Northwest Atlantic Fisheries Organization

Serial No. N2342 NAFO SCR Doc. 93/130

SCIENTIFIC COUNCIL MEETING - NOVEMBER 1993

The Shrimp Fishery in NAFO Subarea 1 January to October 1993

by

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INTRODUCTION

For 1990 to 1992 STACFIS has advised a TAC for the offshore catch of shrimp in NAFO Subareas 0 and 1 (not including Subarea 1 north of 71°N) of 50,000 tons. At the June meeting in 1992 STACFIS changed the advice for 1992 to 40,000 tons and advised the same TAC for 1993, based on indications in trawl survey data from 1991 of a substantial reduction of total biomass and absence of new recruiting year classes.

The effective TAC in 1993 for offshore Subarea 1 was set by the Greenland Home Rule Authorities at 33,800 tons for the area south of 68°N and 8,300 tons for more northern areas, including the area north of 71°N, not covered by the advice of STACFIS.

From January through October 1993 trawlers (above 75 GRT) reported a total catch in Subarea 1 of 34,057 tons, including 641 tons taken north of 71°N and 1,060 tons taken in the inshore areas. Total catches of smaller vessels from January through September are estimated to 18,814 tons, of which about 9,400 tons were taken in the offshore area.

Since 1986 logbooks have been compulsory for all vessels above 50 GRT fishing in Greenland waters. For the January to October period logbooks available to Greenland Fisheries Research Institute cover about 110,000 hours of trawling and a total catch of about 36,600 tons of shrimp in Subarea 1. Logbook data have been used to estimate standardized effort in catch rate calculations.

This paper updates information on the geographical distribution and catch rates in the offshore Subarea 1 shrimp fishery. Also, results from analysis of samples from the commercial shrimp fishery are presented.

MATERIAL AND METHODS

Based on the compulsory weekly reportings to Greenland authorities by all vessels above 75 GRT total catches and numbers of vessels in the shrimp fishery in NAFO Subarea 1 in January to October 1993 were compiled by nation and month.

Logbook data were analyzed to show the yearly and monthly distribution of catches, fishing effort and mean catch-rates.

Based on logbook data from 27 Greenland trawlers a multiplicative model was run using the SAS multiple regression procedures to calculate standardized annual catch rate indices for the total catch, and for shrimp larger than 8.5 g to avoid the influence of unreported discard. The method is described in Carlsson and Lassen, 1991. Catch of large shrimp and total catch were aggregated by vessel, area, month and year (areas have been selected based on the distribution of the commercial fishery - see Fig. 3). All cells with less than 10 hours of effort or with 10% or more of the catch not being sorted by shrimp size were excluded to avoid the influence of cells with few hauls and of non-sorted catch. Due to differences in seasonality the analysis was carried out for Div. 1B and Div. 1CD separately. The above mentioned filters reduced the number of cells in Div. 1B from 8748 to 1256, of which further 21 were removed as marked outliers. In Div. 1CD filters reduced the number of cells

from 6480 to 1333, and further 20 were removed as marked outliers. Although some improvement in r-square values could be obtained by including interactions in the model, the final runs were done with the simple model.

Shrimp samples from the commercial fishery in 1993 were available from Div. 1B in February, September, and October, from 1C in February, March and August, from 1D in March and August, and from 1E in March. Samples were not sorted by sexual characteristics. Shrimp were measured to nearest 1 mm carapace length and pooled in 5 mm length groups by division and month to show overall size distribution of commercial catches.

RESULTS AND DISCUSSION

Reported catches in January to October 1993

Only Greenland vessels fished shrimp in Subarea 1 in 1993. Table 1 shows catches by division and month in Subarea 1 in January through October as reported by vessels above 75 GRT, and Table 2 the numbers of reporting vessels. The figures include catches in the offshore fishery north of 71°N (in Division 1A north; 641 tons), and inshore catches of 1,060 tons.

The shrimp landings from Subarea 1 in January through September by smaller Greenland vessels (below 75 GRT) were about 13,300 tons, of which about 6,700 tons are estimated to be inshore catches.

The total nominal shrimp catch in Subarea 1 was 47,383 tons in January through September 1993.

Summary table (nominal catch by Greenland in Subarea 1 in January to September 1993 distribution between inshore and offshore catches of vessels < 75 GRT is estimated):

	Vessel > 75 GRT	Vessels < 75 GRT	Total
Offshore, north of 71°N	378	0	378
Offshore, south of 71°N	27,131	9,384	36,515
Inshore	1,060	9,430	10,490
Total	28,569	18,814	47,383

Reported catches in January through October by vessels above 75 GRT declined from about 45,000 tons in 1992 to about 34,100 tons in 1993. Catches in January through September by smaller vessels decreased from about 17,900 tons in 1992 to about 18,800 tons in 1993.

Catches in 1993 by larger vessels may be affected upwards by the initiation of an observer program aimed to reduce unreported discard of shrimp. From April to July in the same year the minimum mesh size regulation (for the cod-end) was changed from the otherwise enforced 40 mm to 55 mm, which to some extent may have reduced catches in this period.

Geographical distribution of the offshore fishery

Figure 1 shows that the distribution of total catches in January to October 1993 as recorded in logbooks from Greenland trawlers was very similar to 1992 (Carlsson and Kanneworff, 1993) except for an increase in the fishery south of 61°N (Div. 1F) and a decrease north of 71°N; in this area, however, more fishing may occur later in 1993. Catches were widespread over the fishing grounds along the coast. Table 3 and 4 show the distribution of effort and catches in logbooks by division and year from 1987 to October 1993. The tables show a significant shift in the fishery in recent years from Div. 1A and 1B to Div. 1C, D, E and F. Data from 1993 are incomplete, and it is therefore difficult to compare this year with earlier years. However, an increase in effort and catch is evident in Div. 1F, and even after adding the fishery of the last month of 1993 there will be a decrease in Div. 1A.

The decrease in total effort in Subarea 1 in 1993 is among others due to the participation of Greenland trawlers in the new shrimp fishery on Flemish Cap (NAFO Div. 3M). From May to October 1993 12 Greenland trawlers spent about 10,000 hours of trawling in this area.

Figure 2a and 2b show the monthly distribution of mean catch-rates and effort (numbers of hours trawled) from January to October 1993. As has been the case in recent years (1987 - 1992) ice prevented the access to the fishing grounds west and north of the Store Hellefiske Bank area in the beginning of the year. From January to April only the grounds south of 67°N were partly open, and even in August ice influenced the distribution of the fishery in the southern areas. It was not possible to access all the fishing grounds north at Store Hellefiske Bank until the end of August.

The fishery north of 71°N in 1993 did not begin until August. In 1992 it started in June.

Standardized CPUE-indices

The results of multiple regression analysis to standardize catch rates of large shrimp show that the model explains 41% in Div. 1B and 38% in Div. 1CD of the total variation. In both runs all four

variables are highly significant. T-values suggest that for Div. 1B in 1987 and 1988 catch rates were significantly higher and in 1992 significantly lower than in 1993. For Div. 1CD catch rates were significantly higher in 1988, 1989 and 1990 than in 1993. Histogram, box- and probit plots of the residuals (Fig. 4a and 4b) suggest that in both analysis the residuals are normally distributed without marked outliers.

Results of the same models run for the total catch (not shown here) were similar to the results for large shrimp catch, except that the catch rate in Div. 1B only in 1987 was significantly higher and in both 1989 and 1990 significantly lower than in 1993. In Div. 1CD only the catch rates in 1988 and 1989 were significantly higher than in 1993.

Calculated annual cpue-indices for large shrimp and total catch based on results from the regression analysis are shown in Fig. 5a (Div. 1B) and 5b (Div. 1CD). In Div. 1B the indices for large shrimp show a declining trend from 1987 to 1989, stability between 1990 and 1992, and an increase from 1992 to 1993. In Div. 1CD the indices show an increase from 1987 to 1988 and stability or a slight declining trend between 1988 and 1993.

Standardized cpue-indices may be affected upwards in 1993 by the new observer system in the Greenland zone, aimed to reduce the amount of unreported discards. The temporarily mesh size regulation of minimum 55 mm mesh size in the cod-end, in force from April to July 1993, may on the other hand have affected the catch rates somewhat downwards in this period.

Biological samples

All samples from the commercial fishery in Div. 1B and 1C in 1993, pooled by month, are dominated by a female group at 25-26 mm CL. In Div. 1B a male group at 21.5 mm CL is present in both February, September and October. Especially in the last two months smaller male groups are also represented in the catches, however in smaller numbers.

In Div. 1C the male proportion of the catch is relatively larger than in Div. 1B. In February a male group at 21.5 mm CL is found, and in March and August several male groups are present (at 17.5, 19.5, 21.5 and 23 mm CL).

Samples from Div. 1D in March and September are dominated by a male group at 19.5 mm CL, but other size groups are also present in the catches (males at 15.5 and 21.5 mm, females at 25-26 mm CL).

In Div. 1E in March catches were composed of a dominating female group at 26.5 mm CL and three to four size groups of males.

If the same size at age structure as interpreted in earlier years (Carlsson and Kanneworff, 1993) is valid in 1993, the male groups at 15.5, 17.5, 19.5, 21.5 and 23 mm CL may represent the 1990, -89, -88, -87 and -86 year classes, and the female group at 25-26 mm CL does - at least partly - consist of the 1985 year class.

CONCLUSIONS

The total reported catch in Subarea 1 of vessels > 75 GRT in January to October 1993 was 34,100 tons, a decrease of about 11,000 tons when compared to the same months in 1992. This decrease may be due to several circumstances - an unusual long period of ice coverage in both inshore and offshore areas, the participation of 12 larger Greenland vessels in the new shrimp fishery at Flemish Cap, and a minor reduction in number of large vessels in the fleet. Preliminary data on the landings of smaller vessels from January to September 1993 show a total catch of about 18,800 tons, an increase of about 900 tons compared to 1992.

The trend observed in recent years of a displacement of the fishery in Subarea 1 to the southern divisions (from Div. 1AB to Div. 1CDEF) was continued in 1993. Catch and effort figures for offshore Div. 1F are the highest on record.

Standardized catch rate indices for large shrimp based on the fishery of 27 Greenland trawlers in Div. 1B show a decrease from 1987 to 1989, stability from 1989 to 1992, and a minor increase from 1992 to 1993. Standardized catch rate indices for the same trawlers in Div. 1CD show an increase from 1987 to 1988, a minor decrease from 1988 to 1991, and stability from 1991 to 1993.

Shrimp samples from the commercial fishery in 1993 show that in Div. 1B and 1C catches are dominated by female shrimp and in Div. 1D and 1E by male shrimp. Female shrimp show one dominating peak at 25-26 mm CL. The 1985 year class has probably contributed significantly to this size group. Several year classes are present in the catch of male shrimp, the 1987 and 1988 year classes (around 19.5 and 21.5 mm CL) being the most important.

