unless otherwise stated there are data from the northern area.

2. Input Data

2.1 Commercial fishery data

2.1.1. Trends in catch and effort.

Catch and effort data from logbooks were available from Greenland, Norway, Iceland, Faroe Islands and Denmark since 1980 and from 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. For revision of catch effort and CPUE for all nations in the years 1980-1996 see Skúladóttir (1996 a).

Total catches increased rapidly from 1978 to 1980, decreased in 1981 and remained stable to 1983. Catches increased steadily from 1983 to 1988 to 10 500 tons and then decreased to 4 000 tons in 1995 in the northern area. The overall catch in north and south was 9 500 in 1995 (Fig. 2, Table 5).

Total effort values in the northern area showed the same pattern as catch. Between 1980 and 1989, effort increased from about 35 000 hours to more than 100 000 hours in and 1989, declining thereafter gradually to about 40 000 in 1993 and then further to 15 500-24 000 hours in 1994 and 1995. The fishery from July-December became more important at the end of the eighties, accounting for approximately 50% of the total annual effort. In the early nineties the effort is again exerted in the first half of the year. In the southern area the effort was between 36 000-40 000 hours in 1993-95 (Fig. 3, and Skúladóttir, 1996 a).

2.1.2 Trends in catch rates

Abundance indices were calculated from the unstandardized catch rate series of the years 1980 to 1996 using all countries except Norway. In the paper on catch statistics the catch and effort for all countries are combined (Skúladóttir, 1996). But here Norway is not included in the tables for the calculation of unstandardized catch rate for the whole series as there were doubts as to whether the Norwegians were fishing solely in the southern area in the years 1993-1995. The calculations leading up to the annual CPUE can be followed in tables 1-4 in the northern and the whole area respectively. The unstandardized CPUE in the north area has been set against removals as catch from the stock in every 3 previous years (Fig. 4). From this figure it appears that some recovery has taken place as the annual removals of shrimp from the fishery decreased to about 6 000 tons on the average. The last year 1996 appears very out of place and can be explained by either a southward shift of the shrimp or the availability was very low this year when visited by shrimpers. When studying the catch rates, the 1996 value of the northern area was used as the reference point for both the north area and north and south combined (Figs. 5 and 6).

In the northern area there is a declining trend from 1980 to 1989. Catch rates were similar in the period from 1989 to 1993, where the 1989-93 level was about 50% of the level seen during the period of relative stability from the early 1980's. But in year 1994 there is a considerable increase in CPUE and in 1995 there is a continued stability. In 1996 the CPUE seems to be at the level of the period 1989-1993. In the whole area the CPUE is first low in 1993 increases thereafter and is stable in the years 1994-1996.

2.1.3 Standardization of the catch rates

The catch and effort data from Greenland from 1987 to 1994 were analyzed using SAS multiple regression procedures to account for the vessel size and seasonality (months) of the fishery both the total catch and the proportion of shrimp >8.5 g of weight (Fig. 7). The results for both showed a continuous decline till 1992 stability in 1993 and a considerable increase in 1994 and again stability in 1995. There is a drop in 1996 in the CPUE index north of 65° N for all shrimp, but there only fishery in January.

2.2 Commercial Biological data

2.2.1 Icelandic fishery data

The Icelandic samples (Fig.8) taken in the spring of 1991, 1992 and 1993 showed that male shrimp dominated in all three years. In 1994 the samples taken in spring show about 50% occurrence of males again. The occurrence of a component of female shrimp with a mode at 25-26 mm in the Icelandic samples suggested that sex change occurred earlier than normal. The 1991 and 1992 samples show the occurrence of these small females but there was no noticeable component as seen in the 1990 data (Skúladóttir et al, 1994) Samples from the Icelandic and Greenlandic fisheries in the late 1980s (Figs. 8 and 9) were comprised mainly of females. Throughout the 1990s males have dominated the catches in the Icelandic fishery, except in 1995 which may have been affected by sampling problems.

The occurrence of a component of female shrimp with a mode at 25-26 mm as noted in the 1990 samples is here again present but not very distinct and the preliminary age assessment of Icelandic samples of the years 1990 to 1994 indicate that upto 20% of a year-class change sex one year earlier than the rest. There was doubt as to whether this was a response to fishing pressure, as indicated by declining catch rates of the past years, or whether there could have been a migration of shrimp from Icelandic waters where males change sex at a smaller size. samples taken in 1994 on the eastern area and analysed electrophoretically show more affinity with samples taken in the Offshore Icelandic waters than to samples taken west of the midline (Jónsdóttir, 1996). In 1995 however there appears to be just one peak in the immature females. In 1996 the primiparous females show again bimodality with a small proportion changing sex earlier.

2.2.2. Greenlandic fishery data

The samples from the Greenlandic fishery in 1991-1996 shown here

are from the whole area (Fig. 9). There were no samples from 1996 from the northern area. The samples have been aged and there seem to be often 6 year-classes detected. In 1996 males seem to be very dominant (Hvingel et al 1996).

2.3 RESEARCH SURVEY DATA

2.3.1 Abundance estimates

A two phase stratified random trawl survey (Spline method) was conducted by Greenland in the Denmark Strait in September-October, 1995 as was also done in 1994. The biomass estimate of 4 558 and 3 800 tons respectively, being much higher than that of either 1990 or 1992, which were only 1 860 and 1 044 tons respectively. Due to bad weather the second phase was never carried out, so only the abundance indices can be compared. The higher abundance estimate found in 1995 1996 as compared to 1990, 1992 and 1994 is the result of an increasing number of both male and female shrimp (Carlsson 1996).

	Males	Females	Total
1989	231.0	135.4	366.3
1990	142.6	86.7	228.3
1992	163.6	45.3	209.0
1994	264.4	90.4	354.8
1995	315.7	109.9	425.6
1996	527.3	124.0	651.3

2.3.2 Demographic structure

showed an increase in the proportion of males over the period which is consistent with a trend from the 1985 to 1989 in Norwegian surveys. However overall abundance declined, especially for females. In 1996 the total number of females has increased (text table).

