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The Shrimp Fishery in NAFO Subarea 1 in 1987

by

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INTRODUCTION

The scientific advice for the offshore catch of shrimp in NAFO Subareas 0 and 1 (not including Subarea 1 north of 71°N) was 36,000 tons for 1987. The effective TAC for offshore Subarea 1 in the area considered by STACFIS was for 1987 fixed by the Greenland Home Rule Authorities at 34,000 tons, including a Greenland allocation of 31,975 tons. Trawlers above 80 GRT reported a total catch in the Subarea of 48,213 tons, including 10,626 tons taken north of the area considered by STACFIS. Catches of smaller vessels including inshore catches are estimated to about 21,000 tons.

Logbooks from the fishery of nine trawlers owned by the Greenland Home Rule Administration have been available to the Greenland Fisheries and Environmental Research Institute since 1975. In 1987 also logbooks from private vessels have been available, covering, together with logbooks from the state vessels, a total of about 76,000 hours of shrimp trawling and a total catch of 33,032 tons of shrimp in Subarea 1, i.e. about 69% of the total offshore catch by vessels above 80 GRT.

The present paper updates earlier information on the geographical distribution, catch rates and by-catches in the offshore Subarea 1 shrimp fishery, compiled from the logbook data base. Also, results from an analysis of a series of commercial shrimp samples is presented.

MATERIAL AND METHODS

Total catches and numbers of vessels in the shrimp fishery in NAFO Subarea 1 in 1987 were compiled by nation and month based on the compulsory weekly reportings to Greenland authorities by all vessels above 80 GRT. Logbook data were analysed to show the yearly and monthly distribution of fishing effort and mean catch-rates.

Monthly mean catch rates in Division 1B from 1975 to December 1987 and the corresponding numbers of hours trawled were calculated from the logbook data base. Indices of mean catch rates for the July-September period used to evaluate the status of the shrimp stock in Division 1B in recent years were derived from the same data base, as were the levels of by-catches in the shrimp fishery in Subarea 1.

A series of shrimp samples from the commercial shrimp fishery in Division 1B was sorted by stages of sexual development, and shrimps were measured to nearest 0.1 mm carapace length. Length-frequencies were analysed to evaluate the occurrence of sexual stages.

RESULTS AND DISCUSSION

Reported catches in 1987.

Table 1 shows catches by division, nation and month in Subarea 1 in 1987 as reported by vessels above 80 GRT, and Table 2 shows the corresponding numbers of reporting vessels. The figures for Greenland include catches in the offshore fishery north of 71°N. In September, October, and November these catches constitute a substantial part of the total shrimp fishery by Greenland vessels in Subarea 1. Also catches from trial fisheries in northwest, west and southwest Greenland waters are included, totalling about 1,000 tons of shrimp.

The shrimp landings from Subarea 1 in 1987 by smaller Greenland vessels (below 80 GRT) are estimated to a total of about 22,000 tons, of which about 7,500 tons are estimated to be inshore catches.

The total nominal shrimp catch in Subarea 1 was thus more than 70,000 tons in 1987.

Geographical distribution of the offshore fishery.

Figure 1 shows the distribution of fishing effort (in numbers of hours trawled) in 1987 as recorded in the logbook data base (the map does not include the fishing grounds north of 72°N - see Lund, 1988). The fishery concentrated in the Holsteinsborg Deep, on the northern and western slopes of the Store Hellefiske Bank and in the southernmost grounds in the Northwest Greenland area.

Figure 2 shows the monthly distribution of effort (numbers of hours trawled) and mean catch-rates from January 1987 through December 1987. Different from 1985 and 1986, but similar to the years before, ice hampered the access to the fishing grounds west and north of the Store Hellefiske Bank area in the beginning of the year (from February through April).

Trends in catch rates.

Figure 3 shows the variation in mean catch rates by month from October 1975 through December 1987 in NAFO Division 1B based on logbook information of seven state-owned trawlers (630-857 GRT) - Table 3 shows the corresponding numbers of hours trawled. A spring peak in catch rate is found in April 1987, but - similar to 1986 - it is not followed by the typical decline throughout the year as has been the case in most years since the fishery started. Rather, it is followed by a decrease in May and an increase in June to almost the same level as in April. Catch rates decline again from June to September, and increase in November and December. While the development in the 1986 catch rates may reflect that favourable ice conditions in both 1985 and 1986 influenced the distribution of the fishery on the different components of the stock, the 1987-development may be explained by an improvement either in stock condition or more efficient trawling gears used in the fishery (see Carlsson and Kanneworff, 1987).

Table 4 shows the mean catch rates of eight state-owned trawlers by division and month in a north to south 7.5' latitude grid in 1987, and Table 5 shows the corresponding numbers of hours trawled. Different from 1986, but similar to previous years there is a northward shift in the fishery throughout the year.

Comparison of catch rates between years in the Davis Strait fishery has been based on mean catch rate indices of the state-owned trawlers (using the 1976 mean catch rate as reference point) for the period July-September in Division 1B. CPUE indices for seven Greenland trawlers (630-857 GRT) from 1976 to 1987 are shown in Figure 4, based on the following figures:

	1976	1977	1978	1979	1980	1981
Hours trawled	1,005	2,966	3,446	3,588	1,872	5,285
kg/hour	743	549	501	379	468	438
Index	1.00	0.74	0.67	0.51	0.63	0.59

	1982	1983	1984	1985	1986	1987
Hours trawled	3,543	3,967	2,784	3,817	2,967	3,644
kg/hour	550	490	495	563	620	777
Index	0.74	0.66	0.67	0.76	0.84	1.05

As mentioned by Carlsson and Kanneworff (1987) CPUE indices since 1980 may not be directly comparable to those from earlier years due to the introduction of more efficient gears around 1980. In 1985 and 1986 even more efficient gears with vertical openings ranging up to 20 meters and electronic trawl positioning systems allowing better control with the performance of the trawl were taken into use. The increase in the cpue-index in 1987 may thus be explained partly by better gear performance, but increased shrimp density in the exploited areas cannot be excluded. The latter explanation would imply that the fishery at present is not overexploiting the shrimp stock.

Figure 6 shows the variation from 1976 to 1987 in CPUE of eight stat-owned trawlers in the July- September period in 30' latitude strips (see Figure 5). From 1982 to 1984, catch rates seem to have stabilized at 400-500 kg/hour in all strips. In 1985 all catch rates increased, while in 1986 they remained at the 1985-level with the exception of a drastic increase in strip no. 5 and a decrease in strip no. 6. In 1987 there is again a general increse in catch-rates except for strip no. 5, i.e. the increase in catch-rate-index as mentioned above applies to Division 1B as a whole excepting one strip-area.

By-catches in the shrimp fishery.

Table 6 shows by-catches as reported in the logbook data in 1987 compared to earlier years. The by-catch level in relation to total shrimp catch is similar to 1983, redfish being the dominant species except in Division 1A, where polar cod and Greenland halibut dominate, and Division 1D, where cod is reported as dominating species in the by-catch. This is the first time since 1982 that cod is reported as a dominating by-catch species in the shrimp fishery.

Biological samples.

Figure 7 shows length-frequency diagrams for a series of commercial shrimp samples collected on a diel basis in Division 1B in August 1987. The mesh size (stretched) used was about 44 mm, depth interval ranging from about 280 to about 360 meters. Similar to commercial samples from the same area in 1986 (Carlsson and Kanneworff, 1987) a significant diel variation in sample composition is seen, juveniles and males dominating the catch at mid-day, relative occurrence of multiparous females being highest during night.

Compared to a research shrimp sample from the same statistical unit (KZ014), but from more shallow water (about 270 meters depth - see Carlsson and Kanneworff, 1987, Figure 9), these samples show a higher frequency of juvenile and male shrimp, in spite of being from deeper water and having been fished with a larger mesh size (in the research sample a mesh size of about 20 mm stretched mesh was used). This might indicate a better recruitment to the fishery in this area, although the influence of possible changes in environmental parameters on the distribution of the different size-groups of shrimp is not well known.

CONCLUSIONS

The nominal offshore catch of shrimp in NAFO Subarea 1 is estimated to be about 61,700 tons in 1987, including about 10,600 tons from the area north of 71°N.

As in earlier years, but different from 1985 and 1986, ice hampered the access to the the important shrimp fishing grounds on the slopes of Store Hellefiske Bank in spring time. The northward shift in the fishery as seen in earlier years was not found in 1986, but occurred again in 1987.

Mean catch rates of Greenland trawlers in Division 1B in the July-September period increased again in 1987 compared to preceeding years, reaching a level higher then the reference year of 1976. Introduction of new trawl technology in 1984-1986 is supposed to bias the index upwards, but the upward trend may also indicate a higher density of shrimp.

Reported by-catches in the shrimp fishery in 1986 were - similar to preceding years - low compared to 1978 and 1979 figures. Redfish is the dominant species except in Division 1A, where polar cod and Greenland halibut dominate, and in Division 1D, where cod is reported as dominating species.

Commercial shrimp samples from Division 1B in August 1987 showed - similar to samples from August 1986 - a significant diel variation in the relative occurrence of sexual stages, males and juveniles being most dominant in mid-day samples, when catch rates are known to be at the highest. More frequent occurrence of small shrimp (juveniles and males) compared to 1986-samples from the same area may indicate a better recruitment to the fishery.

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Table 1. Offshore catches of shrimp (tons) by division, nation and month in NAFO Subarea 1 by trawlers above 80 GRT as reported to Greenland authorities in 1987. Figures for Greenland include minor catches from trial fisheries.

NAFO DIVISION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1A NORTH	GREENLAND	-	-	-	-	-	246	1382	651	2936	2931	1838	642	10626
	TOTAL	-	-	-	-	-	246	1382	651	2936	2931	1838	642	10626
1A SOUTH	GREENLAND	-	-	-	-	7	-	10	69	45	35	9	32	207
	TOTAL	-	-	-	-	7	-	10	69	45	35	9	32	207
1B	DENMARK	20	-	-	23	230	117	15	-	-	-	-	-	405
	FAROE ISL.	-	-	-	-	4	-	-	-	107	121	86	-	318
	FRANCE	-	-	-	-	-	-	226	199	-	-	-	-	425
	GREENLAND	1526	681	2257	3633	3398	5013	4985	3425	1884	528	777	1567	29674
	NORWAY	-	-	-	83	-	6	-	-	-	-	-	-	89
	TOTAL	1546	681	2257	3739	3632	5136	5226	3624	1991	649	863	1567	30911
1C	DENMARK	46	-	-	-	-	-	17	-	-	-	-	-	63
	FAROE ISL.	-	-	-	41	43	-	-	-	12	-	-	-	96
	FRANCE	-	-	-	-	-	-	172	-	-	-	-	-	172
	GREENLAND	293	151	1330	1495	883	336	54	2	135	-	-	-	4679
	NORWAY	-	-	-	-	-	79	180	-	-	-	-	-	259
	TOTAL	339	151	1330	1536	926	415	423	2	147	-	-	-	5269
1D	DENMARK	-	26	-	-	-	2	-	-	-	-	-	-	28
	FAROE ISL.	-	-	-	-	-	-	-	1	-	41	18	-	60
	GREENLAND	20	304	16	216	425	5	-	-	-	-	1	17	1004
	NORWAY	-	-	-	-	-	102	-	-	-	-	-	-	102
	TOTAL	20	330	16	216	425	109	-	1	-	41	19	17	1194
1E	DENMARK	-	-	-	-	-	6	-	-	-	-	-	-	6
	TOTAL	-	-	-	-	-	6	-	-	-	-	-	-	6
TOTAL	DENMARK	66	26	-	23	230	125	32	-	-	-	-	-	502
	FAROE ISL.	-	-	-	41	47	-	-	1	119	162	104	-	474
	FRANCE	-	-	-	-	-	-	398	199	-	-	-	-	597
	GREENLAND	1839	1136	3603	5344	4713	5600	6431	4147	5000	3494	2625	2258	46190
	NORWAY	-	-	-	83	-	187	180	-	-	-	-	-	450
	TOTAL	1905	1162	3603	5491	4990	5912	7041	4347	5119	3656	2729	2258	48213

Table 2. No. of vessels above 80 GRT by division, nation and month in the shrimp fishery in NAFO Subarea 1 as reported to Greenland authorities in 1987.

NAFO DIVISION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1A NORTH	GREENLAND	-	-	-	-	-	10	16	9	25	31	26	12	33
	TOTAL	-	-	-	-	-	10	16	9	25	31	26	12	33
1A SOUTH	GREENLAND	-	-	-	-	1	-	2	1	1	1	1	1	5
	TOTAL	-	-	-	-	1	-	2	1	1	1	1	1	5
1B	DENMARK	1	-	-	1	1	2	1	-	-	-	-	-	2
	FAROE ISL.	-	-	-	-	1	-	-	-	3	3	3	-	5
	FRANCE	-	-	-	-	-	-	2	2	-	-	-	-	2
	GREENLAND	16	14	26	34	31	34	26	24	20	11	15	19	45
	NORWAY	-	-	-	1	-	1	-	-	-	-	-	-	2
	TOTAL	17	14	26	36	33	37	29	26	23	14	18	19	56
1C	DENMARK	1	-	-	-	-	-	1	-	-	-	-	-	1
	FAROE ISL.	-	-	-	1	1	-	-	-	2	-	-	-	3
	FRANCE	-	-	-	-	-	-	1	-	-	-	-	-	1
	GREENLAND	9	10	15	18	17	9	5	2	4	-	-	-	35
	NORWAY	-	-	-	-	-	3	3	-	-	-	-	-	3
	TOTAL	10	10	15	19	18	12	10	2	6	-	-	-	43
1D	DENMARK	-	1	-	-	-	1	-	-	-	-	-	-	1
	FAROE ISL.	-	-	-	-	-	-	-	1	-	1	2	-	3
	GREENLAND	2	11	1	9	-	2	1	-	-	-	1	1	22
	NORWAY	-	-	-	-	-	3	-	-	-	-	-	-	3
	TOTAL	2	12	1	9	-	6	1	1	-	1	3	1	29
1E	DENMARK	-	-	-	-	-	1	-	-	-	-	-	-	1
	TOTAL	-	-	-	-	-	1	-	-	-	-	-	-	1
TOTAL	DENMARK	1	1	-	1	1	2	1	-	-	-	-	-	2
	FAROE ISL.	-	-	-	1	1	-	-	1	3	3	3	-	5
	FRANCE	-	-	-	-	-	-	2	2	-	-	-	-	2
	GREENLAND	16	17	27	34	34	35	37	30	34	37	33	23	45
	NORWAY	-	-	-	1	-	3	3	-	-	-	-	-	4
	TOTAL	17	18	27	37	36	40	43	33	37	40	36	23	58

Table 3. No. of hours trawled by month from October 1975 through December 1987 in the shrimp fishery in NAFO Division 1B, in logbooks from seven trawlers (630-857 GRT) owned by the Greenland Home Rule Administration.