REFERENCES

CARLSSON, D. M., and P. KANNEWORFF. 1992. The shrimp fishery in NAFO Subarea 1 in 1991. *NAFO SCR Doc.*, No. 65, Serial No. N2119, 21 p.

CARLSSON, D. M., and H. LASSEN. 1991. A catch-rate index for large shrimp in the Greenland shrimp fishery in NAFO Division 1B. *NAFO SCR Doc.*, No. 57, Serial No. N1941, 14 p.

Table 1. Shrimp catches (tons) by division and month in January-October 1993 in Subarea 1 as reported to the Greenland authorities by vessels above 75 GRT (including 1060 tons taken inshore). Only Greenland vessels participated in the fishery.

DIVISION	JAN	FEB	MAR	APR	MAJ	JUN	JUL	AUG	SEP	OKT	TOTAL
1AN	.	.	.	.	.	.	.	9	369	264	641
1AS	.	.	.	.	33	25	0	189	684	524	1456
1B	40	32	418	828	874	1099	1402	2656	1527	3874	12750
1C	322	855	1238	1343	663	1086	1048	574	436	9	7573
1D	643	402	554	509	1042	1672	1093	1040	991	592	8536
1E	123	14	486	61	494	92	28	200	492	225	2214
1F	151	229	198	112	161	.	36	.	.	.	886
TOTAL	1278	1532	2894	2852	3267	3973	3607	4667	4499	5488	34057

Table 2. Number of vessels above 75 GRT by division and month in the shrimp fishery in Subarea 1 in January-October 1993 as reported to the Greenland authorities. Only Greenland vessels participated in the fishery.

DIVISION	JAN	FEB	MAR	APR	MAJ	JUN	JUL	AUG	SEP	OKT	TOTAL
1AN	.	.	.	.	.	.	.	1	7	5	9
1AS	.	.	.	.	1	1	1	8	15	10	18
1B	5	2	16	18	22	13	17	19	24	25	34
1C	12	15	22	25	26	16	21	16	14	2	35
1D	20	15	22	22	26	16	21	14	15	8	34
1E	8	4	15	5	11	2	3	4	7	4	24
1F	6	6	6	4	6	.	2	.	.	.	14
TOTAL	22	18	26	34	32	22	30	28	32	34	35

Table 3. Distribution of effort (in hours and % of total hours per year) by Division and year in logbooks from the Greenland fishery, January 1988 to October 1993.

Year	1A hours	%	1B hours	%	1C hours	%	1D hours	%	1E hours	%	1F hours	%	Total hours
1988	31818	27.2	72034	61.7	10807	9.3	1381	1.2	2	0.0	729	0.6	116771
1989	36123	26.4	61513	44.9	23113	16.9	12906	9.4	2	0.0	3344	2.4	137001
1990	32656	20.2	61764	38.2	42356	26.2	22660	14.0	-	-	2205	1.4	161641
1991	27421	15.9	68759	39.8	39138	22.7	35858	20.8	564	0.3	962	0.6	172702
1992	34137	20.6	55140	33.2	33990	20.5	36345	21.9	5336	3.2	924	0.6	165872
1993	9224	8.4	37332	34.0	26349	24.0	27922	25.4	4746	4.3	4193	3.8	109766

Table 4. Distribution of catches (in tons and % of total logbook catch per year) by Division and year in logbooks from the Greenland fishery, January 1988 to October 1993.

Year	1A tons	%	1B tons	%	1C tons	%	1D tons	%	1E tons	%	1F tons	%	Total tons
1988	7667	18.1	29957	70.7	4330	10.2	316	0.7	1	0.0	91	0.2	42362
1989	9705	21.4	21541	47.5	7940	17.5	5878	13.0	0	0.0	297	0.7	45361
1990	7570	15.2	19564	39.5	14497	29.2	7742	15.6	-	-	298	0.6	49671
1991	7572	14.4	20659	39.3	11665	22.2	12106	23.0	380	0.7	150	0.3	52532
1992	9170	16.2	19422	34.3	11504	20.3	13382	23.6	2861	5.0	365	0.6	56704
1993	2498	6.8	13139	35.9	8584	23.5	8885	24.3	2029	5.5	1439	3.9	36574

Table 5a. Estimation of parameters, standardization of CPUE for large shrimp (>8.5 g) in Div. 1B.

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNCPUE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F
MODEL	46	192.20949210	4.17846722	17.63	0.0
ERROR	1188	281.50783669	0.23695946		
CORRECTED TOTAL	1234	473.71732879			

R-SQUARE	C.V.	ROOT MSE	LNCPUE MEAN
0.405747	9.2346	0.48678482	5.27130743

SOURCE	DF	TYPE I SS	F VALUE	PR > F
VESS	26	82.50399528	13.39	0.0001
YR	6	56.85370515	39.99	0.0001
MO	11	44.64535803	17.13	0.0001
AREA	3	8.20643364	11.54	0.0001

SOURCE	DF	TYPE III SS	F VALUE	PR > F
VESS	26	67.32385029	10.93	0.0001
YR	6	50.61872549	35.60	0.0001
MO	11	45.61641525	17.50	0.0001
AREA	3	8.20643364	11.54	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		5.12036103 B	44.27	0.0	0.11566222
VESS	OUIN	0.22009957 B	1.90	0.0579	0.11595704
	OUIQ	0.27159450 B	2.85	0.0045	0.09541135
	OUOQ	0.08627060 B	0.89	0.3716	0.09652825
	OUPJ	0.51811898 B	4.77	0.0001	0.10870952
	OUTM	0.28938011 B	3.10	0.0020	0.09336888
	OUWH	0.21985490 B	2.18	0.0295	0.10089586
	OUYM	0.02967339 B	0.32	0.7475	0.09213236
	OWDV	0.17549870 B	1.98	0.0480	0.08867390
	OWLQ	0.16874069 B	1.56	0.1189	0.10813846
	OWQU	0.92057402 B	9.24	0.0001	0.09960546
	OWSH	0.21986434 B	1.70	0.0888	0.12907524
	OWUD	0.05971446 B	0.61	0.5416	0.09780472
	OWUJ	-0.20388083 B	-1.97	0.0486	0.10327419
	OWVM	0.11233610 B	1.05	0.2953	0.10728204
	OWWP	0.63205723 B	6.89	0.0001	0.09178766
	OYBZ	0.32460882 B	2.69	0.0073	0.12082295
	OYCK	0.02470468 B	0.23	0.8165	0.10643737
	OYFF	0.60818261 B	5.87	0.0001	0.10363275
	OYHO	0.14303492 B	0.49	0.6242	0.29187995
	OYKK	0.31581446 B	3.14	0.0017	0.10062617
	OYNR	0.14916422 B	1.66	0.0971	0.08984483
	OYNS	0.24310941 B	2.26	0.0237	0.10735583
	OYRK	0.40306906 B	4.77	0.0001	0.08442659
	OYRT	0.48629093 B	4.46	0.0001	0.10915361
	OYXT	0.55139614 B	4.97	0.0001	0.11093127
	OZKQ	0.69390696 B	6.86	0.0001	0.10119762
	ZZZZ	0.00000000 B	.	.	.
YR	87	0.36215861 B	4.11	0.0001	0.08813753
	88	0.31740250 B	4.04	0.0001	0.07848459
	89	-0.13114573 B	-1.66	0.0965	0.07883260
	90	-0.14115589 B	-1.79	0.0730	0.07865249
	91	-0.14425002 B	-1.84	0.0660	0.07838989
	92	-0.23446006 B	-2.92	0.0036	0.08036376
	93	0.00000000 B	.	.	.
MO	1	0.18876546 B	1.54	0.1231	0.12234545
	2	0.05340598 B	0.24	0.8141	0.22701200
	3	0.06274179 B	0.65	0.5165	0.09667959
	4	0.30832315 B	4.20	0.0001	0.07338308
	5	-0.19245262 B	-2.87	0.0041	0.06694460
	6	-0.37314784 B	-5.68	0.0001	0.06572238
	7	-0.29746727 B	-4.47	0.0001	0.06655352
	8	-0.37079274 B	-5.46	0.0001	0.06786711
	9	-0.40463298 B	-5.58	0.0001	0.07253505
	10	-0.28167985 B	-3.81	0.0001	0.07395996
	11	-0.10915884 B	-1.60	0.1095	0.06814998
	12	0.00000000 B	.	.	.
AREA	3	0.22740443 B	2.58	0.0099	0.08800344
	4	0.04352095 B	1.14	0.2555	0.03825424
	5	0.20093904 B	5.14	0.0001	0.03907777
	6	0.00000000 B	.	.	.

Table 5b. Estimation of parameters, standardization of CPUE for large shrimp (>8.5 g) in Div. 1CDE.

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNCPUE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F
MODEL	45	138.53823257	3.07862739	17.09	0.0
ERROR	1267	228.17526272	0.18009097		
CORRECTED TOTAL	1312	366.71349529			

R-SQUARE	C.V.	ROOT MSE	LNCPUE MEAN
0.377783	8.0037	0.42437127	5.30218466

SOURCE	DF	TYPE I SS	F VALUE	PR > F
VESS	26	65.50395329	13.99	0.0001
YR	6	12.66829676	11.72	0.0001
MO	11	55.54669371	28.04	0.0001
AREA	2	4.81928882	13.38	0.0001