	Percent males									
	1985	1986	1987	1988	1989	1990	1992	1994	1995	1996
Norway	43.8	41.4	53.5	58.5	58.0					
Greenland					63.1	62.5	78.3	74.5	74.2	81.0

3. SUMMARY OF ALL INDICES

Trends in catches

Increase from 1978 to 1980.
 Decrease in 1981 and stabilization in '82 and '83 at around 4.700 tonnes.
 Steady increase from 1983 to 1988 to 12.500.
 Decrease from 1988 to 1995 and 1996.

Trends in effort

General increase from 1979 to 1989.
 General decrease from 1989 to 1995 and 1996.

Trends in catch rates

Overall declining trend in the unstandardized catch rate from 1980 to 1989.
 Considerable increase from 1993 to 1994.
 A steady decrease for the standardized catch rate for both large shrimp and all shrimp from 1987 to 1992 for Greenland.
 Leveling off from 1992 to 1993
 Increase in 1994 and stability in 1995.
 Decline in 1996 in the north but stability when looking at north and south combined.

Biomass estimate from research surveys

Number of shrimp estimated in 1996 the highest of comparable surveys.

Demographic structure from research surveys

Increase in proportions of males since 1989 in Greenlandic surveys

4. SUMMARY OF ADVICE FROM PREVIOUS YEARS

The interpretation of the effects of fishing on the stock in the Denmark Strait north of 65°N has changed since the first assessment was conducted in 1980. In 1981, it was thought that the decrease observed in the spring catch rates were due to heavy exploitation. Also it was considered that the stock was at the northern limit of the species distribution range, and as such, could be more sensitive to exploitation. Therefore, a cautious approach for the exploitation was recommended, and a TAC of 5,000 tonnes (average catch 1981-1984) was advised.

No TAC advice was provided for 1986, 1987 or 1988 because the catch rates could not be interpreted as an index of stock abundance. In 1988, it was observed that increased catches over the previous several years had no apparent effect on the resource and catch levels at around 10,000 tonnes were recommended as an exploratory level for several years.

Catch rates declined in 1987 and 1988, however catch composition and biomass estimates from 1985 to 1989 suggested that the stock was stable and in 1990 it was recommended that the TAC remain at 10,000 tonnes. The 1989 Norwegian survey showed that the stock was dispersed and the sexes well mixed. In 1991, the catch rate series for the Greenlandic fleet was standardized to account for changes in seasonality and fleet composition and it was interpreted that the stock in 1989-90 was substantially lower than in the period of stabilized catch rates. Also more males appeared in the catches and there were indications of earlier sex change. These concerns resulted in an arbitrary reduction of the TAC from 10,000 to 8,000 tonnes. The depressed conditions were still evident in the 1991 data and in 1992 a further reduction to 5,000 tonnes was advised for 1993 and several years thereafter in an attempt to protect the spawning biomass and rebuild the stock.

5. STATUS ON THE RESOURCE

Unstandardized catch rates in the northern area for all nations combined showed a declining trend from 1987 to 1989, but a stabilization between 1989 and 1993 a rise in 1994 and 1995. Taking the whole area into account the catch rates are stable. The standardized catch rates of Greenland show also a decline from 1987 to 1992 and a stabilization between 1992 and 1993 followed by about the same increase in catch rate in 1994 and 1995 as for that of all fleets combined. Moreover there was an increase in abundance index from low abundance of the years 1990 and 1992. As such this could be an indication of improvement of the resource. On the other hand the proportion of males to females is high according to Greenlandic survey as well as according to the Icelandic commercial samples.

6. PROGNOSIS

The changes in fishing pattern (decline in changes in north area, increased in south area) make assessment of this stock difficult. The decline in catch rate in the northern area is difficult to reconcile with other indices. Catch rates are increasing in the southern area and are stable considering north and south area combined. The 1996 survey indicates that abundance is being maintained in the northern area. Despite the uncertainty of the present assessment, it seems that the stock has recently improved, however, it remains below the level of the mid-1980s.

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Table 1. North area. Catch rates (kg per hour trawling) and corresponding effort (hours trawling) and catch (tons) from the shrimp fishery in Denmark Strait north of 65° N, by all nations except Norway, combined in two periods of the year.

Year	Country	January-June			July - December		
		CPUE	Effort	Catch	CPUE	Effort	Catch
1980	Greenland, Denmark	350	1665	582.0	129	2483	320.0
	Iceland	125	1760	219.3	101	5318	539.4
	Faroe Islands	427	9115	3692.0			
	Total	374	12540	4693.3	110	7801	859.4
1981	Greenland, Denmark	395	4013	1585.0			
	France	246	1436	353.0			
	Iceland	99	688	68.0	67	848	56.9
	Subtotal	327	6137	2006.0	67	848	56.9
	Total	327	6137	2006.0	67	848	56.9
1982	Greenland, Denmark	220	8432	1855.0			
	France	226	1833	414.0			
	Subtotal	221	10265	2269.0			
	Total	221	10265	2269.0			
1983	Greenland	255	5752	1467.0			
	France	192	1516	291.0			
	Iceland	99	52	5.1	161	236	38.3
	Subtotal	241	7320	1763.1	161	236	38.3
	Total	241	7320	1763.1	161	236	38.3
1984	Greenland	340	6627	2250.0			
	Norway	191	11141	2128.0			
	Iceland	42	53	2.2	103	7164	739.6
	Subtotal	246	17821	4380.2	103	7164	739.6
	Total	246	17821	4380.2	103	7164	739.6
1985	Greenland	270	6469	1744.0	251	3389	852.0
	France	194	2594	504.0	170	814	136.0
	Iceland	88	4485	396.0	94	14944	1398.0
	Denmark				137	1482	203.0
	Subtotal	195	13548	2644.0	126	20629	2591.0
	Total	195	13548	2644.0	126	20629	2591.0
1986	Greenland	288	14285	4114.0	437	3811	1667.0
	France	175	3415	597.0	218	841	183.0
	Iceland	73	3205	234.0	103	8893	916.0
	Denmark	226	1962	443.0	226	252	57.0
	Faroe Islands	93	5428	506.0	416	531	221.0
	Total	208	28295	5894.0	212	14328	3044.0
1987	Greenland	314	17667	5547.0	144	7502	1080.0
	Iceland				79	16835	1330.0
	France	241	2599	626.0			
	Denmark	144	2997	431.0	99	1250	124.0
	Faroe Islands	229	1635	375.0	106	2068	220.0
	Total	280	24898	6979.0	100	27655	2754.0
1988	Greenland	219	24111	5285.0	157	13820	2165.0
	Iceland	107	1769	189.5	54	22735	1234.5
	France	141	3138	444.0			
	Denmark	95	3479	329.0	98	1172	115.0
	Faroe Islands	166	4031	669.0			
	Total	189	36528	6916.5	93	37727	3514.5
1989	Greenland	192	23343	4471.0	75	20039	1510.0
	Iceland	108	7835	847.3	45	10722	478.7
	France	191	1525	291.3	58	1536	89.8
	Denmark	211	1336	282.0	58	1450	84.0
	Faroe Islands	145	3035	439.0	93	1672	156.0
	Total	171	37074	6330.6	65	35419	2318.5

Table 1 continued.