Div.	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1B	1975	-	-	-	-	-	-	-	-	-	50	331	183	564
	1976	12	-	-	-	7	252	326	309	370	329	-	-	1605
	1977	104	84	245	391	643	839	874	1053	1039	1297	1293	957	8819
	1978	233	-	-	13	948	1209	1226	1326	894	1282	1199	626	8956
	1979	27	18	823	752	991	972	1191	1521	876	911	922	891	9895
	1980	771	627	685	670	1330	131	469	822	581	254	-	-	6340
	1981	857	172	366	729	1059	1167	1915	1816	1554	1436	1254	692	13017
	1982	169	-	-	220	711	1001	1301	1302	940	1258	684	13	7599
	1983	-	-	-	15	1032	1184	1244	1307	1416	1452	819	50	8519
	1984	-	-	3	543	1936	1800	1851	602	331	1512	1136	180	9894
	1985	19	146	606	728	1281	785	1244	1071	1502	1418	1608	961	11369
	1986	1706	1645	474	1013	1707	1170	1126	1162	679	586	396	199	11863
	1987	967	489	1118	607	1029	836	1601	1810	233	-	132	177	8999

Table 4. Mean catch of shrimp (kg/hour) by month in 1986 and 1987 in NAFO Subarea 0+1 in the shrimp fishery of eight trawlers (473-857 GRT) of the Greenland Home rule Administration in a south to north grid (7.5 minutes latitude scale, see Fig. 1).

DIV.	8601	8602	8603	8604	8605	8606	8607	8608	8609	8610	8611	8612	8701	8702	8703	8704	8705	8706	8707	8708	8709	8710	8711	8712
0A KP	-	-	-	-	-	-	-	-	275	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KK	-	-	-	-	-	1375	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A MP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	320	-	-
MN	-	-	-	-	-	-	-	189	133	-	-	-	-	-	-	-	-	-	-	-	-	395	-	-
MM	-	-	-	-	-	-	-	199	-	0	139	-	-	-	-	-	-	-	-	-	-	857	-	-
ML	-	-	-	-	-	-	-	-	-	26	-	-	-	-	-	-	-	-	-	-	-	428	-	-
MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	272	-	-
MG	-	-	-	-	-	-	-	-	-	286	-	-	-	-	-	-	-	-	-	-	-	412	-	-
MF	-	-	-	-	-	-	-	-	-	221	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MD	-	-	-	-	-	-	-	-	257	226	-	-	-	-	-	-	-	-	-	-	185	-	-	-
MB	-	-	-	-	-	-	-	-	-	735	302	-	-	-	-	-	-	-	-	-	303	361	472	-
MA	-	-	-	-	-	-	-	-	-	497	289	-	-	-	-	-	-	-	-	-	379	324	327	-
LV	-	-	-	-	-	846	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168	-	-	-
1B LD	187	-	-	976	-	-	-	559	-	-	0	-	-	-	-	-	498	-	-	1383	-	-	-	-
LB	186	-	-	479	-	-	-	531	-	-	-	-	-	-	-	-	512	-	1589	687	492	-	-	-
LA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	865	828	685	-	-	-
KZ	354	350	519	684	403	400	222	280	-	-	-	-	-	-	-	-	664	539	765	710	581	-	-	547
XX	826	559	665	789	604	376	500	274	-	-	649	-	343	-	-	-	638	557	685	788	719	-	781	672
KV	481	496	555	822	592	511	563	409	323	-	621	-	872	-	-	-	961	527	801	895	924	-	-	-
KT	542	410	527	804	496	456	556	591	179	-	-	-	-	-	-	-	-	-	754	863	483	-	-	-
KS	274	-	831	-	407	481	365	464	535	-	-	-	-	-	-	-	270	-	732	589	-	-	-	-
KR	179	25	-	-	408	804	552	285	395	-	-	-	-	-	-	-	856	-	688	693	-	-	-	-
KP	-	317	-	-	198	469	296	537	295	455	-	0	-	-	-	-	-	799	663	622	-	-	-	-
KN	-	-	-	-	433	-	529	515	585	175	-	-	-	-	-	-	-	835	500	742	-	-	-	-
KM	107	-	-	-	514	594	975	304	229	409	111	-	-	-	-	-	924	1170	409	-	-	-	436	-
KL	-	1350	-	-	414	782	878	406	-	227	837	150	-	-	-	851	591	860	661	-	683	-	997	866
KK	-	312	-	-	187	1124	758	355	94	106	668	860	-	-	-	1046	1049	703	766	-	-	-	-	-
KJ	-	-	-	-	108	756	209	-	-	-	478	1564	-	-	-	-	364	696	-	-	1303	-	538	-
KH	-	-	-	-	-	-	147	-	-	-	889	1346	-	-	-	-	-	-	-	-	-	-	472	-
KG	557	-	-	-	-	-	-	-	-	575	19	1091	-	-	-	683	896	-	-	-	-	-	802	-
KF	569	487	523	1087	497	846	-	-	0	357	-	-	-	457	713	877	785	-	-	-	-	-	-	-
KE	449	480	408	788	453	857	-	476	379	596	0	576	884	653	591	844	764	771	526	-	-	-	-	274
KD	546	444	601	955	304	609	709	359	383	493	436	391	643	383	620	814	743	877	795	432	-	-	785	550
KB	313	219	815	803	367	805	971	660	488	353	463	1157	389	634	533	911	650	959	891	333	-	-	800	855
																							81	447
1C KA	104	-	826	936	409	454	1026	569	576	415	454	80	480	-	1051	750	626	385	882	-	319	-	-	-
JZ	341	0	546	1149	689	504	983	578	396	229	482	-	-	-	1019	813	298	497	130	-	-	-	-	-
JX	-	-	83	-	-	-	500	457	-	-	-	-	961	-	-	-	-	-	-	-	-	-	-	-
JV	-	-	114	1011	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JT	440	1286	1479	1233	-	-	292	-	-	0	-	-	788	1108	527	-	-	-	-	-	-	-	-	-
JS	-	-	3010	712	-	-	494	219	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JP	-	-	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JN	-	-	0	-	-	0	-	-	-	502	1125	-	443	188	-	-	-	-	-	-	-	-	-	-
JM	-	354	630	-	-	150	-	639	-	713	321	-	-	-	-	-	-	597	-	-	-	-	-	-
JL	-	0	504	-	624	322	0	475	344	614	1168	-	-	-	-	-	-	128	-	-	-	-	-	-
JK	-	255	477	-	505	397	-	515	-	720	-	-	-	-	-	-	-	-	363	-	-	-	-	-
JJ	-	-	470	745	575	470	0	247	-	383	-	-	-	-	-	-	-	598	-	-	-	-	-	-
JH	-	748	689	-	150	310	-	-	-	225	-	689	38	-	-	-	-	-	-	-	-	-	-	-
JG	-	467	334	-	-	697	-	160	-	656	-	0	-	-	-	-	-	-	-	-	-	-	-	-
JF	-	25	623	-	379	942	154	432	-	122	-	-	187	749	-	-	-	-	-	-	-	-	-	-
1D JE	-	-	641	415	-	453	1364	430	327	178	-	300	320	391	-	-	-	-	-	-	-	-	-	-
JD	-	-	1189	-	-	944	1015	532	304	419	-	338	-	-	-	-	-	-	-	-	-	-	-	-
JB	-	-	-	-	-	1288	1579	-	200	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JA	-	-	-	-	-	1825	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HZ	-	-	-	-	-	-	-	-	-	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HX	-	-	-	-	-	-	-	-	-	83	-	270	-	-	-	-	-	-	-	-	-	-	-	-
HV	-	-	-	-	-	-	-	-	-	-	-	256	-	-	-	-	-	-	-	-	-	-	-	-
HT	-	-	-	-	-	-	-	-	-	-	-	343	-	-	-	-	-	-	-	-	-	-	-	-
HP	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	-	-	-	-	-	-

Table 5. No. of hours trawled by month in 1986 and 1987 in NAFO Subarea 0+1 in the shrimp fishery of eight trawlers (473-857 GRT) of the Greenland Home Rule Administration in a south to north grid (7.5 minutes latitude scale, see Fig. 1).

DIV.		8601	8602	8603	8604	8605	8606	8607	8608	8609	8610	8611	8612	8701	8702	8703	8704	8705	8706	8707	8708	8709	8710	8711	8712
0A	KP	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	KK	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A	MP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98	-	-
	MN	-	-	-	-	-	-	-	13	4	-	-	-	-	-	-	-	-	-	-	-	-	366	-	-
	MM	-	-	-	-	-	-	-	19	-	2	27	-	-	-	-	-	-	-	-	-	-	185	-	-
	ML	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	19	-	-
	MJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-
	MG	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	15	-	-
	MF	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	49	-	-	-
	MD	-	-	-	-	-	-	-	-	122	108	-	-	-	-	-	-	-	-	-	-	13	10	77	-
	MB	-	-	-	-	-	-	-	-	-	357	109	-	-	-	-	-	-	-	-	-	389	733	495	-
	MA	-	-	-	-	-	-	-	-	-	19	34	-	-	-	-	-	-	-	-	-	14	-	-	-
	LV	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1B	LD	3	-	-	10	-	-	-	36	-	-	4	-	-	-	-	-	32	-	-	16	-	-	-	-
	LB	22	-	-	19	-	-	-	56	-	-	-	-	-	-	-	-	13	-	83	654	53	-	-	-
	LA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	91	455	68	-	-	-
	KZ	16	10	59	22	20	11	2	9	-	-	-	-	-	-	-	-	30	21	184	110	57	-	-	34
	KX	616	414	56	53	58	14	8	16	-	-	256	-	13	-	-	-	189	155	321	339	123	-	56	188
	KV	513	1021	150	45	890	161	59	135	131	-	24	-	71	-	-	-	362	13	122	144	100	-	-	-
	KT	80	72	8	16	187	91	48	273	7	-	-	-	-	-	-	-	-	-	285	29	89	-	-	-
	KS	16	-	2	-	99	47	45	79	102	-	-	-	-	-	-	-	14	-	109	113	-	-	-	-
	KR	10	4	-	-	50	17	19	46	26	-	-	-	-	-	-	-	57	-	103	113	-	-	-	-
	KP	-	4	-	-	32	25	19	98	22	15	-	11	-	-	-	-	-	46	53	50	-	-	-	-
	KN	-	-	-	-	39	-	69	55	27	4	-	-	-	-	-	-	-	48	64	41	-	-	-	-
	KM	4	-	-	-	50	60	211	23	14	43	6	-	-	-	-	-	28	108	67	-	-	-	56	-
	KL	-	2	-	-	55	167	448	18	-	49	12	13	-	-	-	10	218	151	94	-	22	-	33	15
	KK	-	15	-	-	8	17	356	34	7	7	8	68	-	-	-	28	79	144	31	-	-	-	51	-
	KJ	-	-	-	-	7	165	7	-	-	-	12	5	-	-	-	-	24	32	-	-	20	-	32	-
	KH	-	-	-	-	-	-	5	-	-	-	12	18	-	-	-	-	-	-	-	-	-	-	16	-
	KG	12	-	-	-	-	-	-	-	-	4	11	17	-	-	-	20	36	-	-	-	-	-	-	-
	KF	70	15	16	73	49	31	-	-	4	3	-	-	-	195	407	58	16	-	-	-	-	-	-	17
	KE	199	35	8	195	93	292	-	14	10	63	4	2	432	318	183	115	14	46	45	-	-	-	54	45
	KD	113	33	45	322	92	290	46	35	141	212	6	57	589	158	212	256	119	231	234	27	-	-	36	91
	KB	32	20	130	259	53	190	100	280	317	187	42	9	151	26	364	287	232	150	295	34	-	-	14	60
1C	KA	13	-	84	58	65	47	158	254	502	108	59	10	8	-	464	331	36	38	29	-	18	-	-	-
	JZ	9	3	21	16	20	32	297	311	96	16	70	-	-	-	170	134	14	17	14	-	-	-	-	-
	JX	-	-	5	-	-	-	10	11	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-
	JV	-	-	2	21	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	JT	13	1	82	194	-	-	15	-	-	9	-	-	48	7	9	-	-	-	-	-	-	-	-	-
	JS	-	-	15	19	-	-	3	8	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	JP	-	-	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	JN	-	-	3	-	-	-	2	-	-	32	8	-	31	10	-	-	-	-	-	-	-	-	-	-
	JM	-	12	39	-	-	4	-	21	-	29	9	-	-	-	-	-	-	19	-	-	-	-	-	-
	JL	-	2	58	-	23	9	5	4	9	35	6	-	-	-	-	-	-	28	-	-	-	-	-	-
	JK	-	16	36	-	24	10	-	16	-	9	-	-	-	-	-	-	-	-	10	-	-	-	-	-
	JJ	-	-	43	6	4	26	2	9	-	8	-	-	-	-	-	-	-	34	-	-	-	-	-	-
	JH	-	6	41	-	4	23	-	-	-	4	-	4	16	-	-	-	-	-	-	-	-	-	-	-
	JG	-	3	30	-	-	79	-	4	-	5	-	5	-	-	-	-	-	-	-	-	-	-	-	-
	JF	-	4	90	-	3	45	9	116	-	12	-	-	16	60	-	-	-	-	-	-	-	-	-	-
1D	JE	-	-	315	17	-	37	47	22	27	19	-	27	31	177	-	-	-	-	-	-	-	-	-	-
	JD	-	-	164	-	-	128	116	8	17	14	-	79	-	-	-	-	-	-	-	-	-	-	-	-
	JB	-	-	-	-	-	90	88	-	4	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	JA	-	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HZ	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	HX	-	-	-	-	-	-	-	-	-	6	-	30	-	-	-	-	-	-	-	-	-	-	-	-
	HV	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-
	HT	-	-	-	-	-	-	-	-	-	-	-	33	-	-	-	-	-	-	-	-	-	-	-	-
	HP	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-	-	-	-	-

Table 6. Reported by-catches (tons) in the shrimp fishery from 1977 to 1987 in NAFO Subarea 0 and 1 by eight trawlers (473-857 GRT) of the Greenland Home Rule Administration and a comparison with the corresponding shrimp catches.