SOURCE	DF	TYPE III SS	F VALUE	PR > F
VESS	26	78.34948790	16.73	0.0001
YR	6	7.65384520	7.08	0.0001
MO	11	55.76923408	28.15	0.0001
AREA	2	4.81928882	13.38	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		4.98983404 B	52.01	0.0	0.09594476
VESS	OUIN	0.21121780 B	2.28	0.0226	0.09253936
	OUIQ	0.11024614 B	1.16	0.2444	0.09465969
	OUOQ	0.01366762 B	0.15	0.8835	0.09325256
	OUPJ	0.13057241 B	1.28	0.2016	0.10219230
	OUTM	0.20687030 B	2.30	0.0218	0.09008895
	OUWH	0.13382548 B	1.49	0.1371	0.08995483
	OUYM	-0.06184639 B	-0.69	0.4923	0.09003647
	OWDV	0.06303844 B	0.72	0.4729	0.08780368
	OWLQ	-0.02015581 B	-0.20	0.8415	0.10079789
	OWQU	0.76661376 B	8.61	0.0001	0.08901297
	OWSH	0.25767851 B	2.55	0.0110	0.10119985
	OWUD	-0.05497493 B	-0.58	0.5589	0.09402898
	OWUJ	-0.42725442 B	-4.29	0.0001	0.09964661
	OWVM	-0.14635455 B	-1.42	0.1555	0.10298114
	OWWP	0.40478817 B	4.71	0.0001	0.08596098
	OYBZ	0.68383760 B	6.91	0.0001	0.09899887
	OYCK	0.05588849 B	0.59	0.5540	0.09442751
	OYFF	0.41043020 B	3.01	0.0026	0.13617349
	OYHO	0.20872969 B	0.92	0.3561	0.22611143
	OYKK	0.00802688 B	0.08	0.9362	0.10029966
	OYNR	-0.00039167 B	-0.00	0.9965	0.09055376
	OYNS	0.23475776 B	2.60	0.0094	0.09021414
	OYRK	0.21700336 B	2.52	0.0118	0.08600965
	OYRT	0.38006541 B	3.97	0.0001	0.09581461
	OYXT	0.56851503 B	5.63	0.0001	0.10092357
	OZKQ	0.53944590 B	5.91	0.0001	0.09126581
	ZZZZ	0.00000000 B	.	.	.
YR	87	-0.09498721 B	-0.93	0.3547	0.10260172
	88	0.21815067 B	2.74	0.0063	0.07971256
	89	0.14492868 B	2.67	0.0078	0.05435435
	90	0.11563406 B	2.43	0.0153	0.04759697
	91	-0.06040315 B	-1.33	0.1838	0.04542515
	92	0.01421034 B	0.32	0.7493	0.04445258
	93	0.00000000 B	.	.	.
MO	1	0.23875874 B	3.57	0.0004	0.06689198
	2	0.23368570 B	3.31	0.0010	0.07059426
	3	0.46573999 B	7.67	0.0001	0.06073042
	4	0.35715298 B	6.53	0.0001	0.05470385
	5	-0.15207722 B	-2.78	0.0056	0.05479640
	6	-0.03158858 B	-0.54	0.5872	0.05816971
	7	0.15195938 B	2.62	0.0090	0.05804709
	8	-0.07909125 B	-1.25	0.2114	0.06325467
	9	-0.29685301 B	-4.35	0.0001	0.06822553
	10	0.02842629 B	0.38	0.7049	0.07503372
	11	0.15848645 B	2.47	0.0137	0.06423199
	12	0.00000000 B	.	.	.
AREA	7	0.06031127 B	1.86	0.0635	0.03246811
	8	-0.08052876 B	-2.60	0.0095	0.03098936
	9	0.00000000 B	.	.	.

Table 6. No. of shrimp per length group in commercial samples from Subarea 1 in 1993, pooled by Division and month. The entry 'catch' is the total catch from which samples were taken.

WEST GREENLAND	month								
	2		3			8	9		10
	area		area			area	area		area
	1B	1C	1C	1D	1E	1C	1B	1D	1B
	sample w	sample w	sample w	sample w	sample w	sample w	sample w	sample w	sample w
	43.2	111.8	19.7	105.4	61.9	39	69.4	53.4	68.5
	catch	catch	catch	catch	catch	catch	catch	catch	catch
	21129	34811	6495	28029	15911	15688	23338	27832	22081
	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples
	12	32	4	21	12	12	15	13	16
	CL MM	CL MM	CL MM	CL MM	CL MM	CL MM	CL MM	CL MM	CL MM
MM									
5	0	0	0	0	0	0	0	0	0
5.5	0	0	0	1	0	0	0	0	0
6	0	0	0	1	0	0	0	0	0
6.5	0	0	0	0	0	0	0	0	0
7	0	0	0	1	0	0	0	0	0
7.5	0	0	0	1	0	0	0	0	0
8	0	0	0	1	0	0	0	0	1
8.5	0	0	0	0	0	0	0	0	2
9	0	0	0	2	0	0	1	2	2
9.5	0	0	0	0	0	2	1	5	0
10	0	0	1	0	0	0	1	11	2
10.5	0	0	1	2	0	1	1	13	0
11	0	0	1	6	1	2	4	9	1
11.5	1	0	1	20	2	3	0	3	3
12	2	0	4	25	1	1	6	3	3
12.5	1	0	8	35	1	1	35	1	7
13	0	1	6	60	1	4	54	6	12
13.5	1	0	11	80	11	6	73	16	32
14	3	1	12	79	9	4	117	29	39
14.5	0	1	12	91	11	5	100	60	52
15	1	0	30	103	7	13	93	108	64
15.5	0	0	29	132	14	17	66	174	52
16	3	0	33	174	25	24	37	161	48
16.5	4	4	50	239	46	29	29	180	25
17	7	4	57	364	98	30	58	207	43
17.5	12	13	71	525	117	30	63	265	71
18	28	20	73	640	177	43	97	311	79
18.5	27	37	70	732	219	57	108	373	96
19	27	68	92	820	270	71	137	396	112
19.5	43	94	103	811	275	73	183	417	168
20	75	160	102	882	296	84	205	368	167
20.5	93	284	99	843	304	133	299	375	281
21	145	372	81	756	306	140	299	345	296
21.5	178	496	77	748	320	180	293	309	362
22	154	536	74	681	355	167	263	221	353
22.5	155	524	98	583	326	175	250	183	331
23	218	465	76	514	239	180	258	192	356
23.5	250	504	113	459	263	147	318	197	403
24	448	768	114	485	216	149	499	251	475
24.5	565	985	147	506	249	195	682	292	661
25	568	1185	173	490	332	231	807	314	793
25.5	504	1160	162	539	413	307	786	292	688
26	430	1088	157	591	542	362	649	289	585
26.5	318	916	112	542	616	379	473	267	363
27	222	728	72	442	449	319	309	221	246
27.5	158	504	34	292	304	226	184	148	172
28	80	322	21	134	161	137	121	81	121
28.5	57	236	8	61	74	56	77	52	79
29	21	141	9	37	19	33	54	18	55
29.5	8	103	1	23	16	12	31	10	35
30	6	66	3	7	11	7	16	4	22
30.5	1	38	0	8	4	2	13	0	13
31	0	16	0	1	2	0	7	0	2
31.5	0	7	0	1	0	1	6	1	2
32	0	5	0	0	1	0	0	0	0
32.5	0	0	0	0	0	1	0	0	1
33	0	0	0	0	0	0	0	0	0
33.5	0	0	0	0	0	0	1	0	0
34	0	0	0	0	0	0	1	1	0
34.5	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
35.5	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
36.5	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
TOTAL	4814	11852	2398	14570	7103	4039	8165	7181	7776

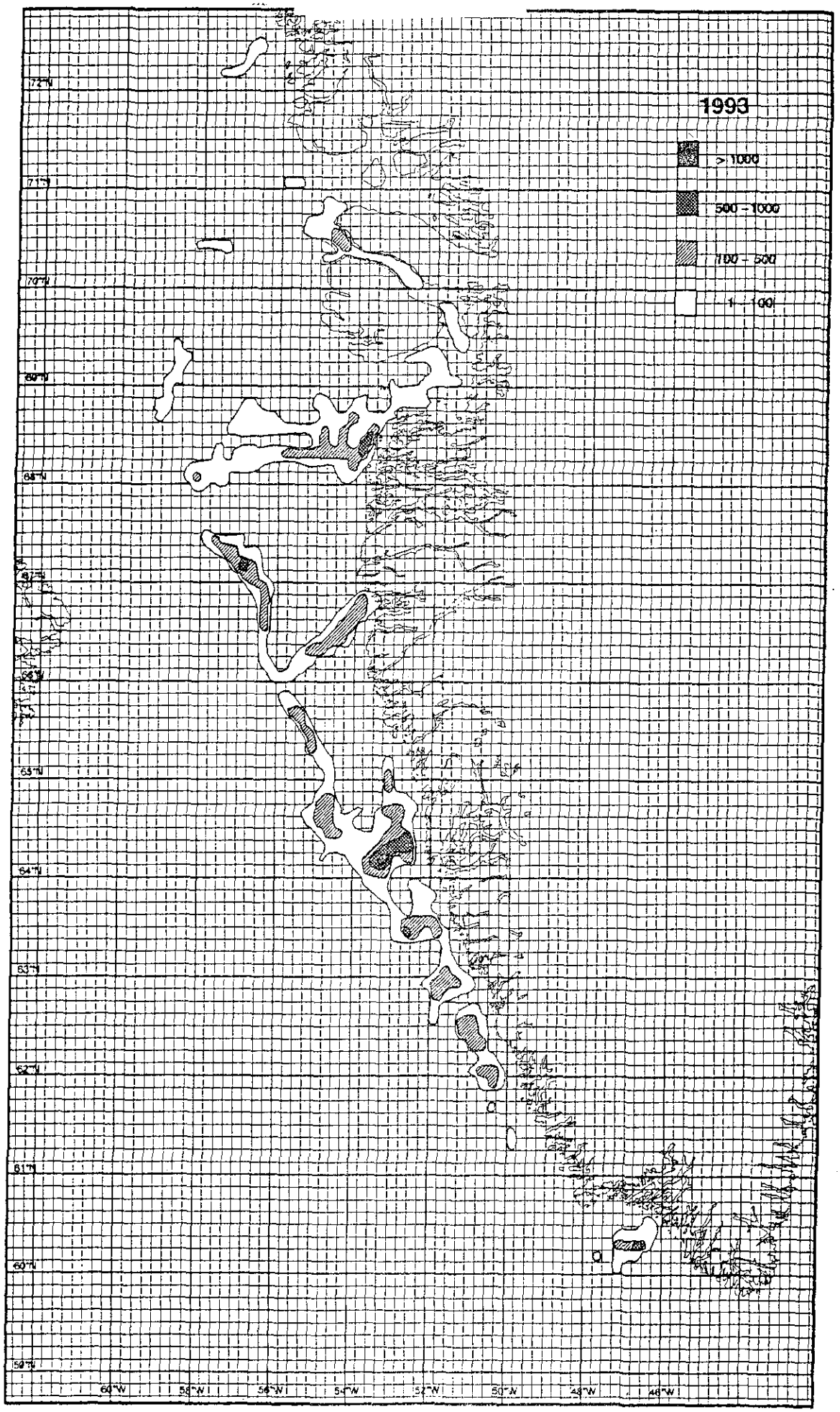


Figure 1. Distribution of total catches of shrimp (tons per statistical unit) in January - October 1993 in NAFO Subarea 1.