Year	Country	January-June			July - December		
		CPUE	Effort	Catch	CPUE	Effort	Catch
1990	Greenland	189	28956	5478.0	71	10298	732.0
	Iceland	80	2538	203.9	66	1165	77.1
	France	126	286	36.0			
	Denmark	91	3304	302.0	42	2120	88.0
	Faroe Islands	122	5631	685.0	82	1925	158.0
	Total	165	40715	6704.9	68	15508	1055.1
1991	Greenland	119	33582	3980.0	88	2560	225.0
	Iceland	218	1930	421.1	104	423	43.7
	France	115	1024	117.5			
	Denmark	71	3295	234.0	58	2123	124.0
	Faroe Islands	93	8610	801.0	77	2659	206.0
	Total	115	48441	5553.6	77	7765	598.7
1992	Greenland	103	17612	1811.0	96	2087	201.0
	Iceland	211	8232	1733.3	101	169	17.1
	Denmark	43	3013	131.0	47	613	29.0
	Faroe Islands	68	7446	508.0	96	6095	584.0
	Total	115	36303	4183.3	93	8964	831.1
	1993	Greenland	93	15073	1408.0	176	97
Iceland		184	13854	2548.4	216	21	4.6
Denmark		41	2094	85.3	72	353	25.4
Faroe Islands		66	8436	554.0			
Total		116	39457	4595.7	100	471	47.0
1994*		Greenland	170	6197	1056.0		
	Iceland	286	5233	1498.9	92	167	15.4
	Denmark	102	634	65.8	140	952	133.0
	Faroe Islands	164	1745	286.0	124	660	82.0
	Total	210	13809	2905.7	130	1779	230
	1995*	Greenland	220	8468	1861.0	54	964
Iceland		309	3721	1150.0	171	7	1.2
Denmark		160	1507	241.0	15	34	1.0
Faroe Islands		96	5558	535.0	63	3347	210.0
Total		197	19254	3787.0	61	4352	264.2
1996*		Greenland	87	1864	163.0		
	Iceland	242	2306	559.0	163	41	6.7
	Denmark	98	163	16.0			
	Faroe Islands	69	4943	343.0			
	Total	117	9276	1081.0	163	41	6.7

Table 2. North area. Catch rates (kg per hour trawling) and corresponding effort (hours trawling) and catch (tons) from the shrimp fishery in Denmark Strait north of 65° N, by years. Norway not included.

Year	Periods	CPUE	Effort	Catch
1980	Jan-Jun	374	12540	4693.3
	Jul-Dec	110	7801	859.4
	Mean/Total	273	20341	5552.7
1981	Jan-Jun	327	6137	2006.0
	Jul-Dec	67	848	56.9
	Mean/Total	295	6985	2062.9
1982	Jan-Jun	221	10255	2269.0
	Jul-Dec	-	-	-
	Mean/Total	221	10265	2269.0
1983	Jan-Jun	241	7320	1763.1
	Jul-Dec	161	238	38.3
	Mean/Total	238	7558	1801.4
1984	Jan-Jun	246	17821	4380.2
	Jul-Dec	103	7181	739.6
	Mean/Total	205	25002	5119.8
1985	Jan-Jun	195	13548	2644.0
	Jul-Dec	126	20629	2591.0
	Mean/Total	153	34177	5235.0
1986	Jan-Jun	208	26295	5894.0
	Jul-Dec	212	14328	3044.0
	Mean/Total	210	42623	8938.0
1987	Jan-Jun	280	24898	5979.0
	Jul-Dec	100	27655	2754.0
	Mean/Total	185	52553	8733.0
1988	Jan-Jun	189	36528	6916.5
	Jul-Dec	93	37727	3514.5
	Mean/Total	140	74255	10431.0
1989	Jan-Jun	171	37074	6330.6
	Jul-Dec	65	35419	2318.5
	Mean/Total	119	72493	8649.1
1990	Jan-Jun	165	40715	6704.9
	Jul-Dec	68	15508	1055.1
	Mean/Total	138	56223	7760.0
1991	Jan-Jun	115	48441	5553.6
	Jul-Dec	77	7765	598.7
	Mean/Total	109	56206	6152.3
1992	Jan-Jun	115	36303	4183.3
	Jul-Dec	93	8964	831.1
	Mean/Total	111	45267	5014.4
1993	Jan-Jun	116	39457	4595.7
	Jul-Dec	100	471	47.0
	Mean/Total	116	39928	4642.7
1994	Jan-Jun	210	13809	2906.7
	Jul-Dec	129	1779	230.0
	Mean/Total	201	15588	3136.7
1995*	Jan-Jun	197	19254	3787.0
	Jul-Dec	61	4352	264.2
	Mean/Total	172	23606	4051.2
1996*	Jan-Jun	117	9276	1081.0
	Jul-Dec	163	41	6.7
	Mean/Total	117	9317	1087.7

Table 3. North and south area. Catch rates (kg per hour trawling) and corresponding effort (hours trawling) and catch (tons) from the shrimp fishery by all nations combined in two periods of the year.