		Species	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Div	0A	Redfishes	4.2	9.2	132.7	106.9	0.1	0.3	-	-	-	-	-
		Others	-	-	-	-	-	-	-	-	-	-	-
-	1A	Redfishes	0.1	4.1	5.8	18.3	0.6	-	-	1.6	0.2	2.3	10.3
		Others	-	-	-	-	-	-	-	-	1.2	2.2	148.9
-	1B	Redfishes	102.3	1035.5	903.8	360.1	63.4	27.6	39.8	154.4	86.1	201.2	126.6
		Others	1.2	19.9	8.4	1.6	-	21.0	-	0.2	61.8	29.1	99.6
-	1C	Redfishes	2.8	15.6	39.3	40.4	6.9	5.6	29.1	49.2	31.3	50.2	10.3
		Others	4.2	-	1.4	20.5	-	-	-	-	18.3	2.2	4.4
-	1D	Redfishes	-	-	-	-	-	-	-	1.2	8.5	15.3	6.4
		Others	-	-	-	-	-	-	-	-	5.2	1.1	11.3
SA	0+1	Redfishes	109.4	1064.4	1081.6	525.7	71.0	33.5	68.9	206.4	126.1	269.0	154.2
		Others	5.4	19.9	9.8	22.1	-	21.0	-	0.2	86.5	34.6	264.2
-		Total bycatch	114.8	1084.3	1091.4	547.8	71.0	54.5	68.9	206.6	212.6	303.6	418.4
-		Total shrimp catch	5503	4703	6605	8484	9239	6946	6228	9907	10356	10757	33032
-		Bycatch in % of total shrimp catch	2.1	23.1	16.5	6.5	0.8	0.8	1.1	2.1	2.1	2.8	1.3

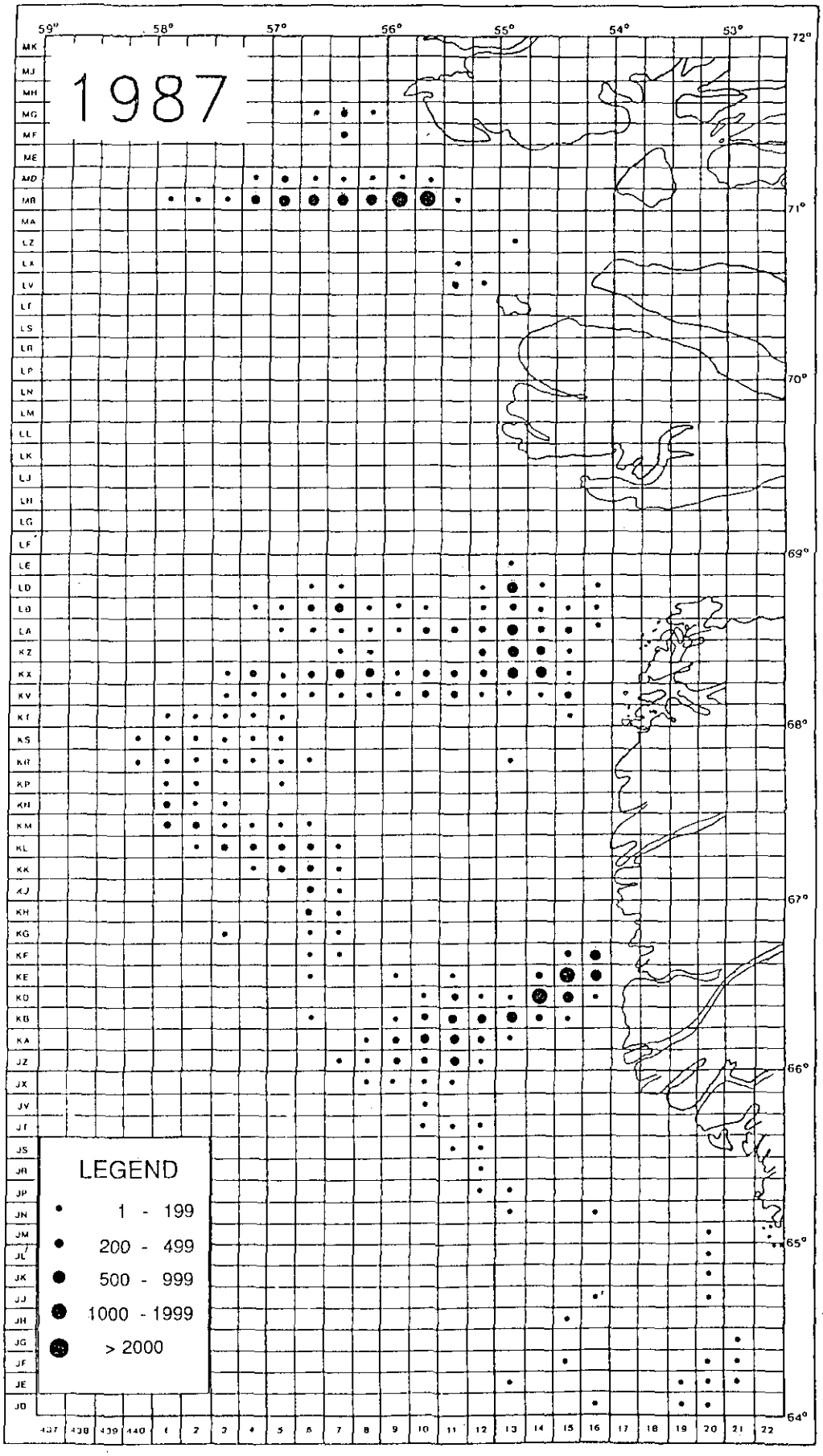
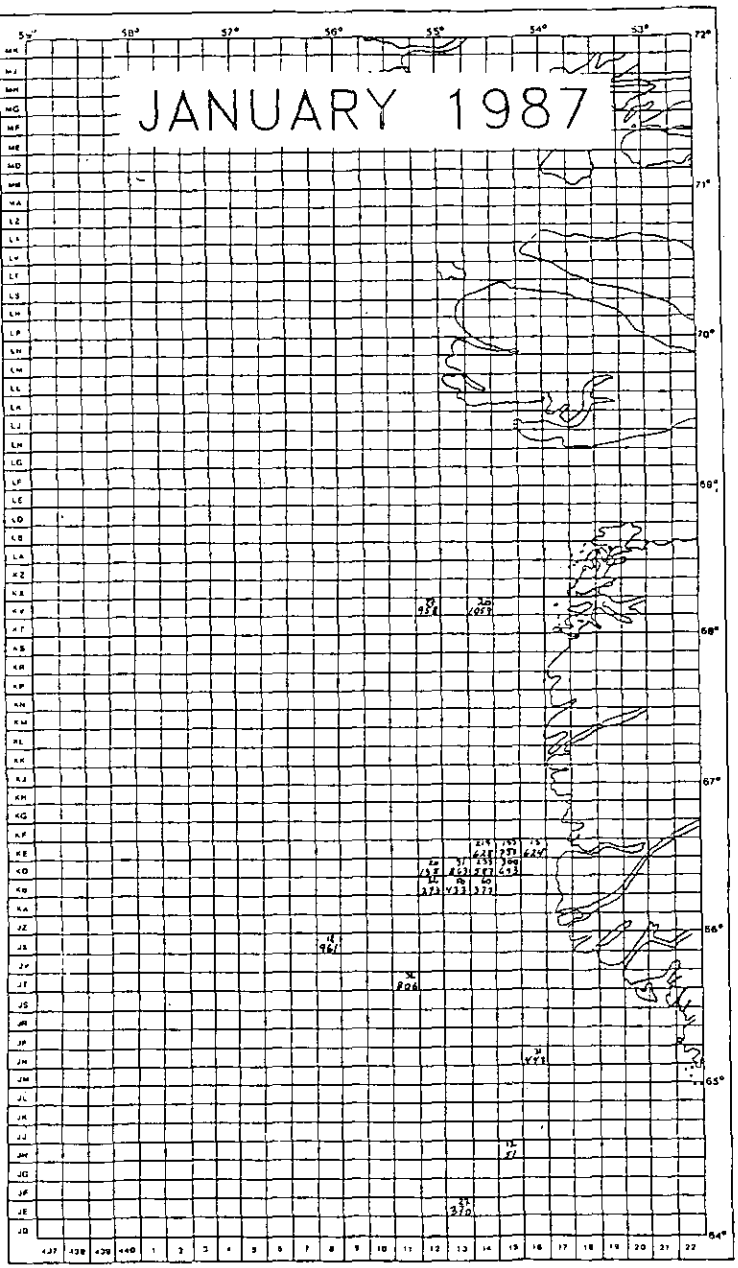


Figure 1. Distribution of effort (in no.s of hauls trawled) in 1987 in the shrimp fishery in NAFO Subarea 1 between 64°N and 72°N, based on logbooks from Greenland trawlers.



2. Distribution of effort and mean catch of shrimp in January 1987 in the shrimp fishery in NAFO Subarea 1 (from 64° to 72°N), based on logbooks from seven trawlers (473-857 GRT) of the Greenland Home Rule Administration. Upper figure in each statistical unit is no. of hours trawled, lower

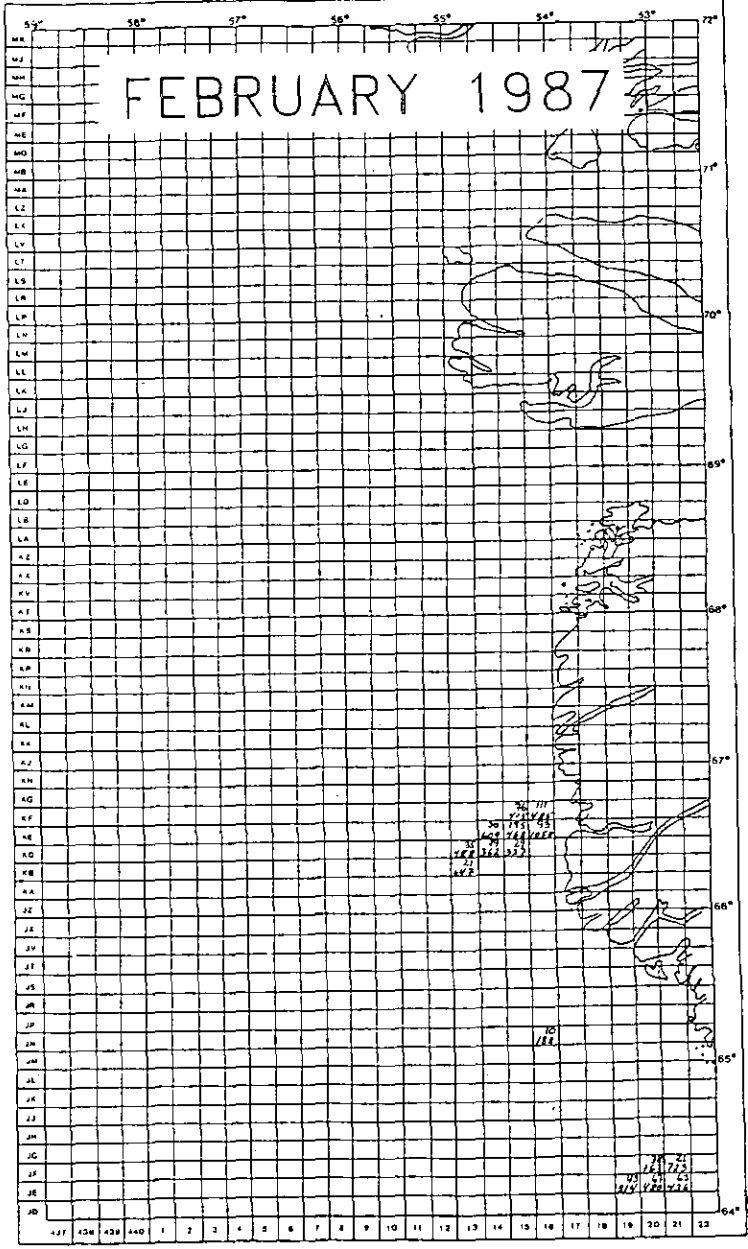


Figure 2. Continued. February 1987.