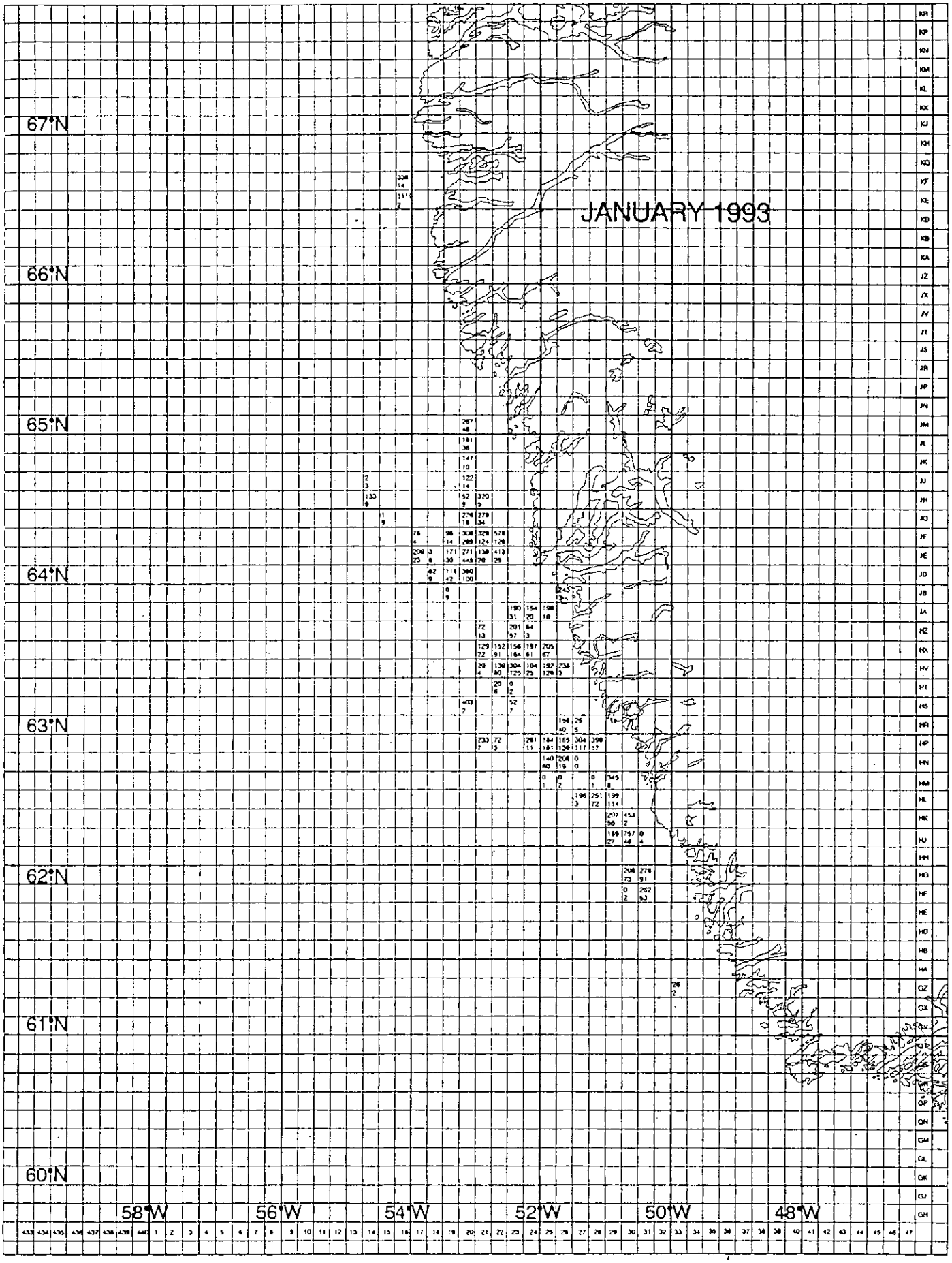


Figure 2a. Distribution of mean catch rate (kg/hour, upper figure) and effort (hours, lower figure) in each statistical unit

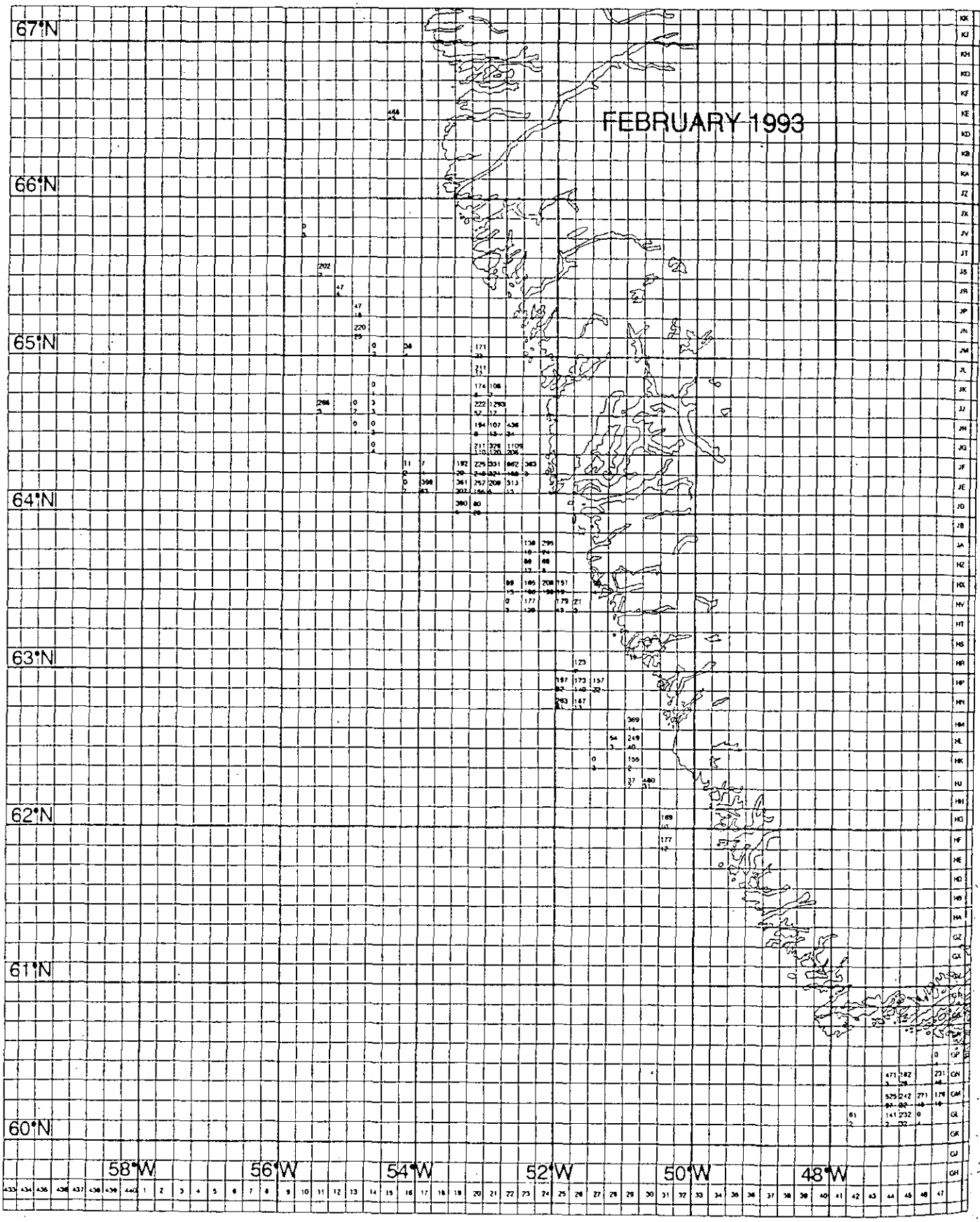


Figure 2a continued. Data from February 1993.

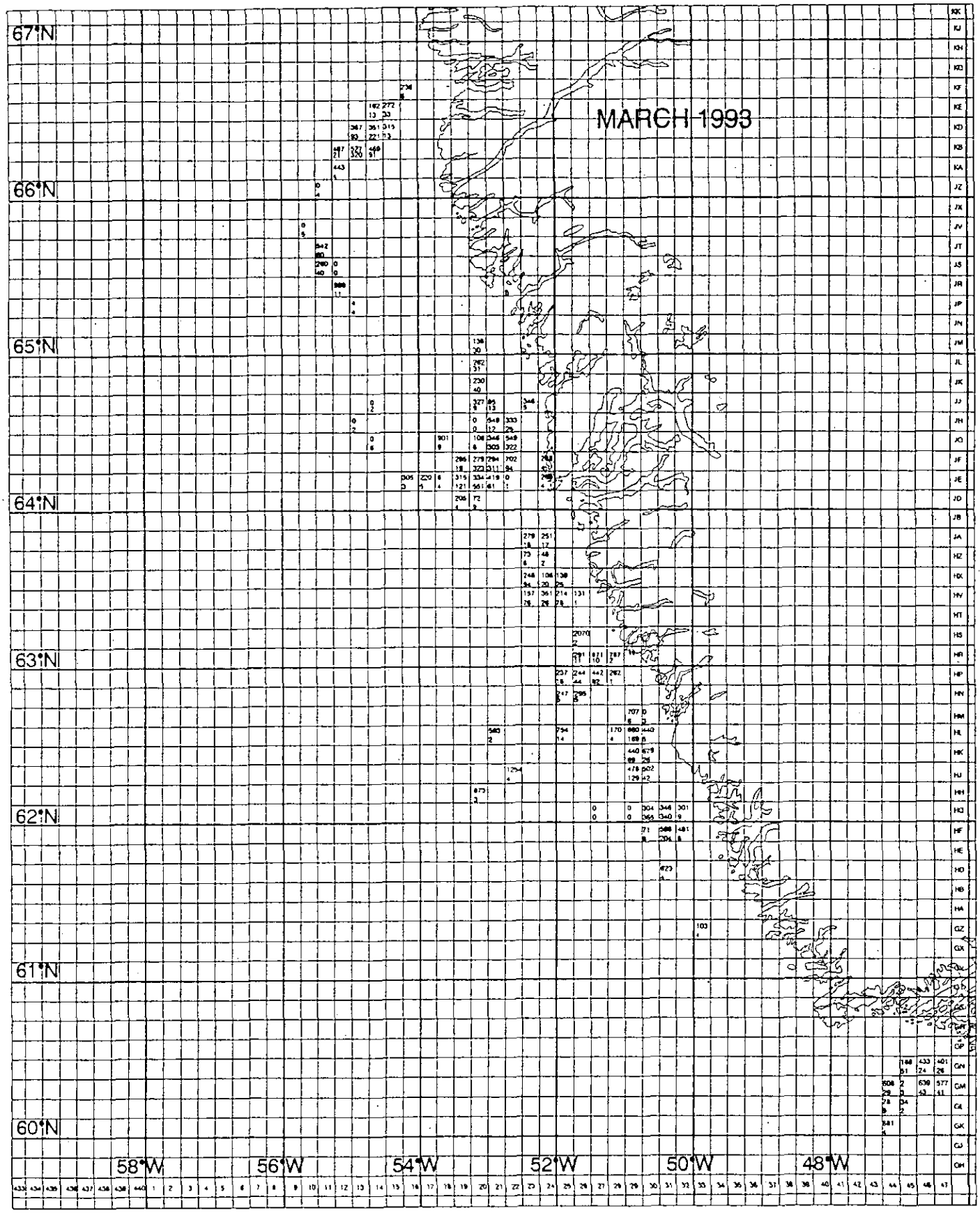


Figure 2a continued. Data from March 1993.