Year	Country	January-June			July - December		
		CPUE	Effort	Catch	CPUE	Effort	Catch
1993	North	116	39457	4595.7	100	471	47.0
	South	81	30677	2494.6	57	8753	500.0
	Total	101	70134	7090.3	59	9224	547.0
1994	North	210	13809	2906.7	129	1779	230.0
	South	194	19738	3827.6	176	15977	2812.4
	Total	201	33547	6734.3	171	17756	3042.4
1995*	North	197	19254	3787.0	61	4352	264.2
	South	128	13676	1753.3	143	26007	3707.7
	Total	168	32930	5540.3	131	30359	3971.9
1996*	North	110	19410	2141.4	163	41	6.7
	South	219	16048	3517.6	387	2226	862.0
	Total	160	35458	5659.0	383	2267	868.7

Table 4. North and south area combined to the whole year as regards effort, catch and CPUE.

Year	Country	CPUE	Effort	Catch
1993	Jan-Jun	101	70134	7090.3
	Jul- Dec	59	9224	547.0
	Total	96	79358	7637.3
1994	North	201	33547	6734.3
	South	171	17756	3042.4
	Total	191	51303	9776.7
1995*	North	168	32930	5540.3
	South	131	30359	3971.9
	Total	150	63289	9512.2
1996*	North	160	35458	5659.0
	South	383	2267	868.7
	Total	173	37725	6527.7

Table 5. Nominal catch (tonnes) of shrimp in the Denmark Strait.

Nation	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995***	1996***	1997		
North area																						
Denmark	-	-	702	581	740	204	443	353	500	555	444	366	390	358	160	111	199	242	16			
Faroe Islands	-	-	4233	713	737	443	688	674	727	595	679	595	843	1007	1092	554	368	745	343			
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	163			
Iceland	363	485	759	125	0	43	742	1794	1150	1330	1431	1326	281	465	1750	2553	1514	1151	566			
Norway	-	800	2461	2016	1896	1727	2128	2051	2026	2041	2052	2098	2500	2504	2500	-	-	-	1060			
Total	363	1285	8405	4792	4902	4175	6731	8110	10964	12178	12556	10742	10275	8657	7514	4643	3137	4051	2148			
Middle and south area																						
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	488	565	778			
Faroe Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	225	776	236	299			
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	918	2870	2135	2277			
Norway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1804	2507	2505	1026			
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2995	6641	5461	4380			
Σ eastern side	363	485	759	125	0	43	742	1794	1150	1330	1431	1326	281	465	1750	2553	1514	1151	566			
Σ north area not eastern side	0	800	7646	4667	4902	4132	5989	6316	9814	10848	11125	9416	9994	8192	5764	2090	1623	2900	1582			
Σ middle and south area																2995	6641	5461	4380			
Σ western side	0	800	7646	4667	4902	4132	5989	6316	9814	10848	11125	9416	9994	8192	5764	5085	8264	8361	5962			
ΣΣ all areas	363	1285	8405	4792	4902	4175	6731	8110	10964	12178	12556	10742	10275	8657	7514	7638	9778	9512	6528			
Advised TAC	-	-	-	-	4200	4200	4200	5000	-	-	-	10000*	10000*	10000*	10000*	8000	5000	5000	5000	5000		
Effective TAC western side	-	-	-	8000	4500	5725	5245	6090	7525**	7725**	8725**	9025**	14100	14500	13000	9563	9563	9563	9563	9563		

* Advised for a few years as a precautionary measure.

** not including Greenland fishery north of 66°30'N.

*** Provisional.

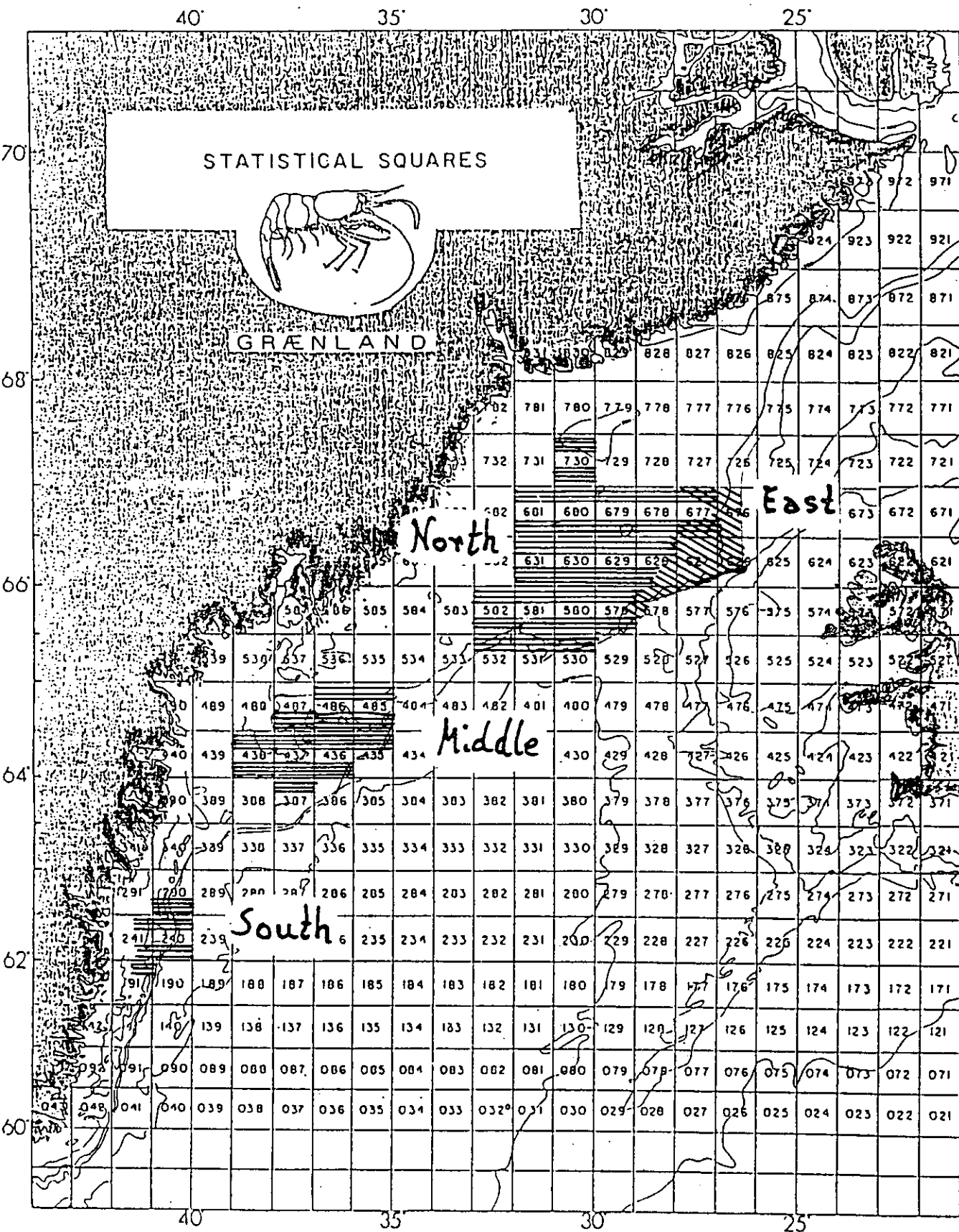


Fig. 1. The different areas in the Denmark Strait and at east Greenland.