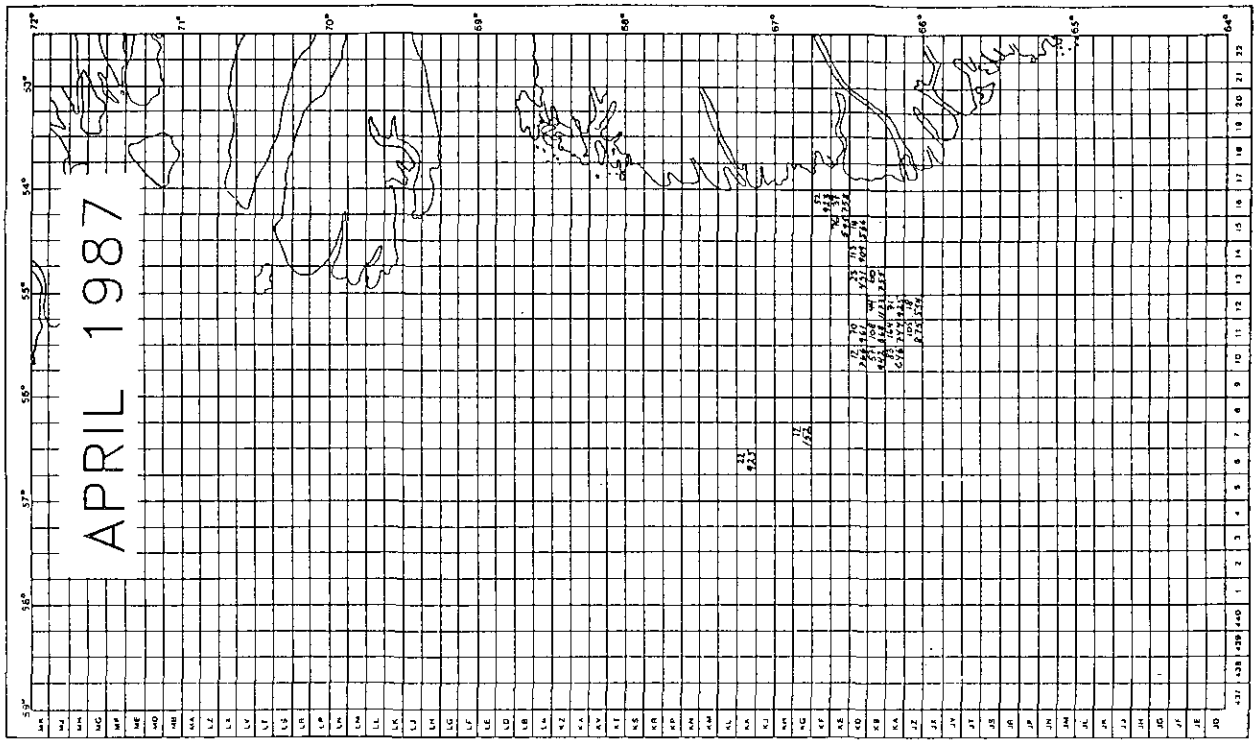


Figure 2. Continued. April 1987.

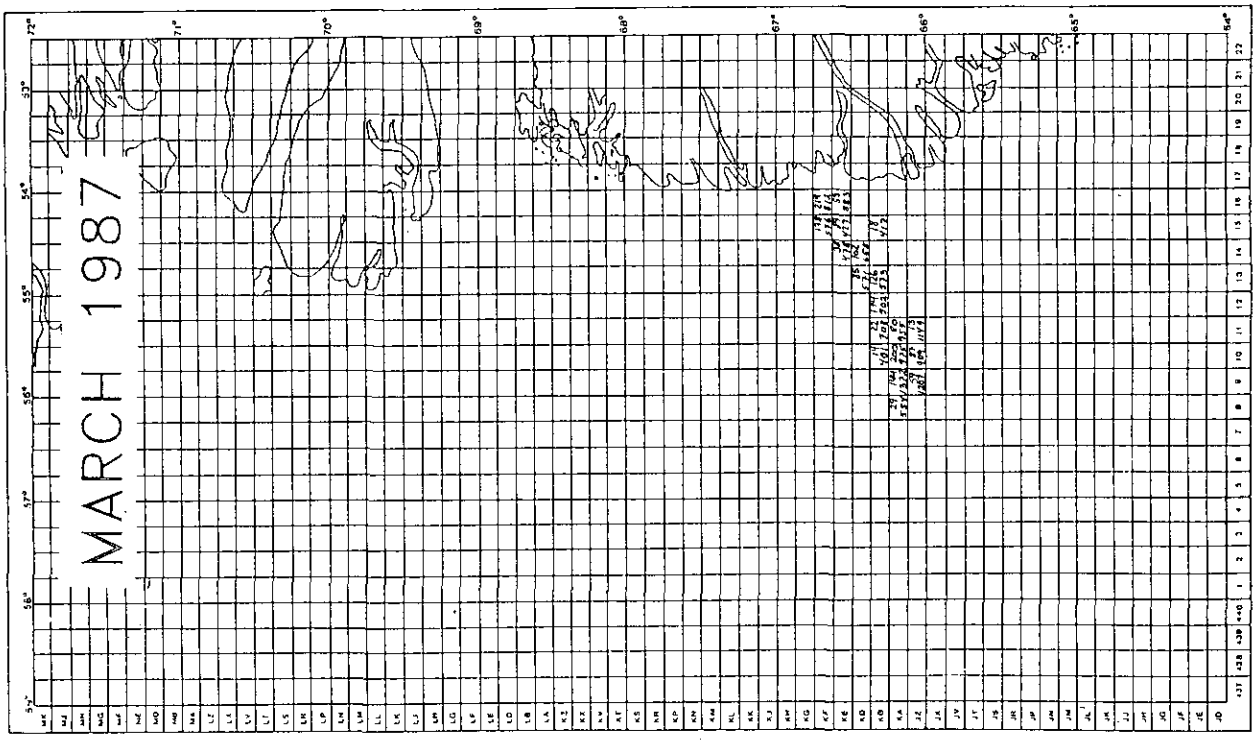


Figure 2. Continued. March 1987.

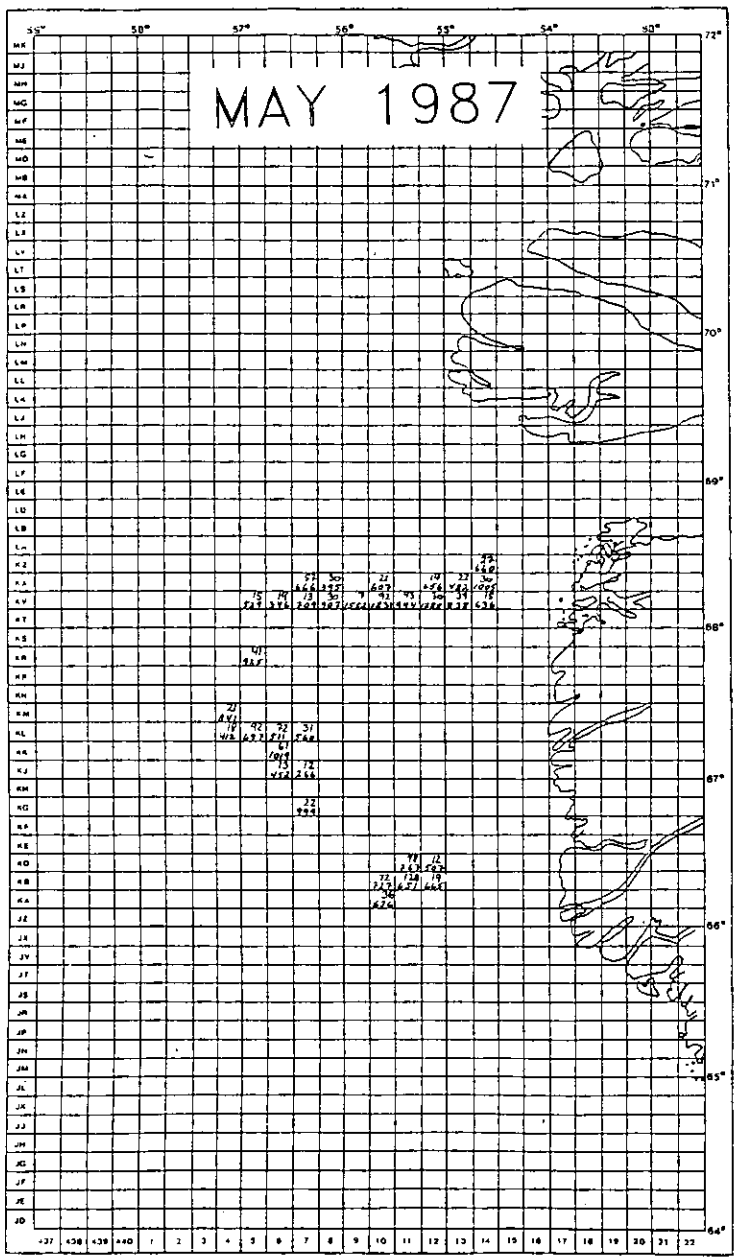


Figure 2. Continued. May 1985.

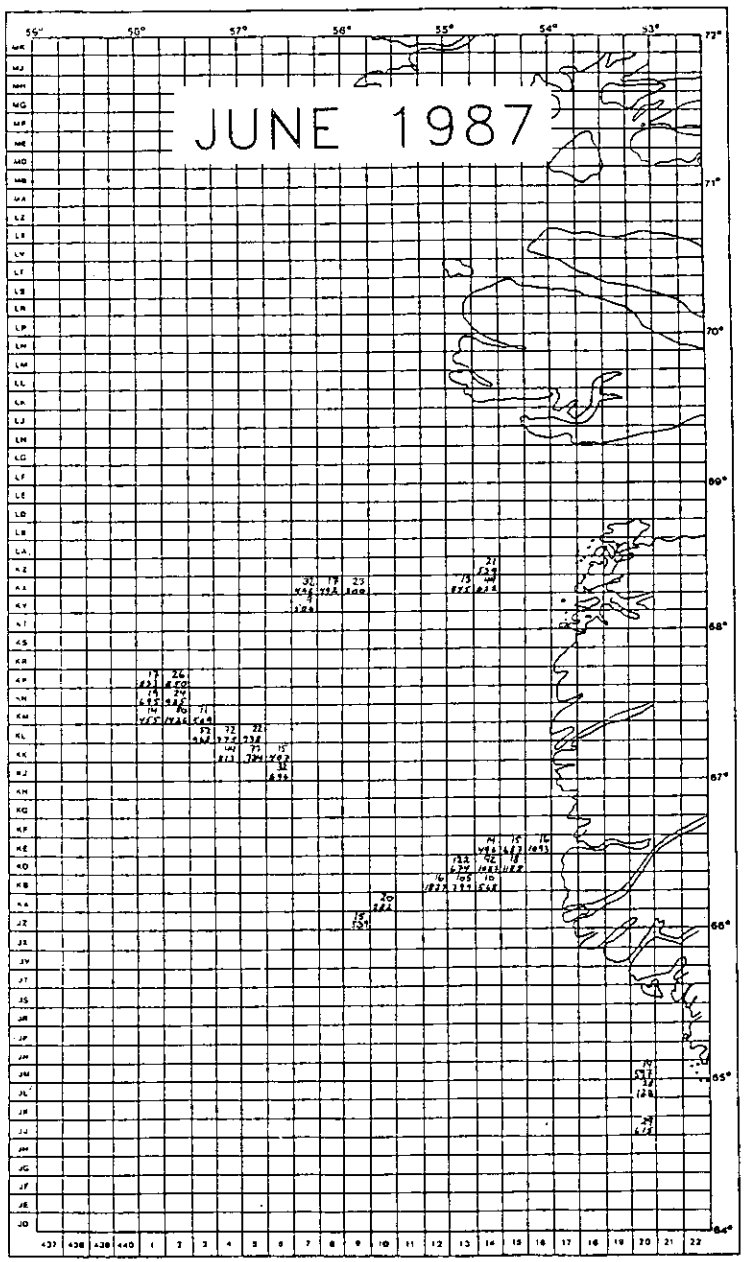
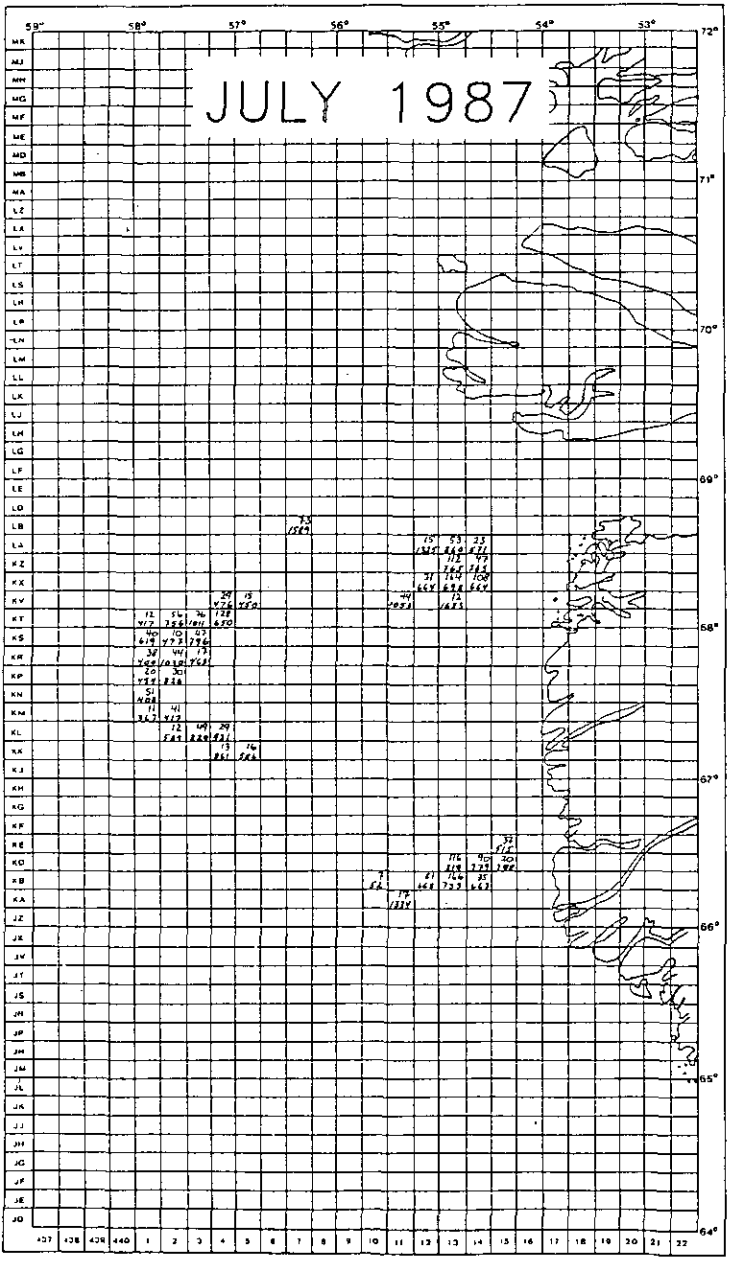


Figure 2. Continued. June 1987.