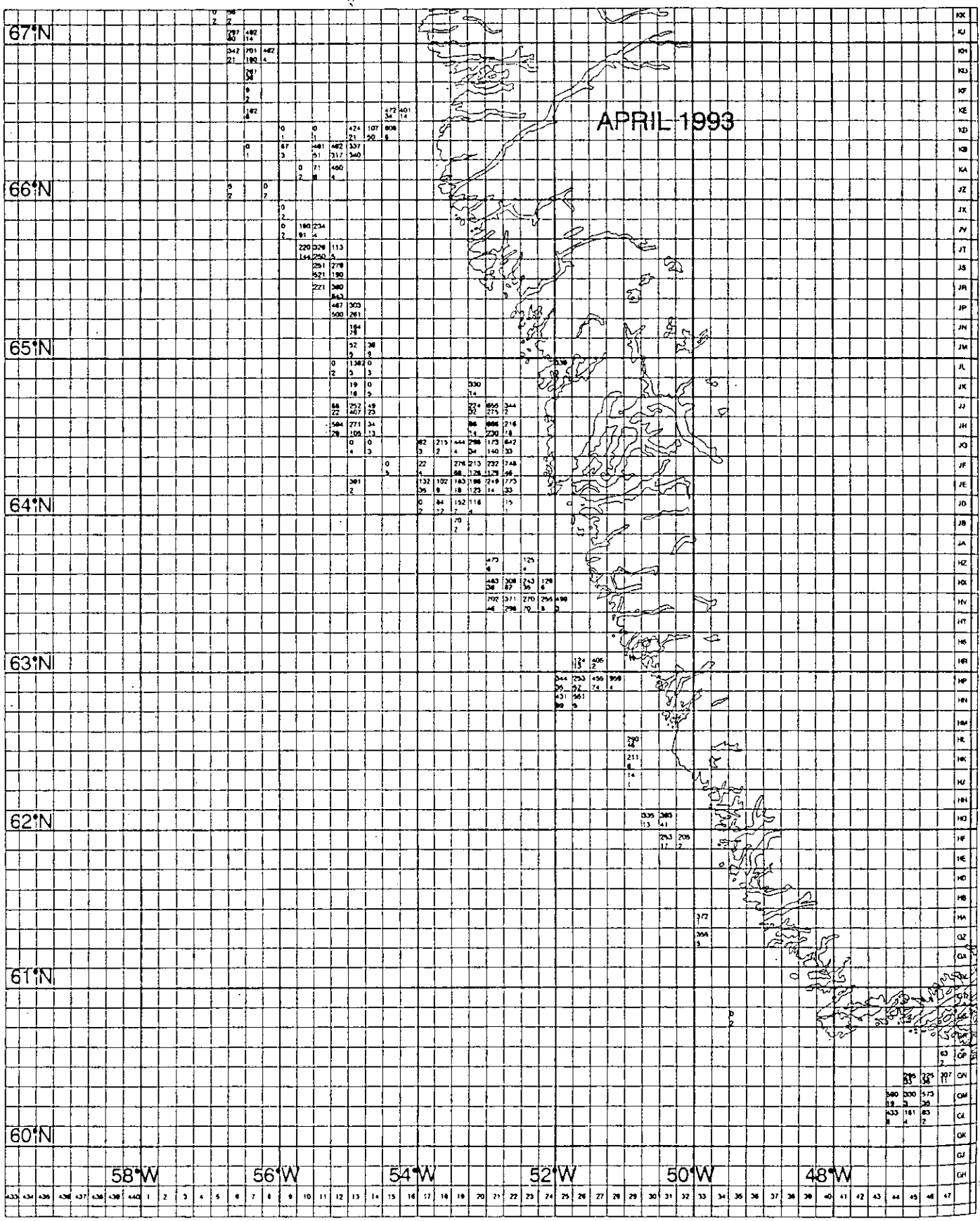


Figure 2a continued. Data from April 1993.

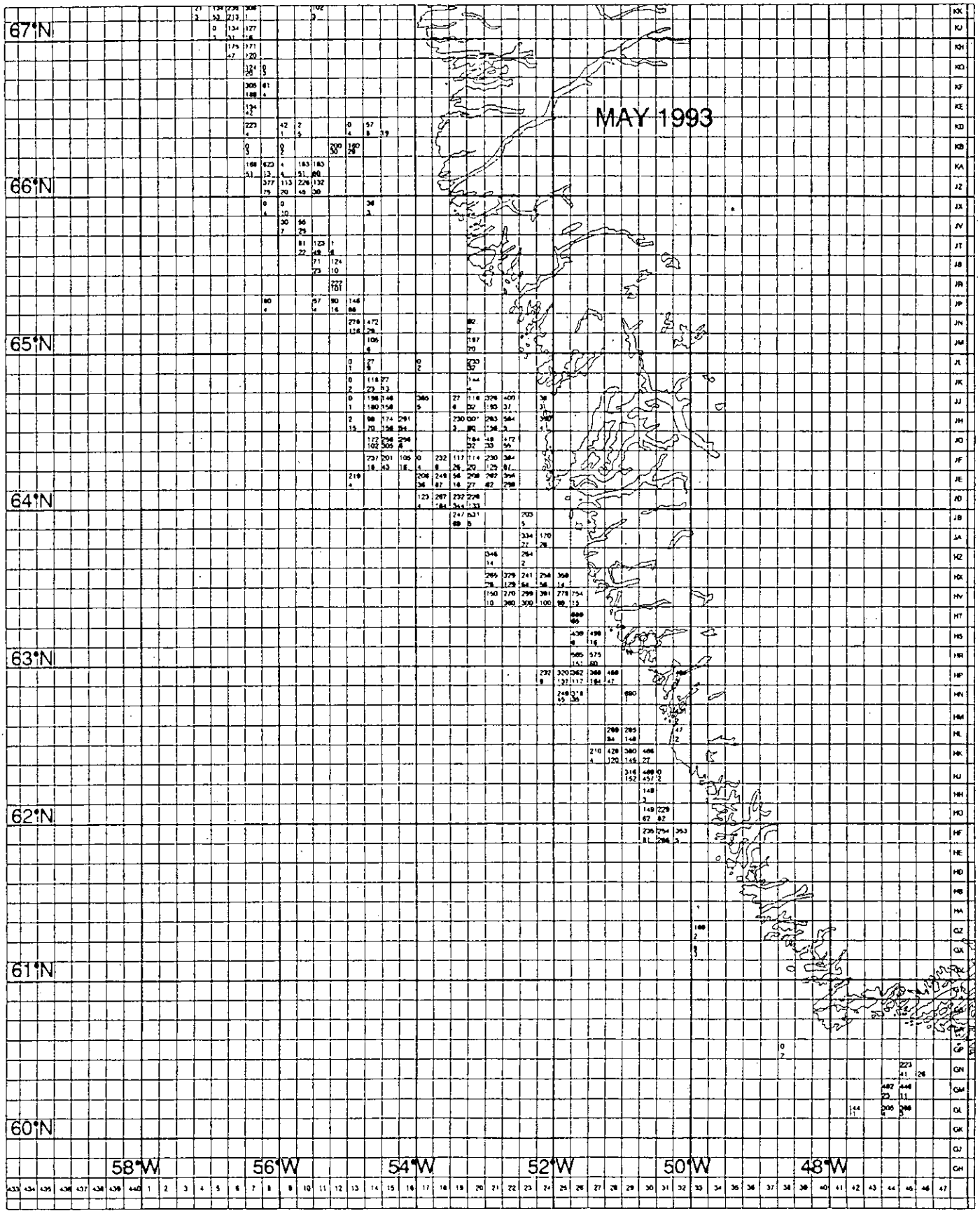


Figure 2a continued. Data from May 1993.

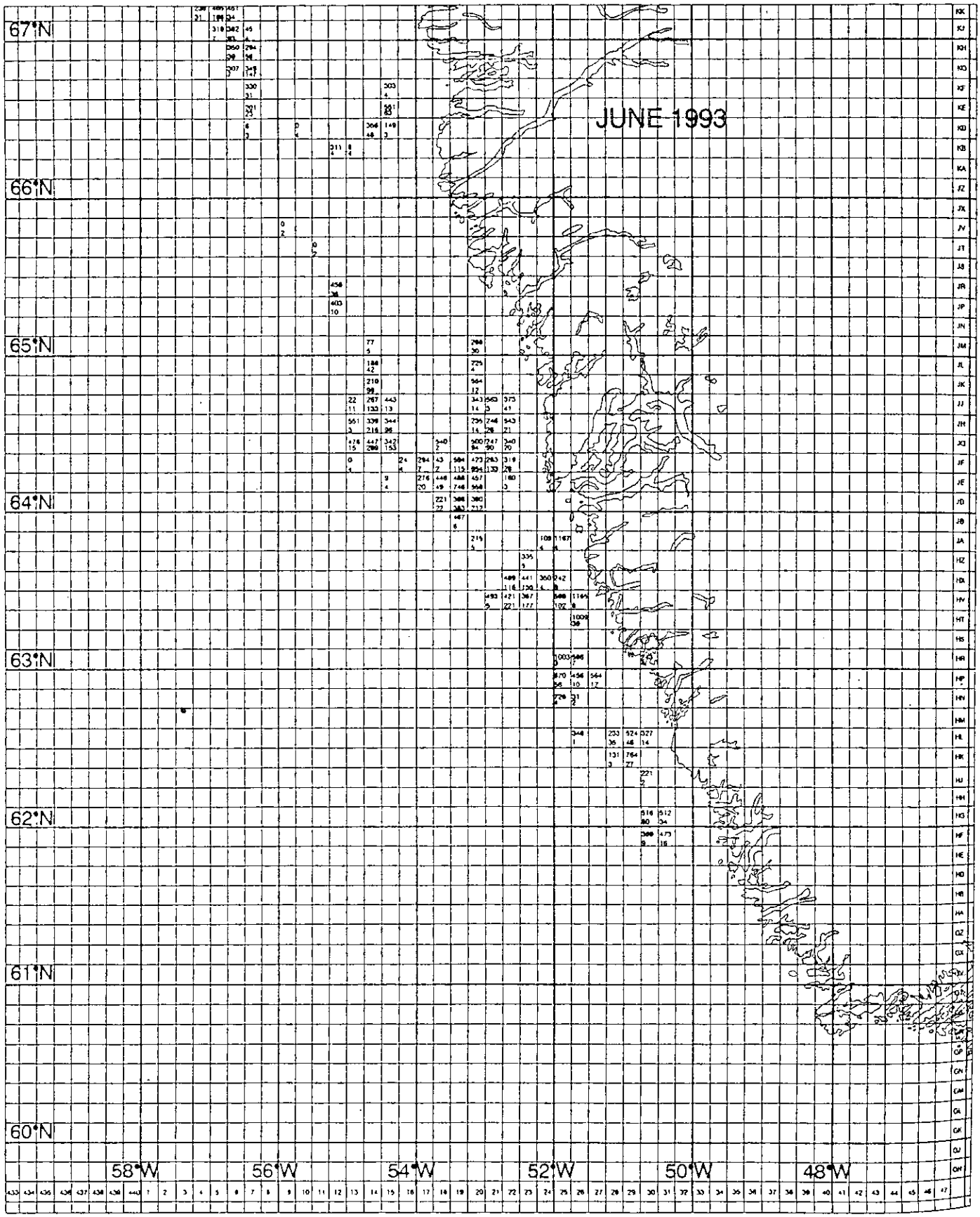


Figure 2a continued. Data from June 1993.