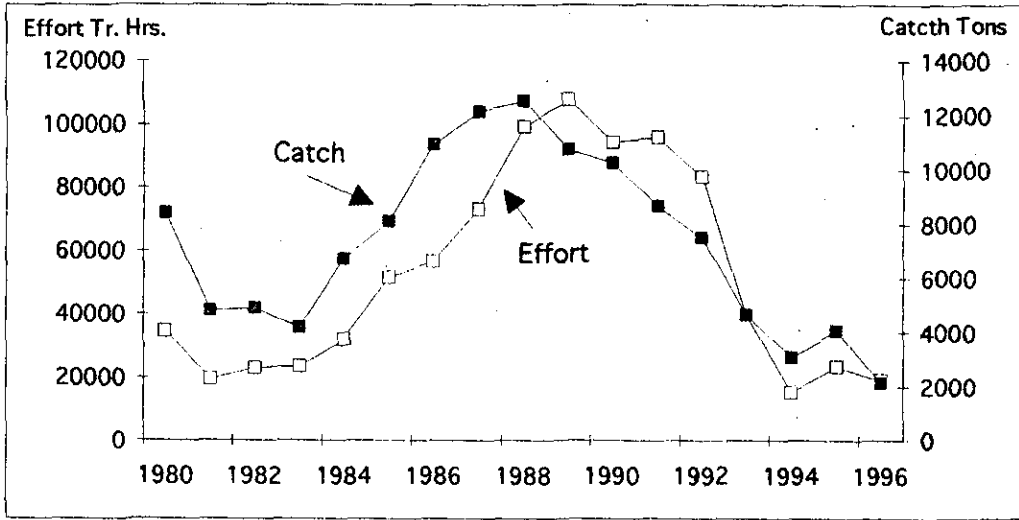


Fig. 2. Catch and effort from the logbooks weighted by nominal catches from the area north of 65°N.

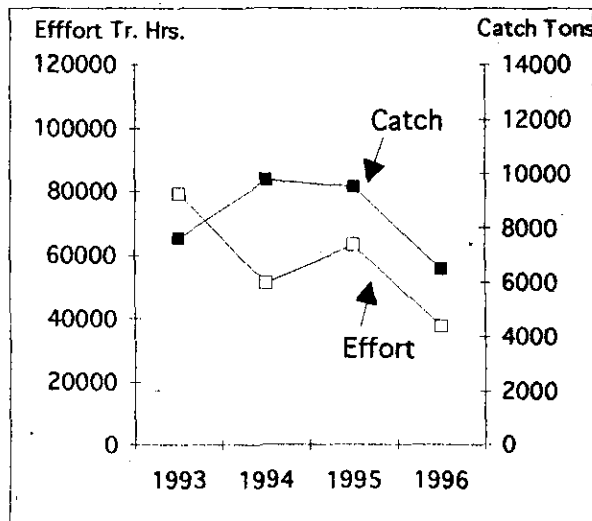


Fig. 3. Catch and effort in north and south combined.

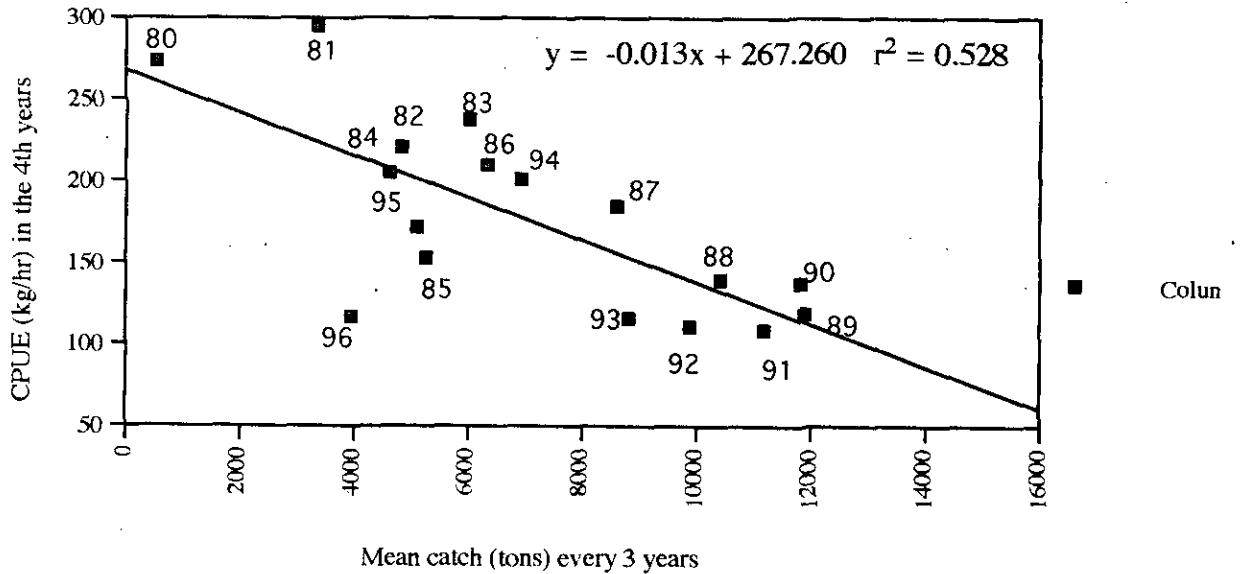


Fig. 4. The mean catch of every 3 years against unstandardized CPUE in the 4th year, denoted by that year. North of 65° N.