2. Continued. July 1987.

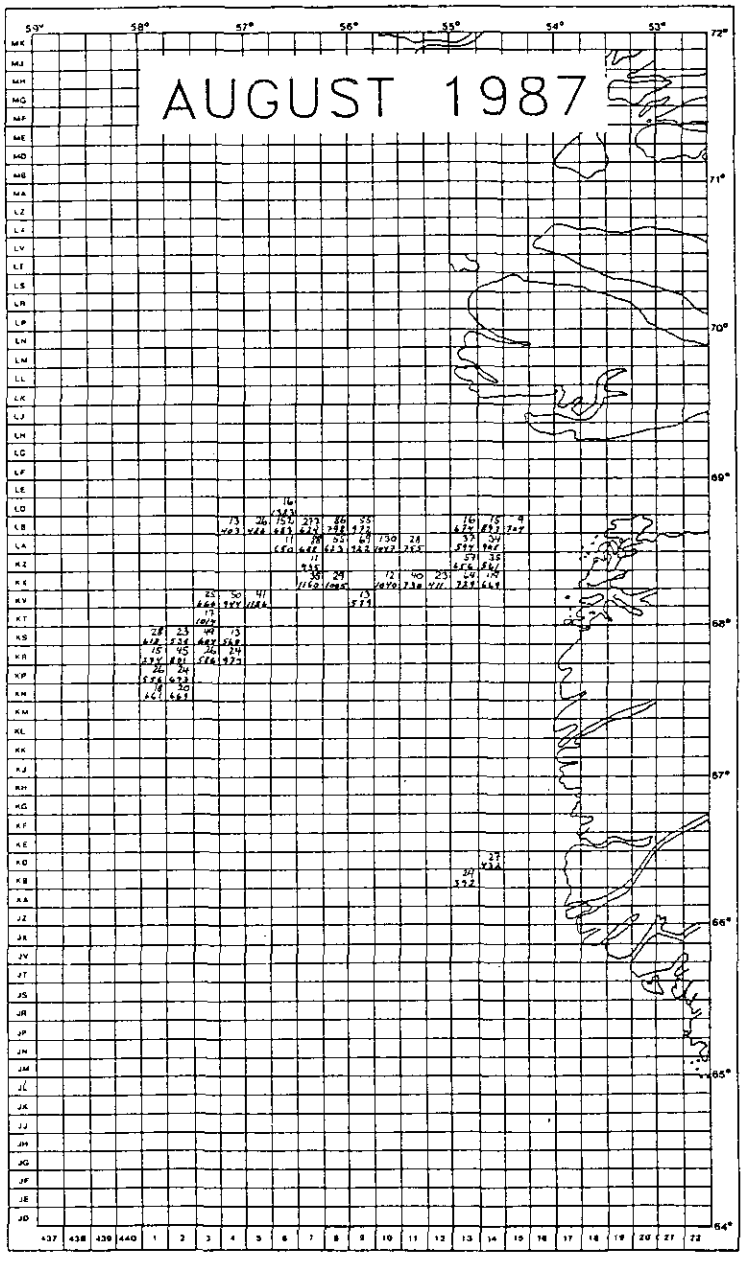


Figure 2. Continued. August 1987.

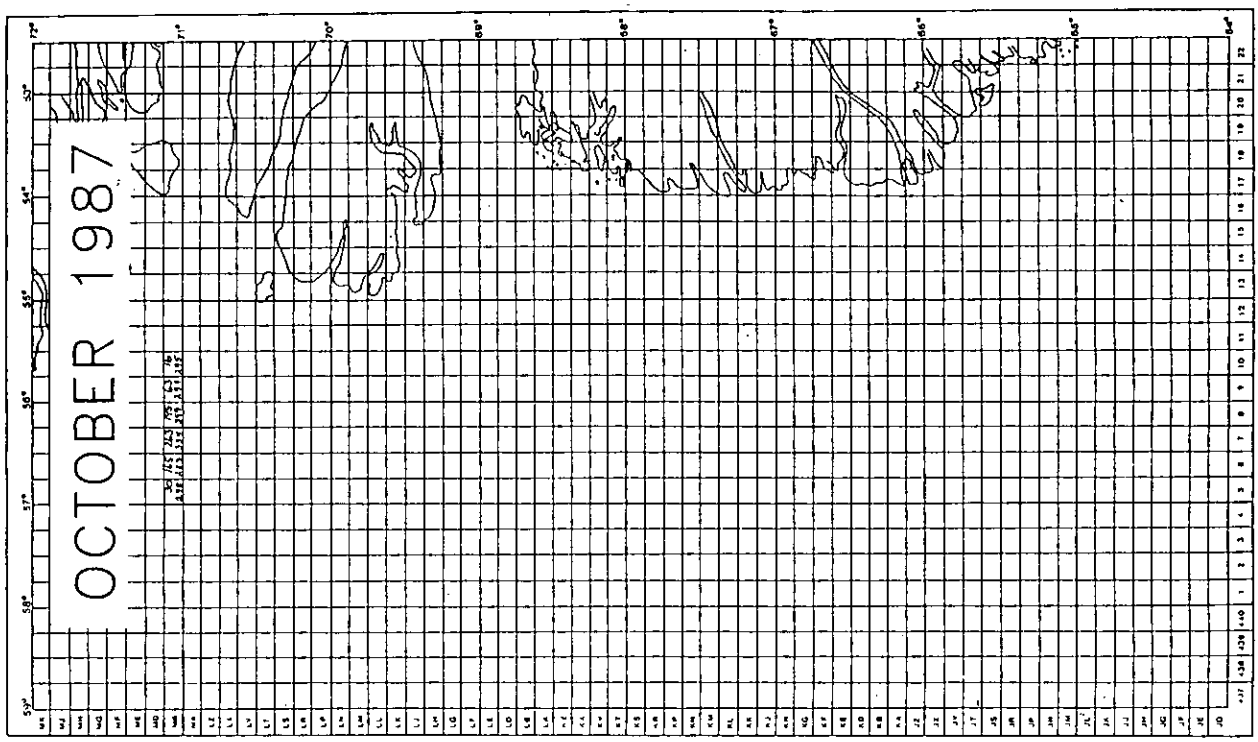


Figure 2. Continued. October 1987.

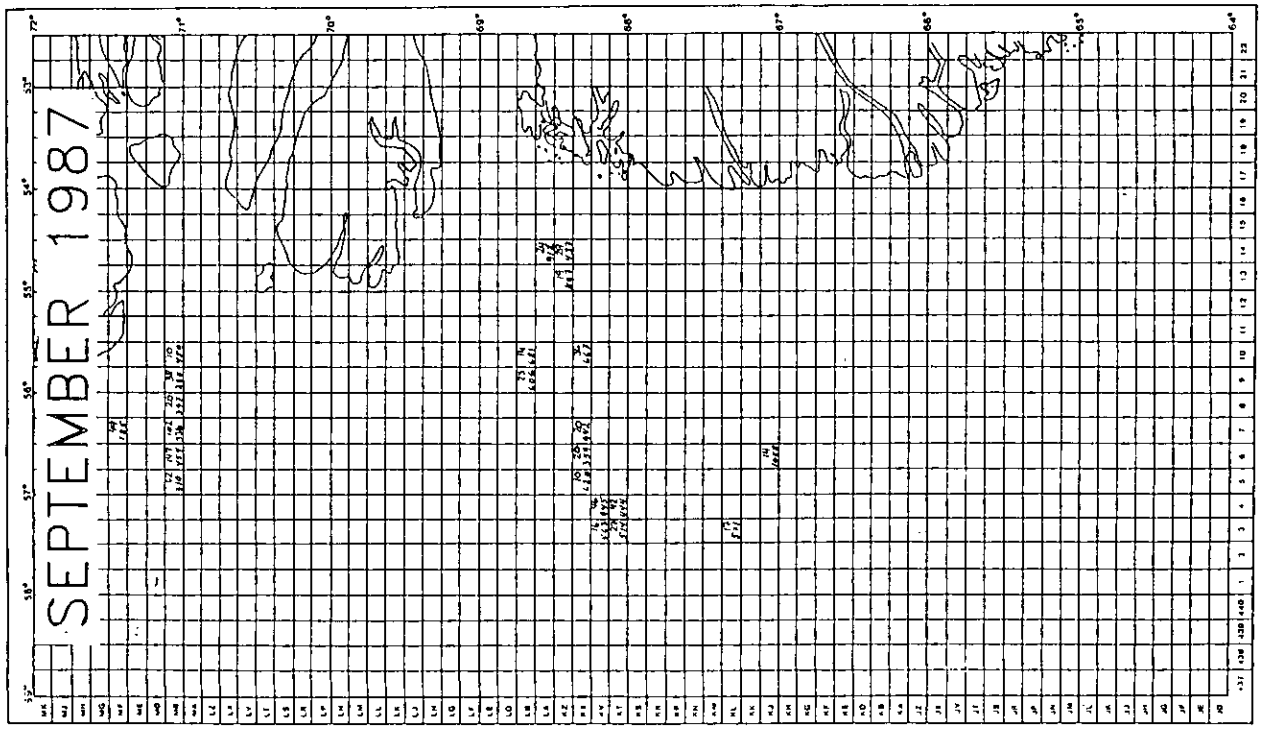


Figure 2. Continued. September 1987.

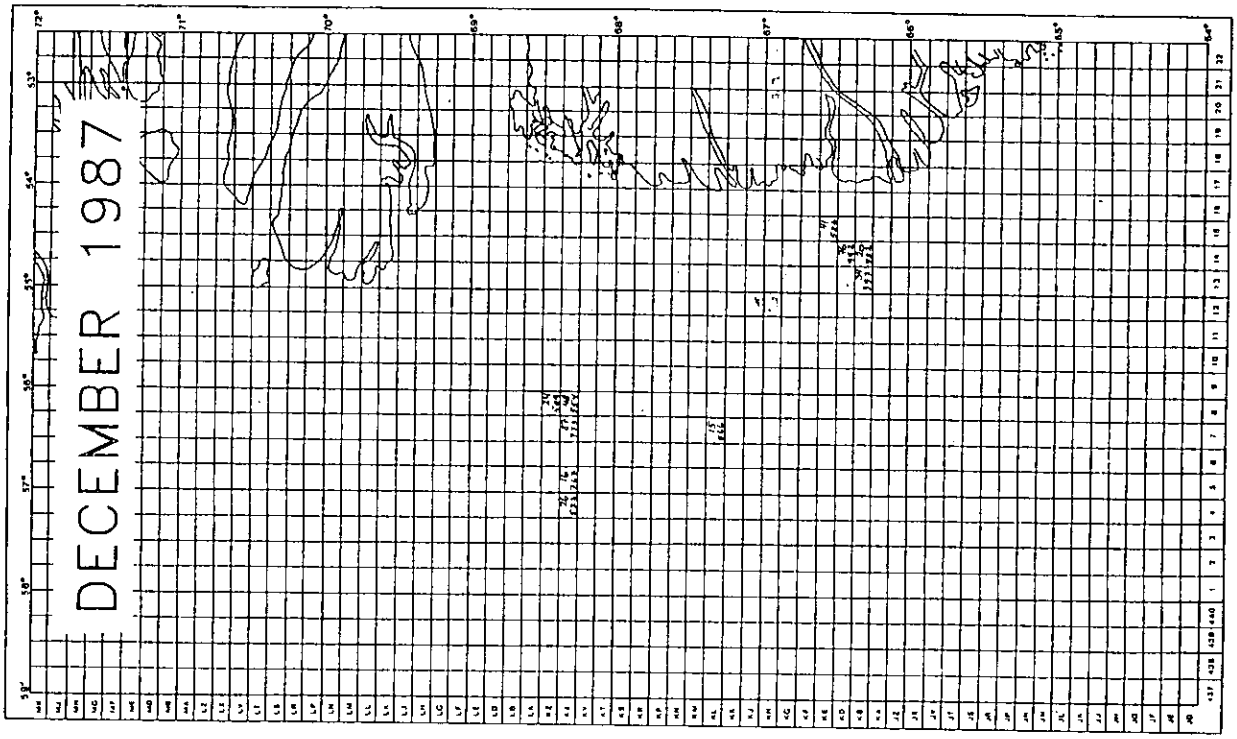


Figure 2. Continued. December 1987.