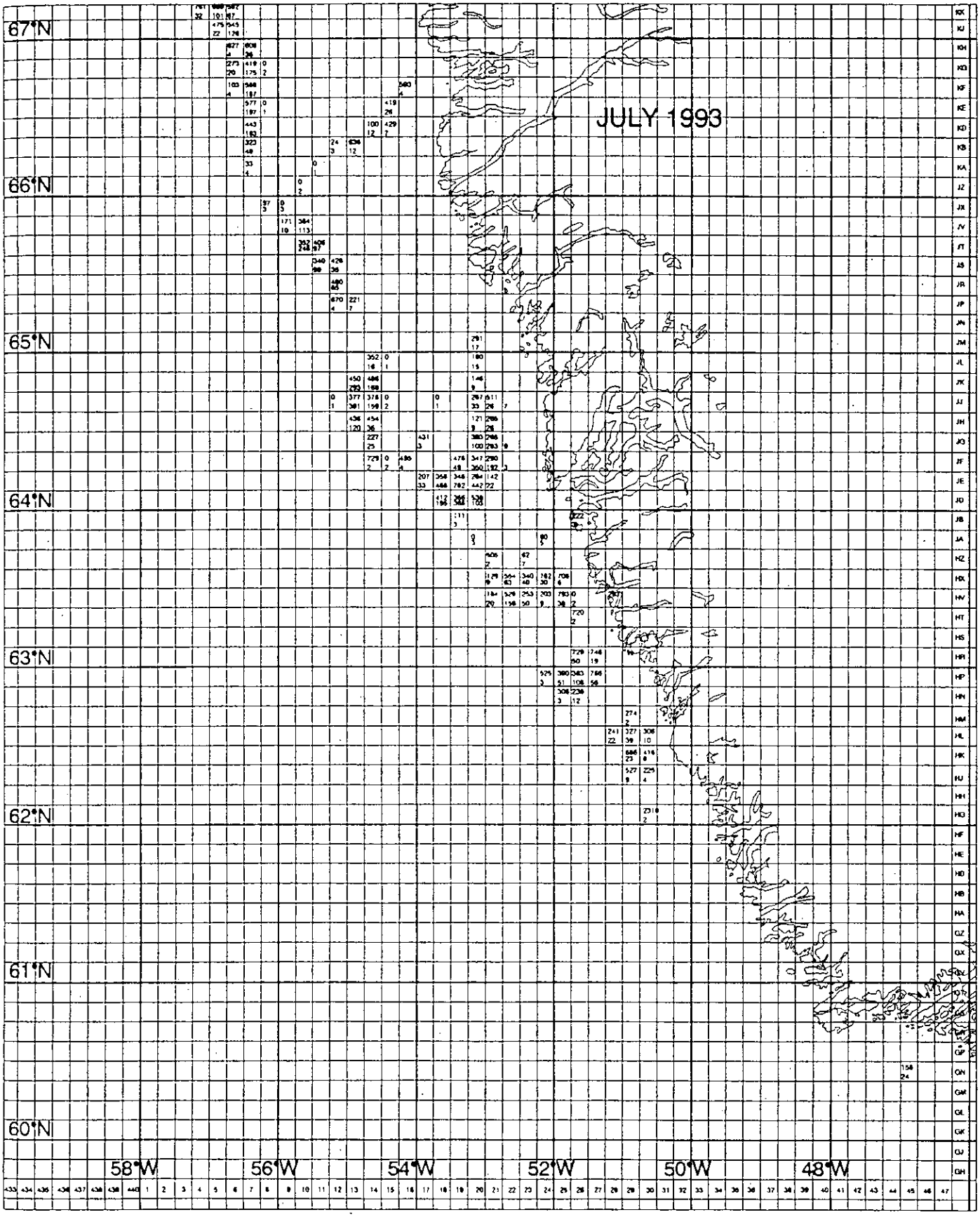


Figure 2a continued. Data from July 1993.

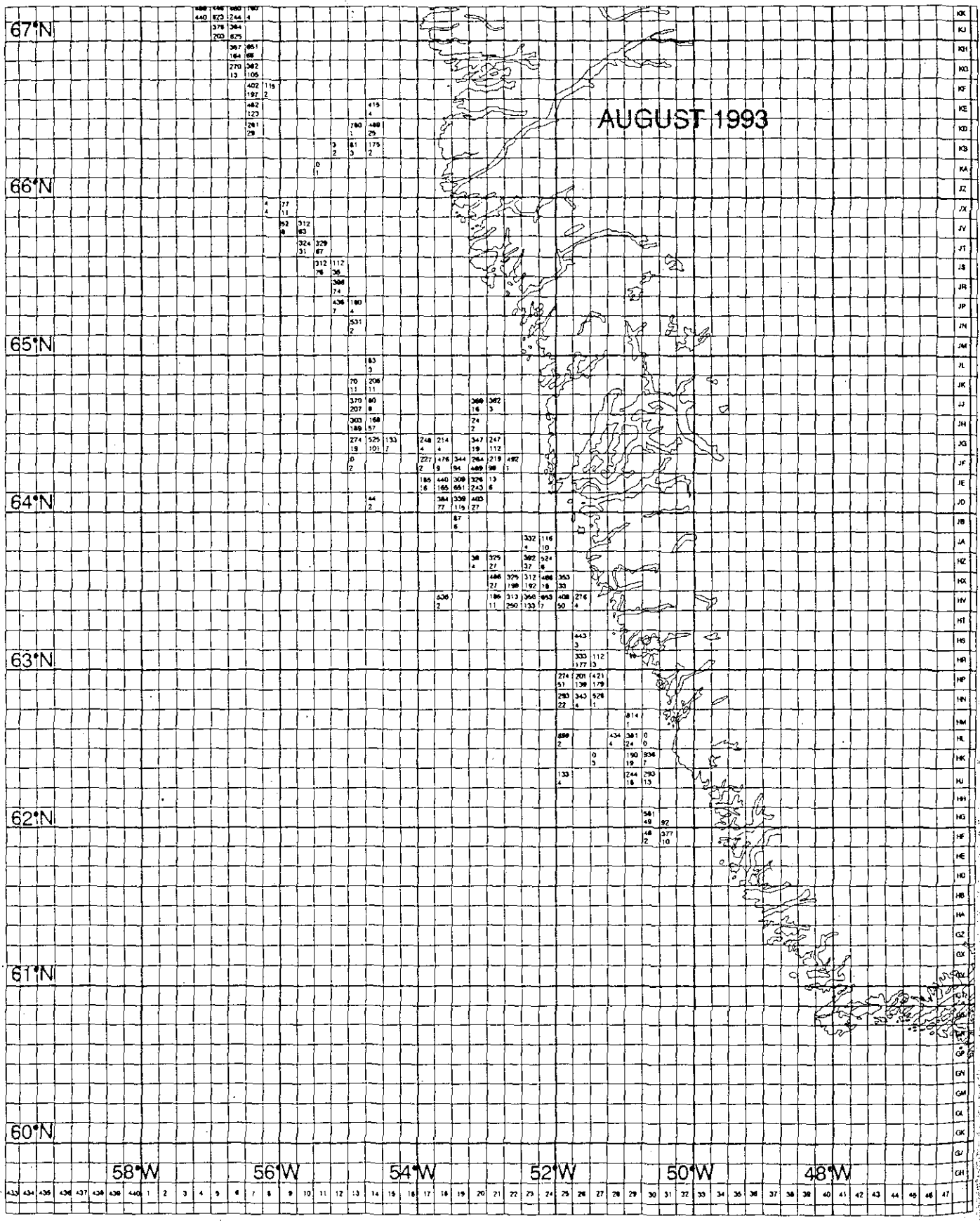


Figure 2a continued. Data from August 1993.