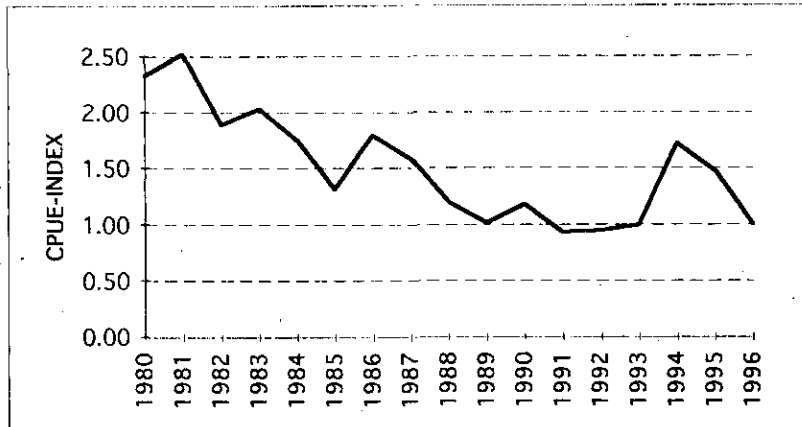


Fig. 5. The unstandardized catch rate indices, north of 65° N, of all countries combined except that of Norway.

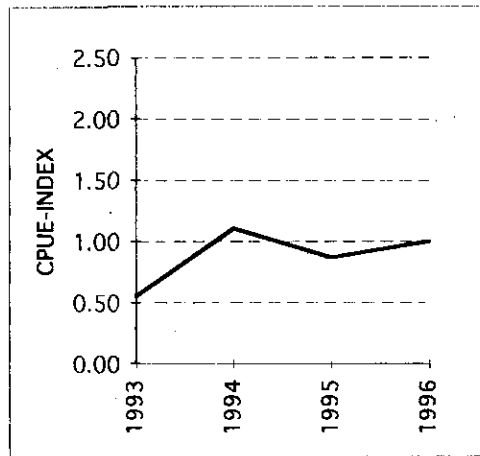


Fig. 6. The unstandardized catch rate indices combined for both north and south area

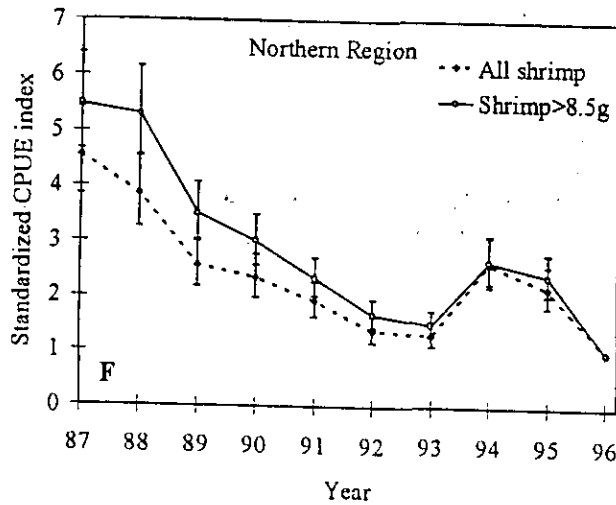


Fig. 7. Annual standardized CPUE-indices calculated for shrimp > 8.5 g and for total catch of 32 trawlers in the area north of 65° N.

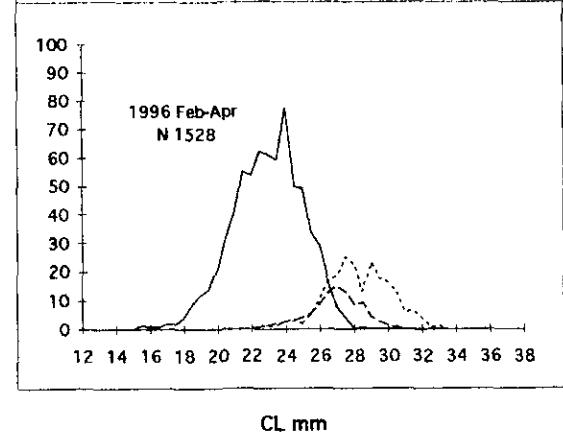
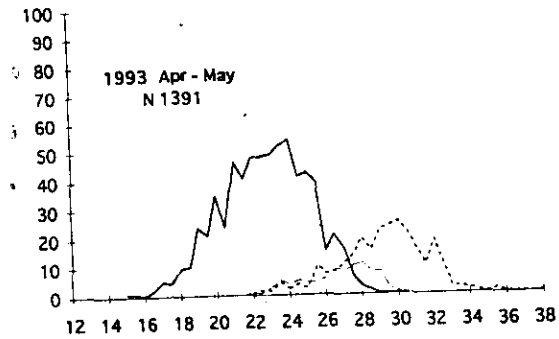
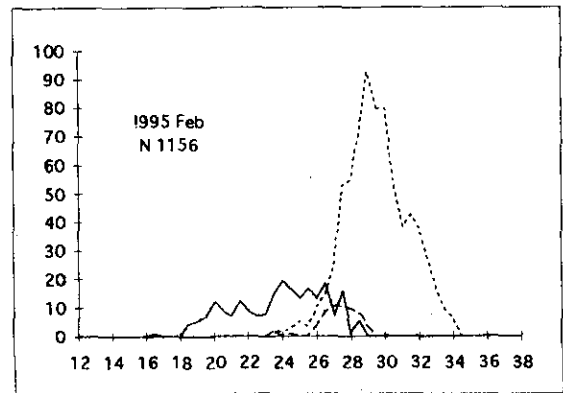
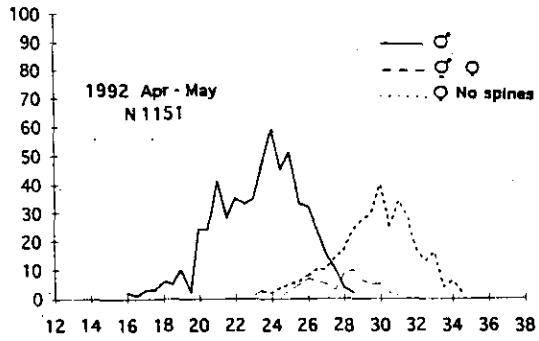
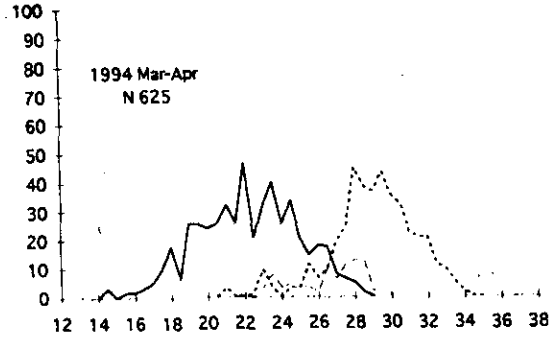
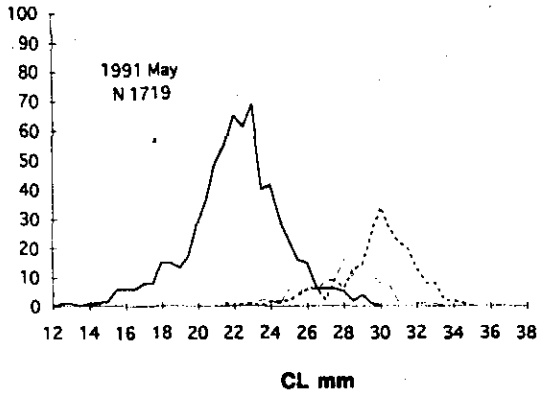