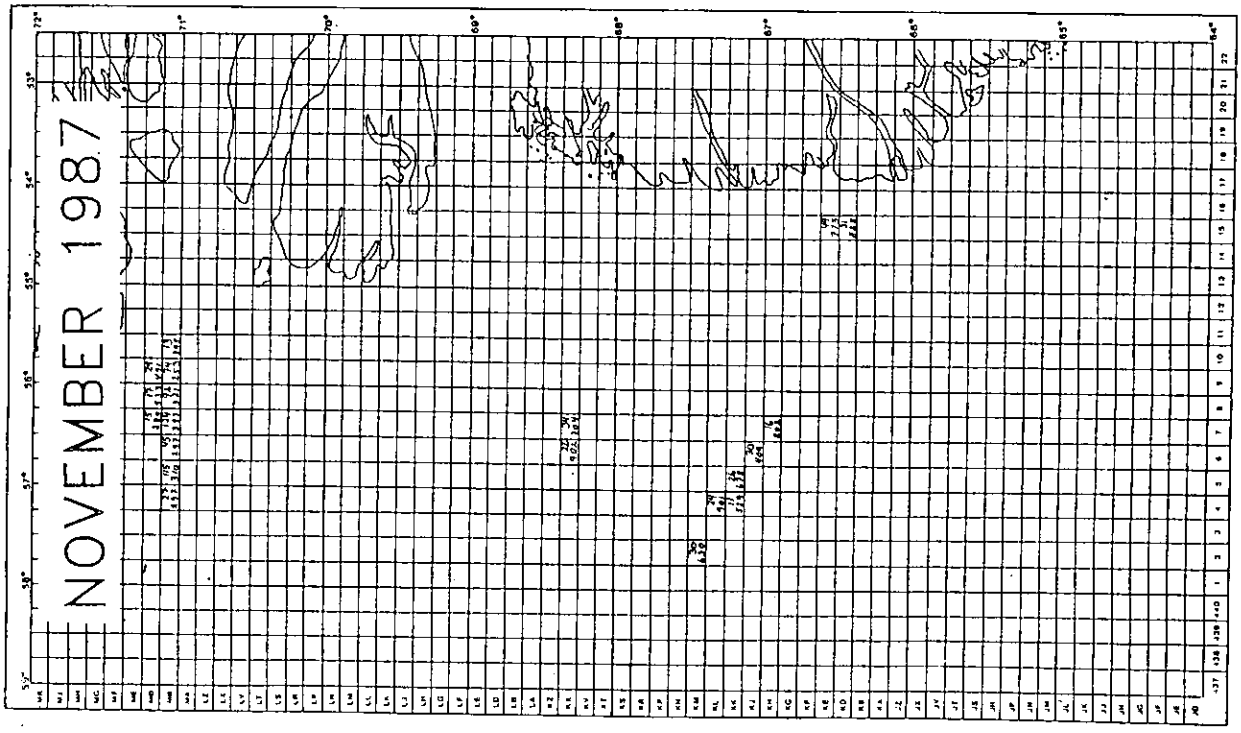


Figure 2. Continued. November 1987.

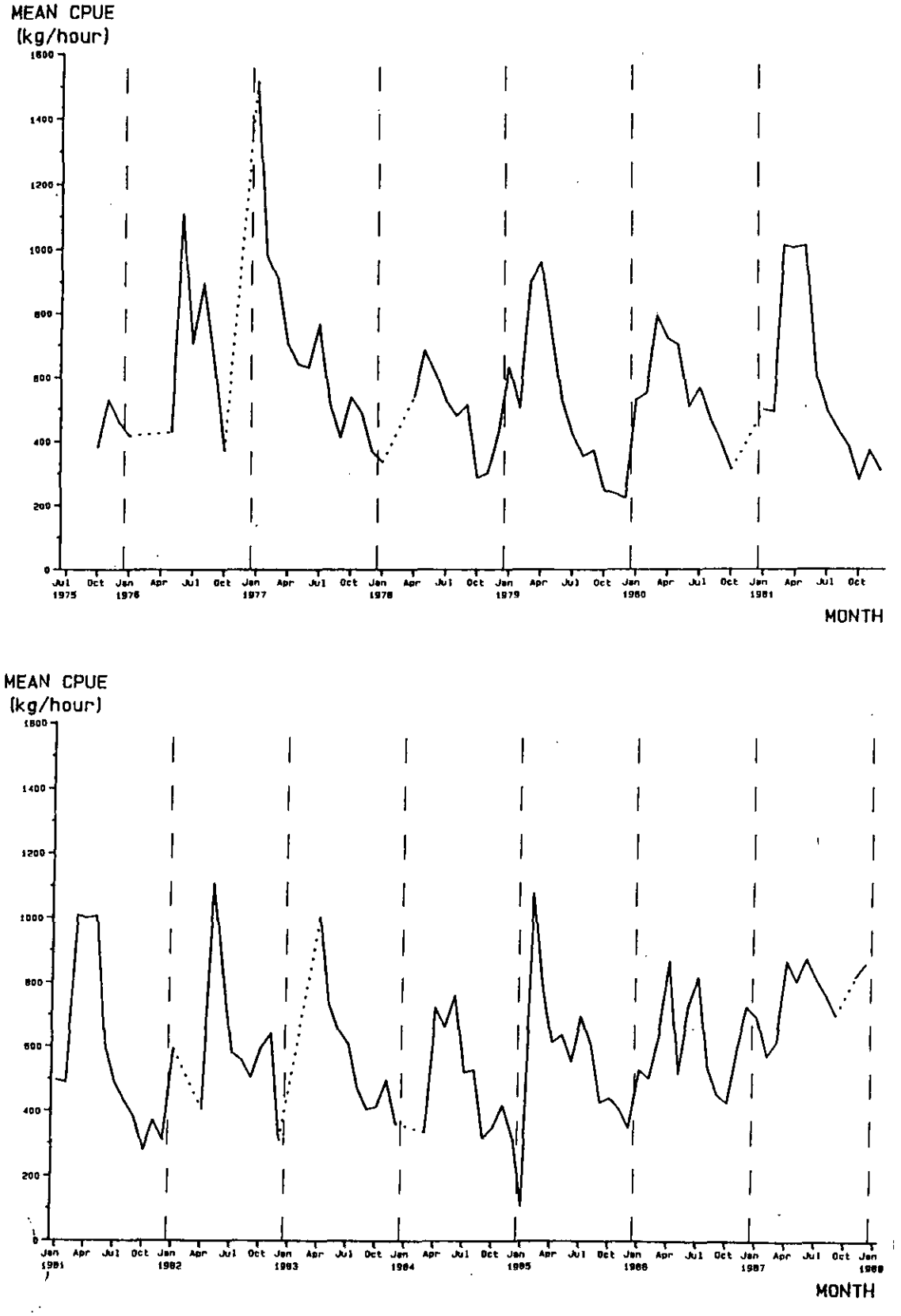


Figure 3. Monthly mean catch rate of shrimp (kg/hour) in NAFO Division 1B from October 1975 to December 1987 based on logbook information and landings from seven trawlers (630-857 GRT) of the Greenland Home Rule Administration (corresponding no. of hours trawled are given in Table 3).

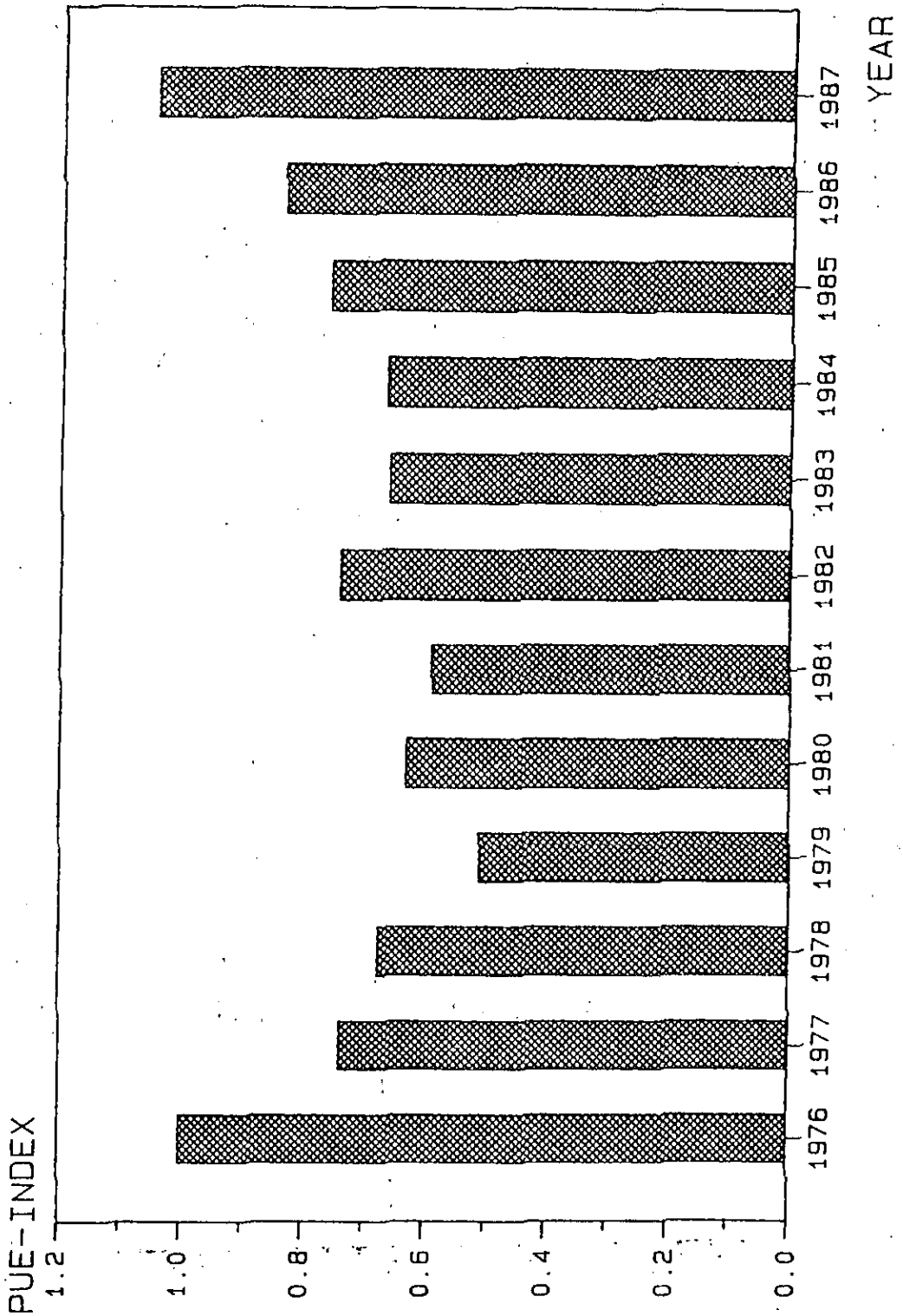


Figure 4. Indices of mean catch rates for the period July-September by year in NAFO Divison 1B from 1976 to 1987, based on logbook information and landings of seven trawlers (630-857 GRT) owned by the Greenland Home Rule Administration. Indices are calculated relative to the mean catch rate for the period in 1976.

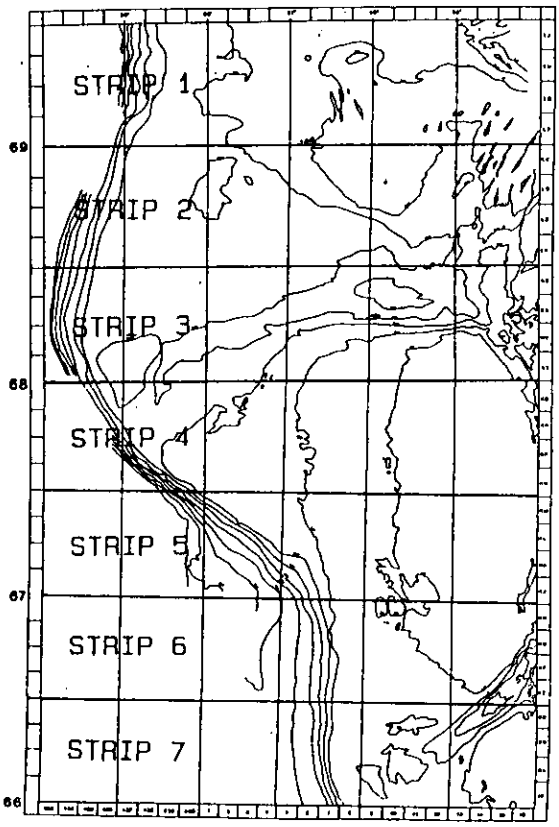


Figure 5. Map showing block-strips used in Figure 6.

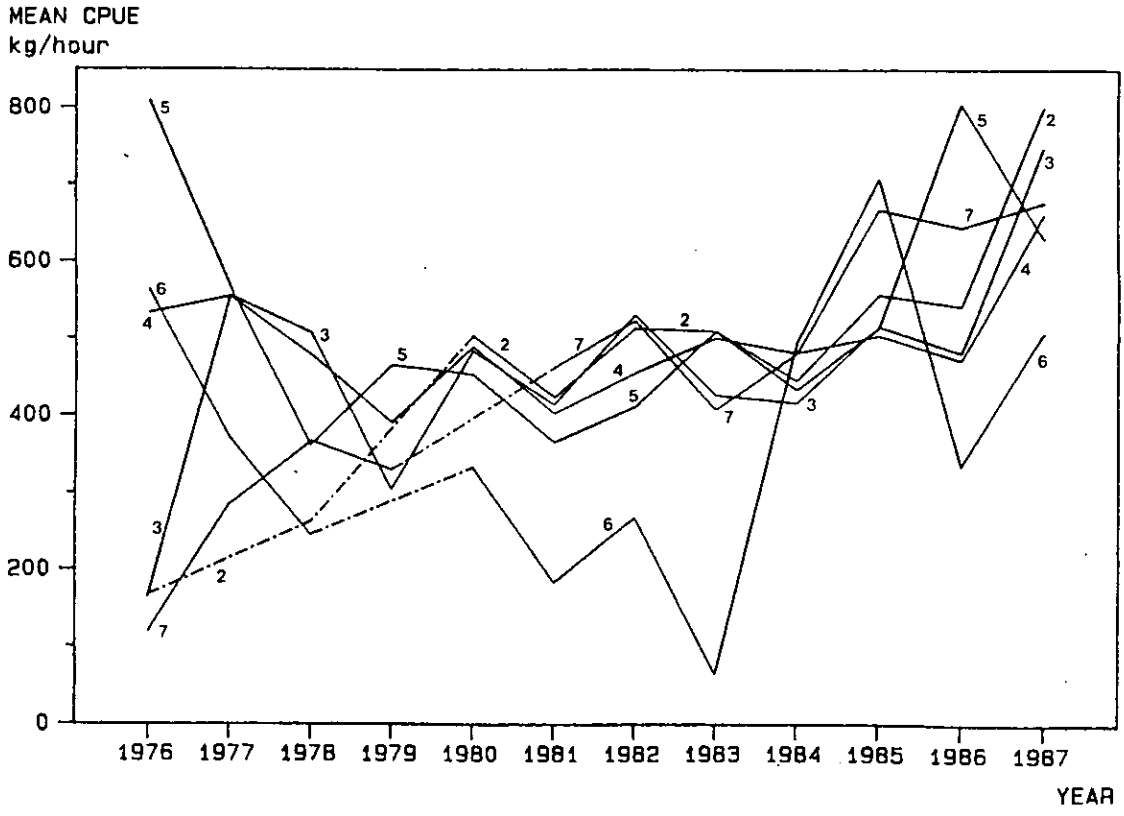


Figure 6. Mean catch rates (kg/hour) of shrimp for the period July- September in block-strips in NAFO Subarea 1 from 1976 to 1987, based on logbook information from eight trawlers (473-857 GRT) owned by the Greenland Home Rule Administration. Curve no.s refer to blockstrips shown in Fig. 5.