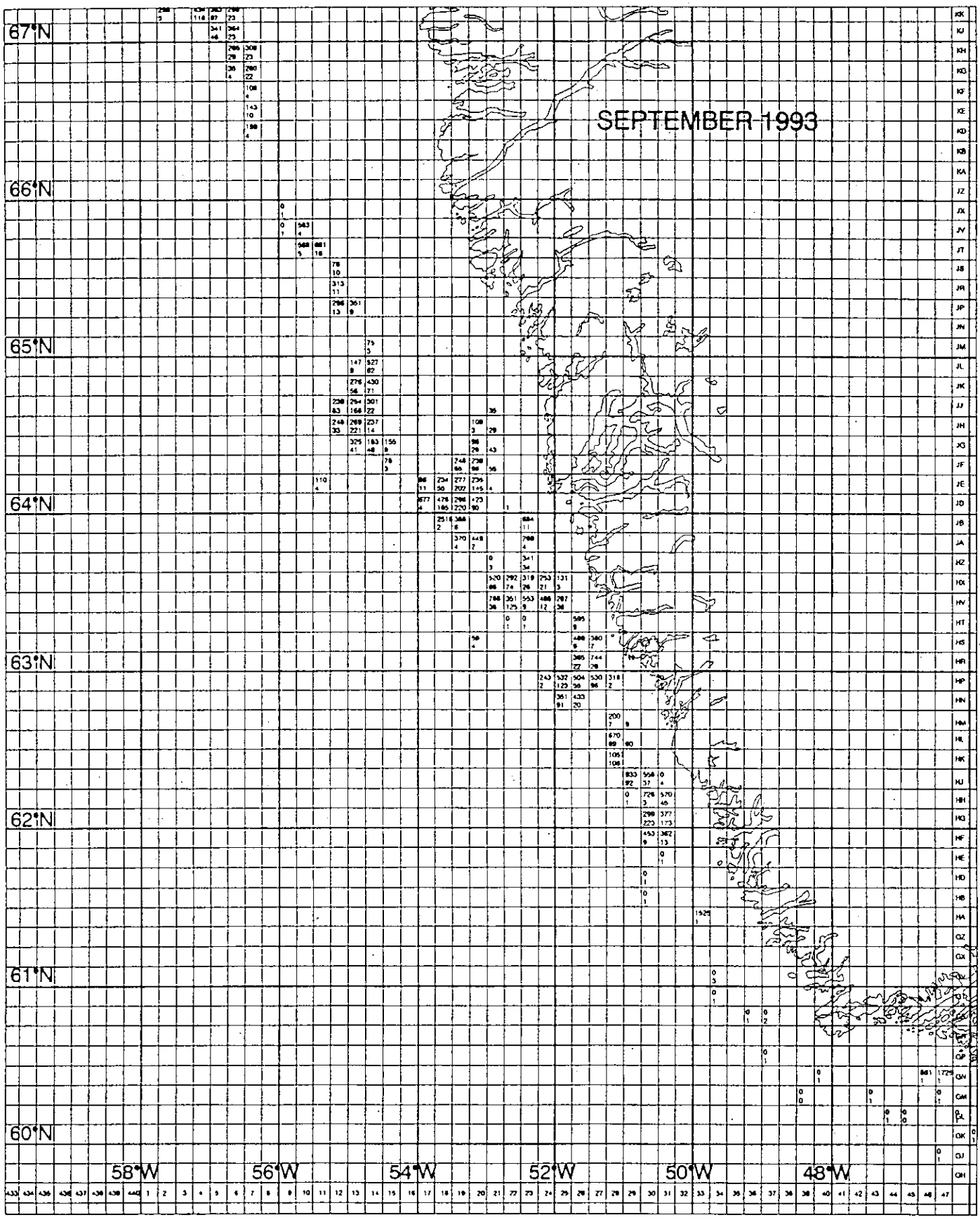


Figure 2a continued. Data from September 1993.

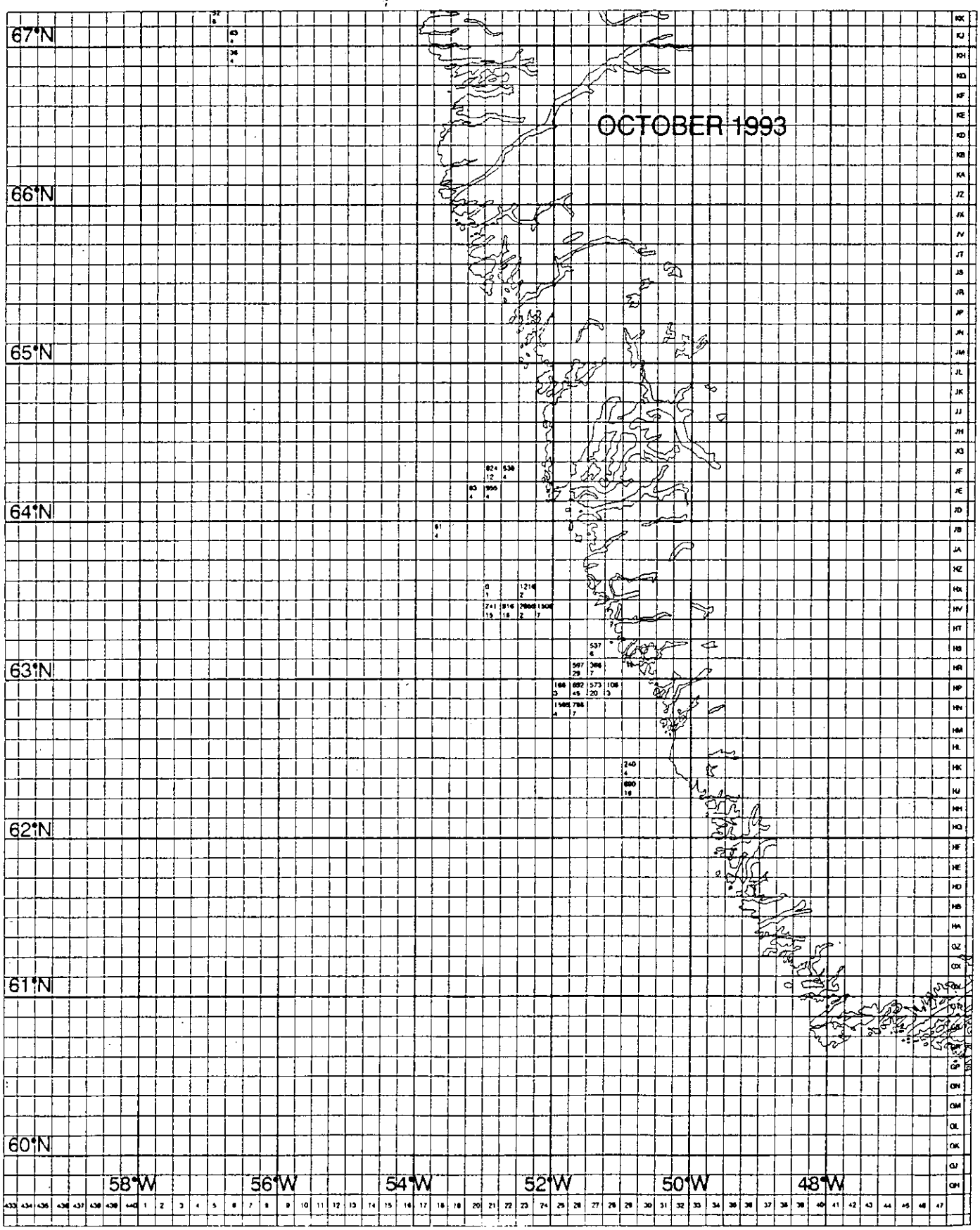


Figure 2a continued. Data from October 1993 (incomplete)..

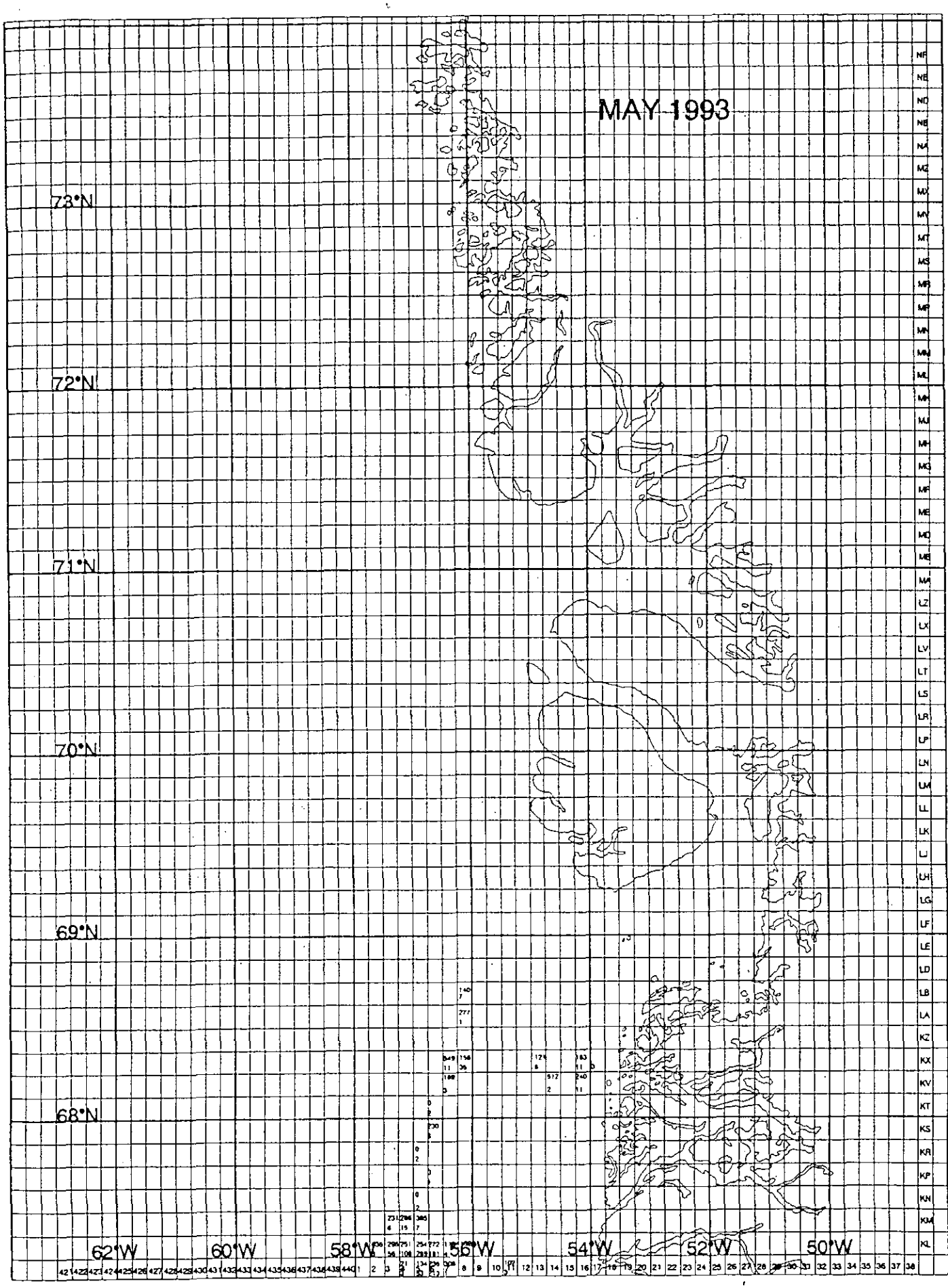


Figure 2b. Distribution of mean catch rate (kg/hour, upper figure) and effort (hours, lower figure) in each statistical unit