Fig. 8. The Icelandic commercial samples in the years 1991 to 1996 in the eastern part of the the Denmark Strait area i.e. north of 65° N.

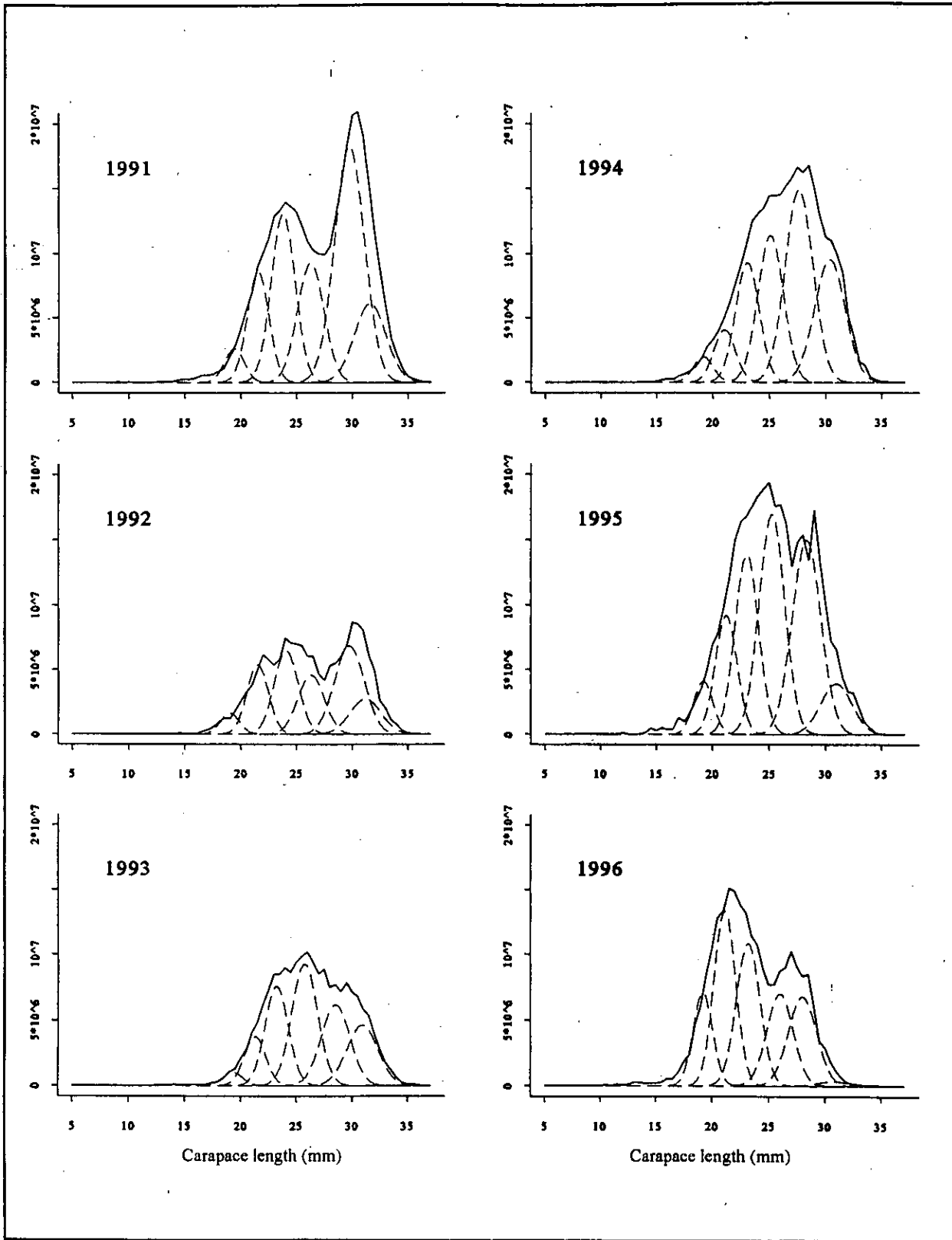


Fig. 9. The Greenlandic commercial samples from the north and south area (only south in 1996) for the years 1991 to 1996.