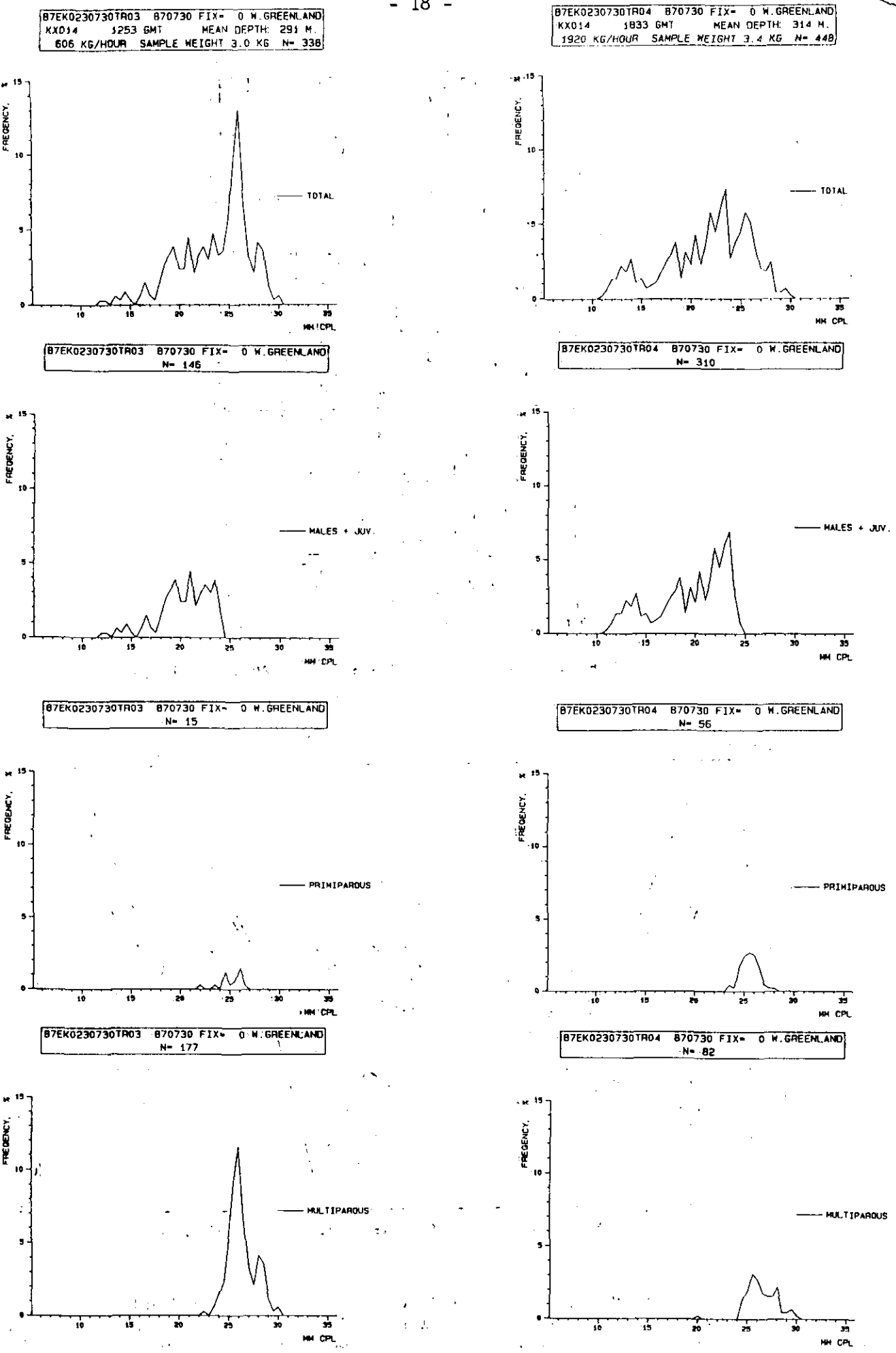


Fig. 7. Length-frequency diagrams for commercial shrimp samples from Div.

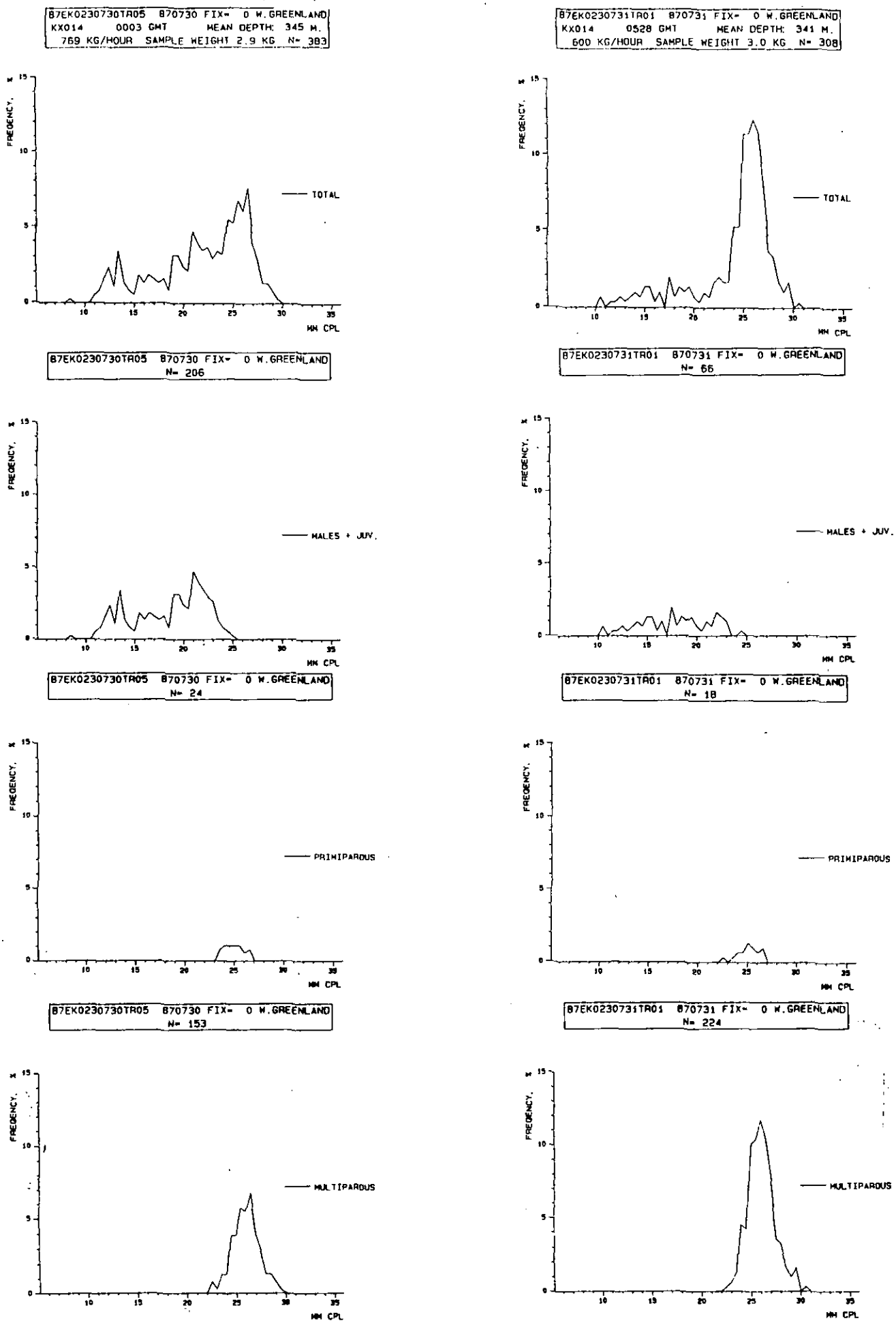
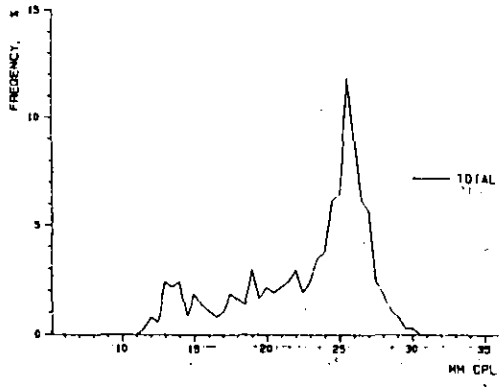
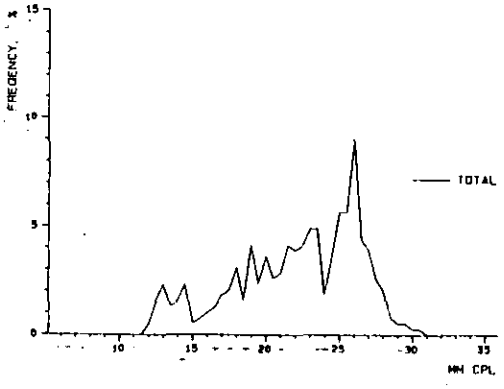


Fig. 7 (continued)

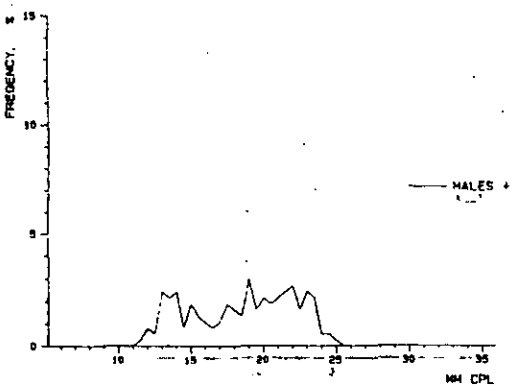
87EK0230731TR02 870731 FIX= 0 W.GREENLAND
KX014 1043 GMT MEAN DEPTH: 335 M.
894 KG/HOUR SAMPLE WEIGHT 3.0 KG N= 372



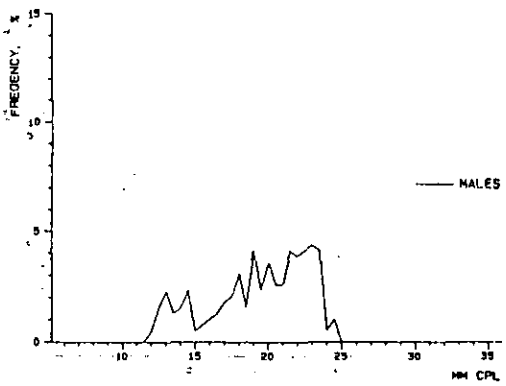
87EK0230731TR03 870731 FIX= 0 W.GREENLAND
KX014 1638 GMT MEAN DEPTH: 355 M.
1032 KG/HOUR SAMPLE WEIGHT 3.0 KG N= 388



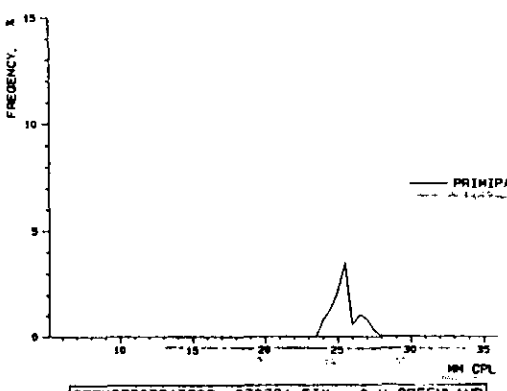
87EK0230731TR02 870731 FIX= 0 W.GREENLAND
N= 163



87EK0230731TR03 870731 FIX= 0 W.GREENLAND
N= 229



87EK0230731TR02 870731 FIX= 0 W.GREENLAND
N= 39



87EK0230731TR03 870731 FIX= 0 W.GREENLAND
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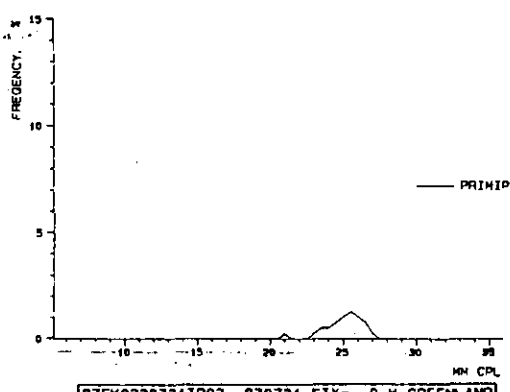