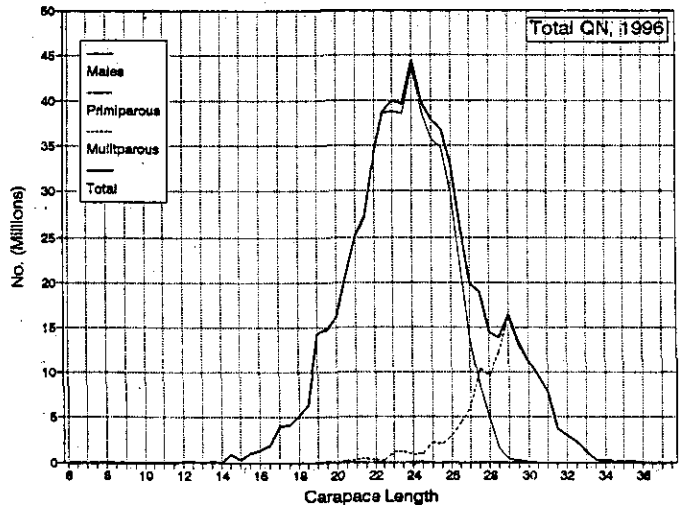
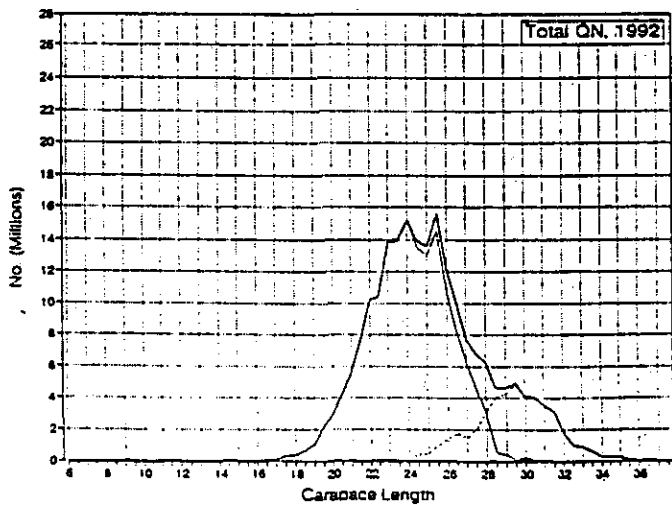
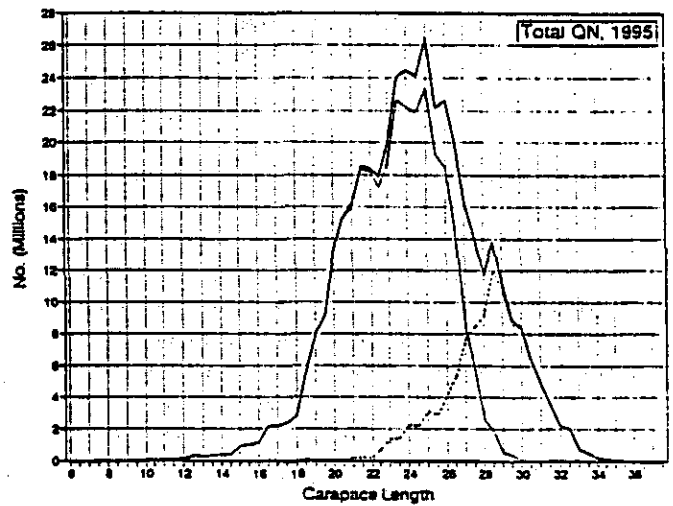
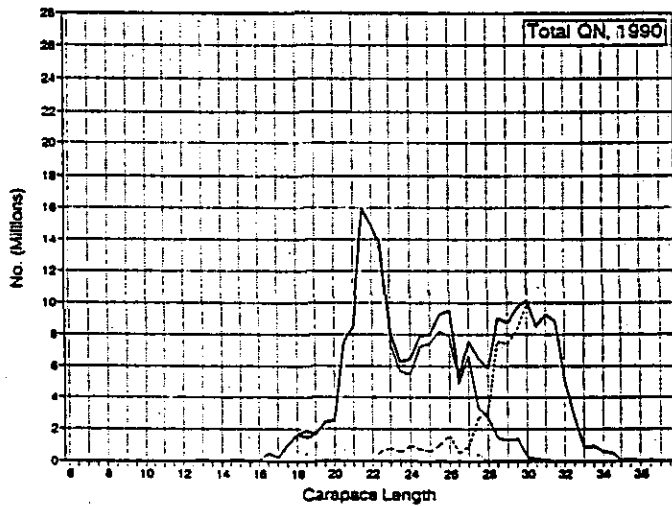
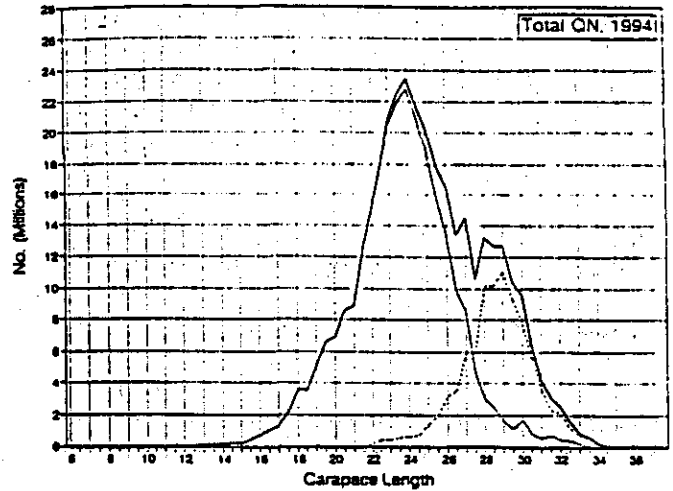
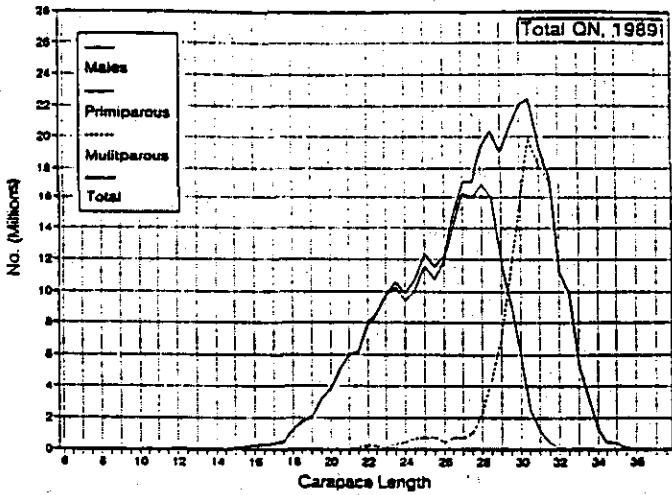


Fig. 10. The Greenlandic survey samples in the years 1989 to 1996 in the Denmark Strait area north of 65° N. In pooling, the samples were weighted by catch and stratum area.