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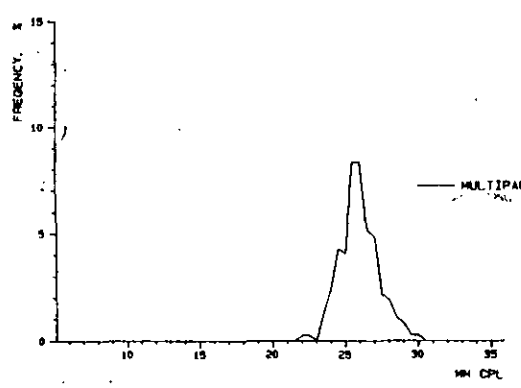
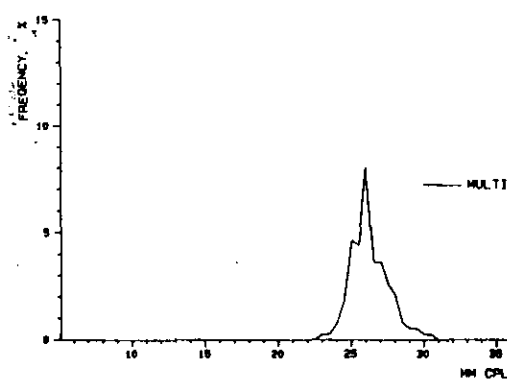


87EK0230731TR03 870731 FIX= 0 W.GREENLAND
N= 133



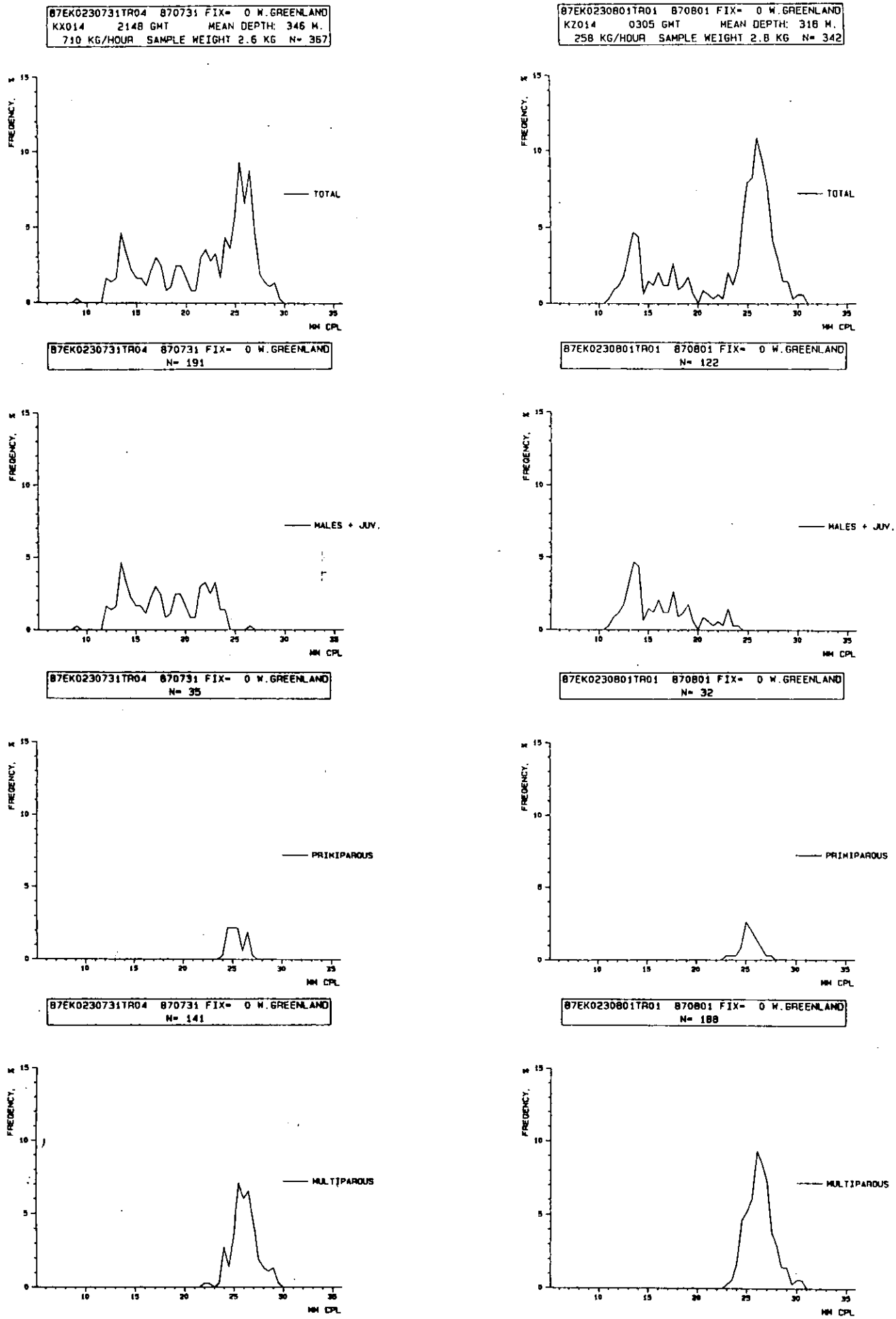
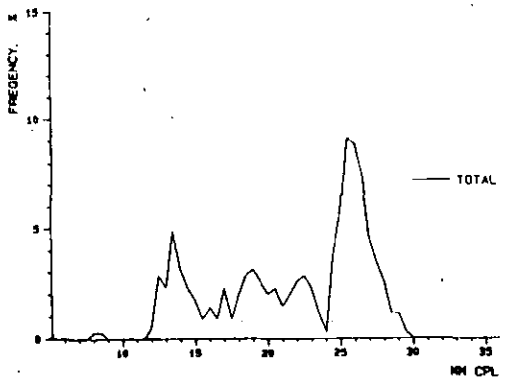
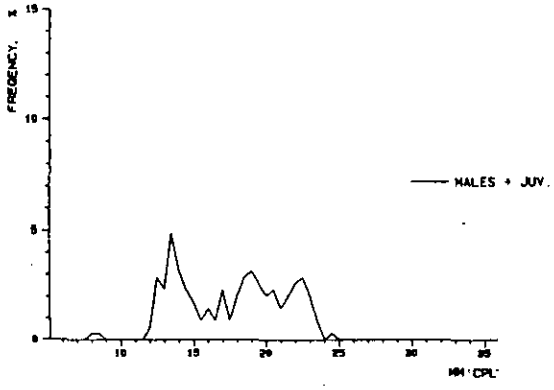


Fig. 7 (continued)

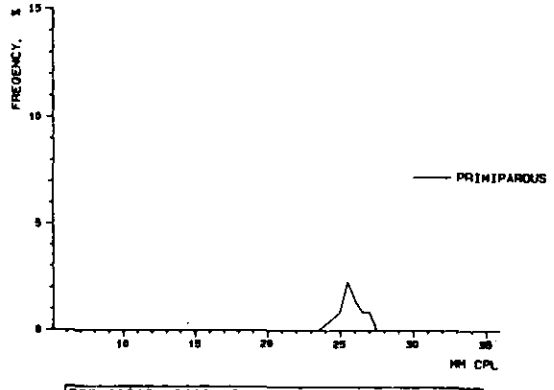
87EK0230801TR02 870801 FIX= 0 W.GREENLAND
KX014 0908 GMT MEAN DEPTH: 336 M.
796 KG/HOUR SAMPLE WEIGHT 2.6 KG N= 350



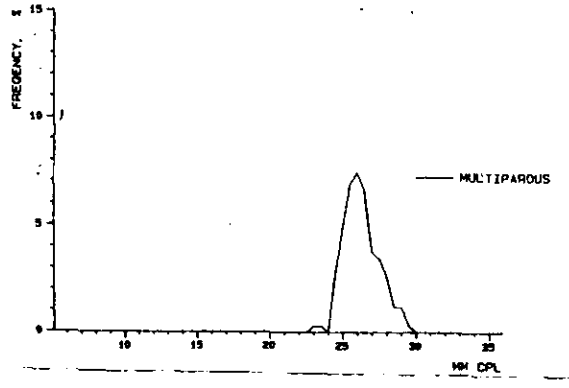
87EK0230801TR02 870801 FIX= 0 W.GREENLAND
N= 180



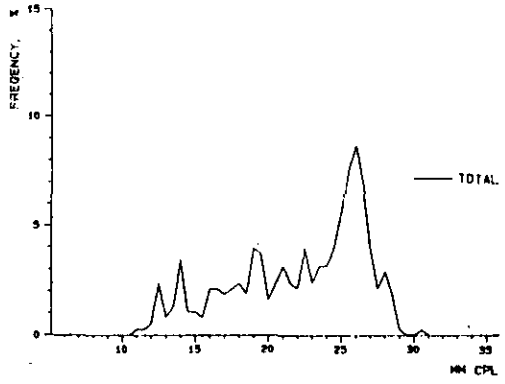
87EK0230801TR02 870801 FIX= 0 W.GREENLAND
N= 25



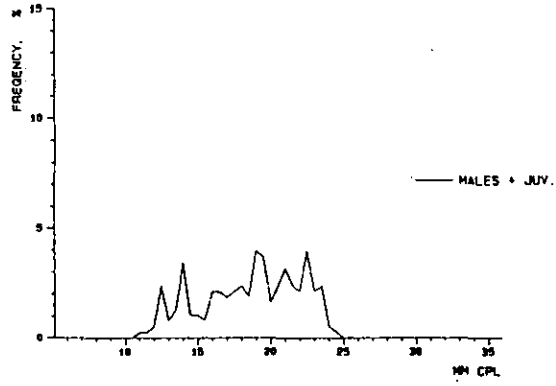
87EK0230801TR02 870801 FIX= 0 W.GREENLAND
N= 145



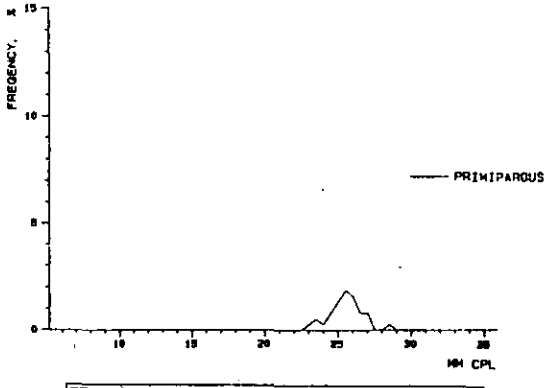
87EK0230801TR03 870801 FIX= 0 W.GREENLAND
KX014 1623 GMT MEAN DEPTH: 316 M.
1001 KG/HOUR SAMPLE WEIGHT 2.9 KG N= 380



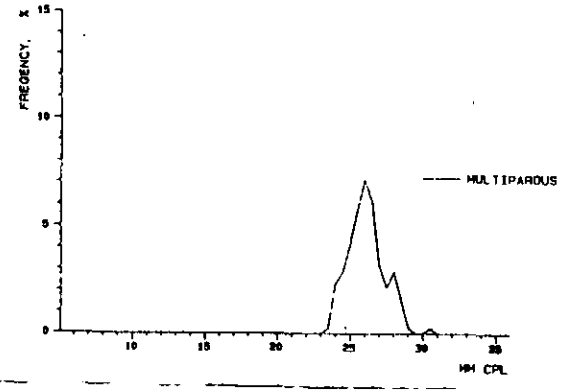
87EK0230801TR03 870801 FIX= 0 W.GREENLAND
N= 200



87EK0230801TR03 870801 FIX= 0 W.GREENLAND
N= 32



87EK0230801TR03 870801 FIX= 0 W.GREENLAND
N= 148



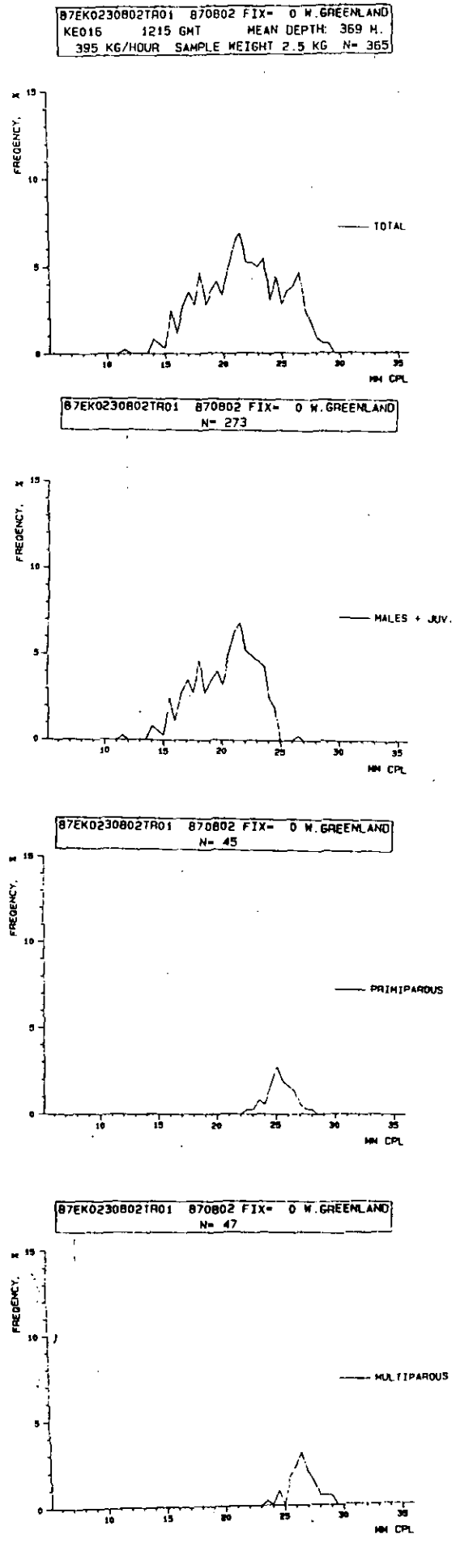


Fig. 7 (continued)