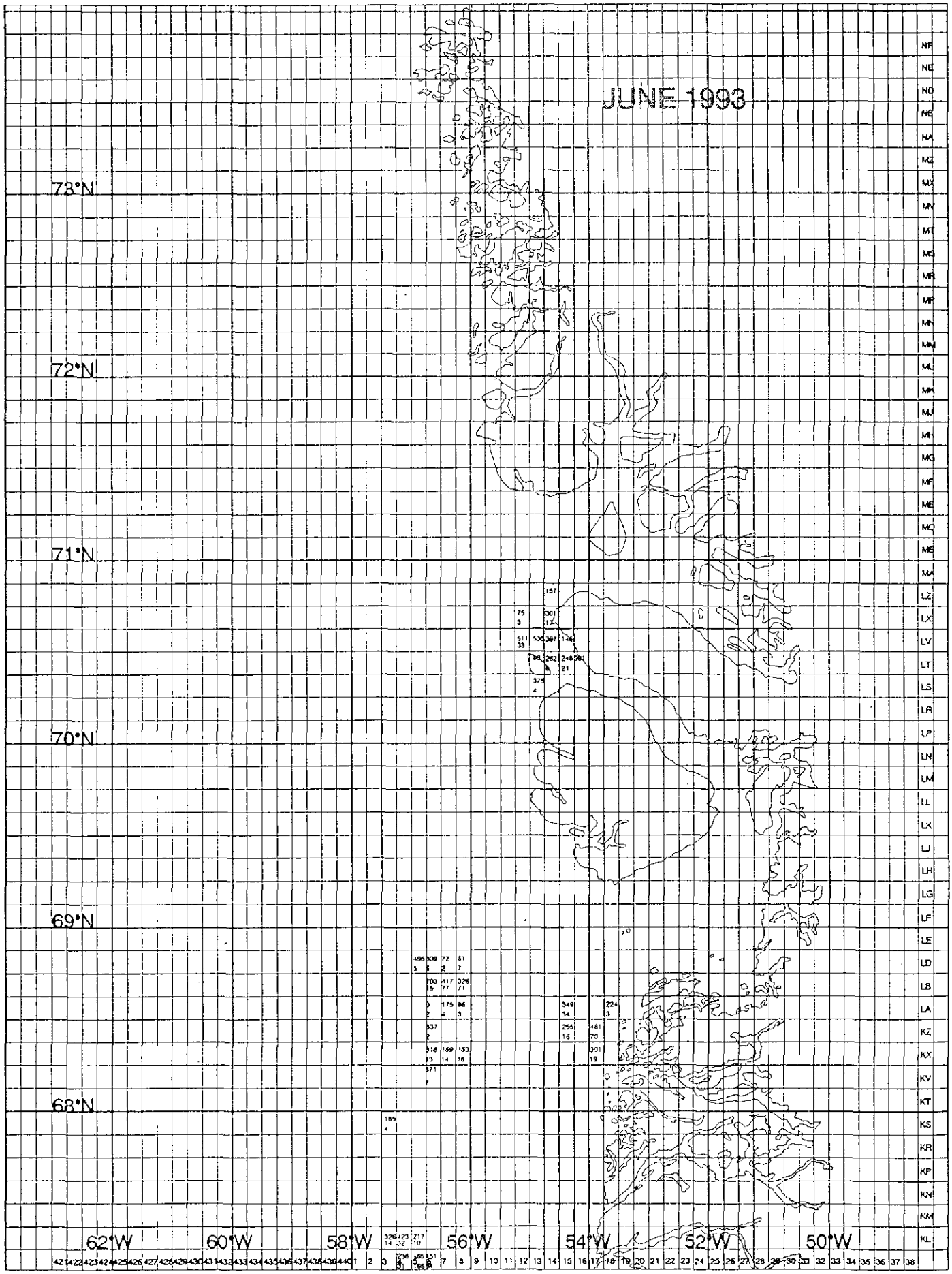


Figure 2b continued. Data from June 1993.

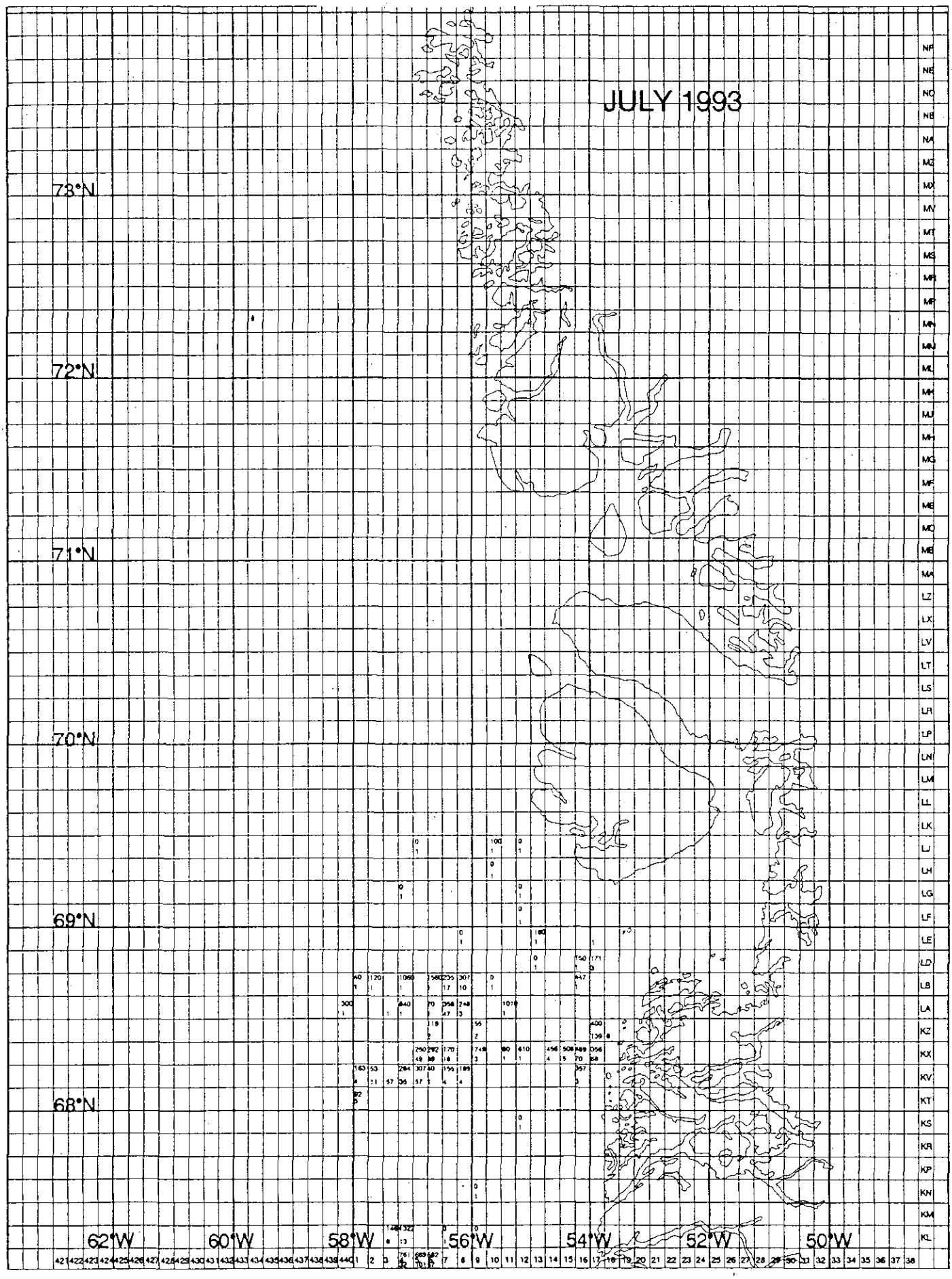


Figure 2b continued. Data from July 1993.

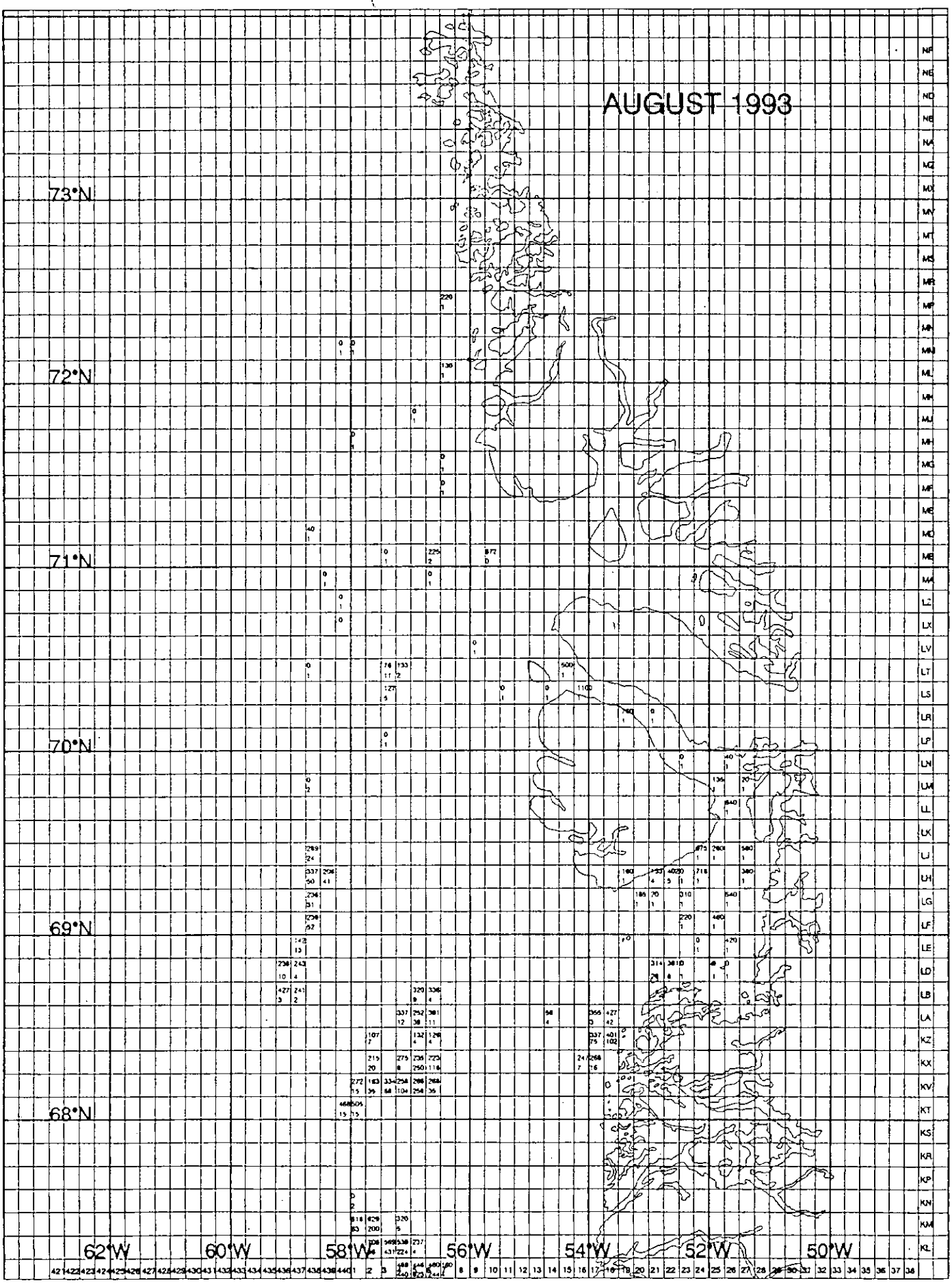


Figure 2b continued. Data from August 1993.

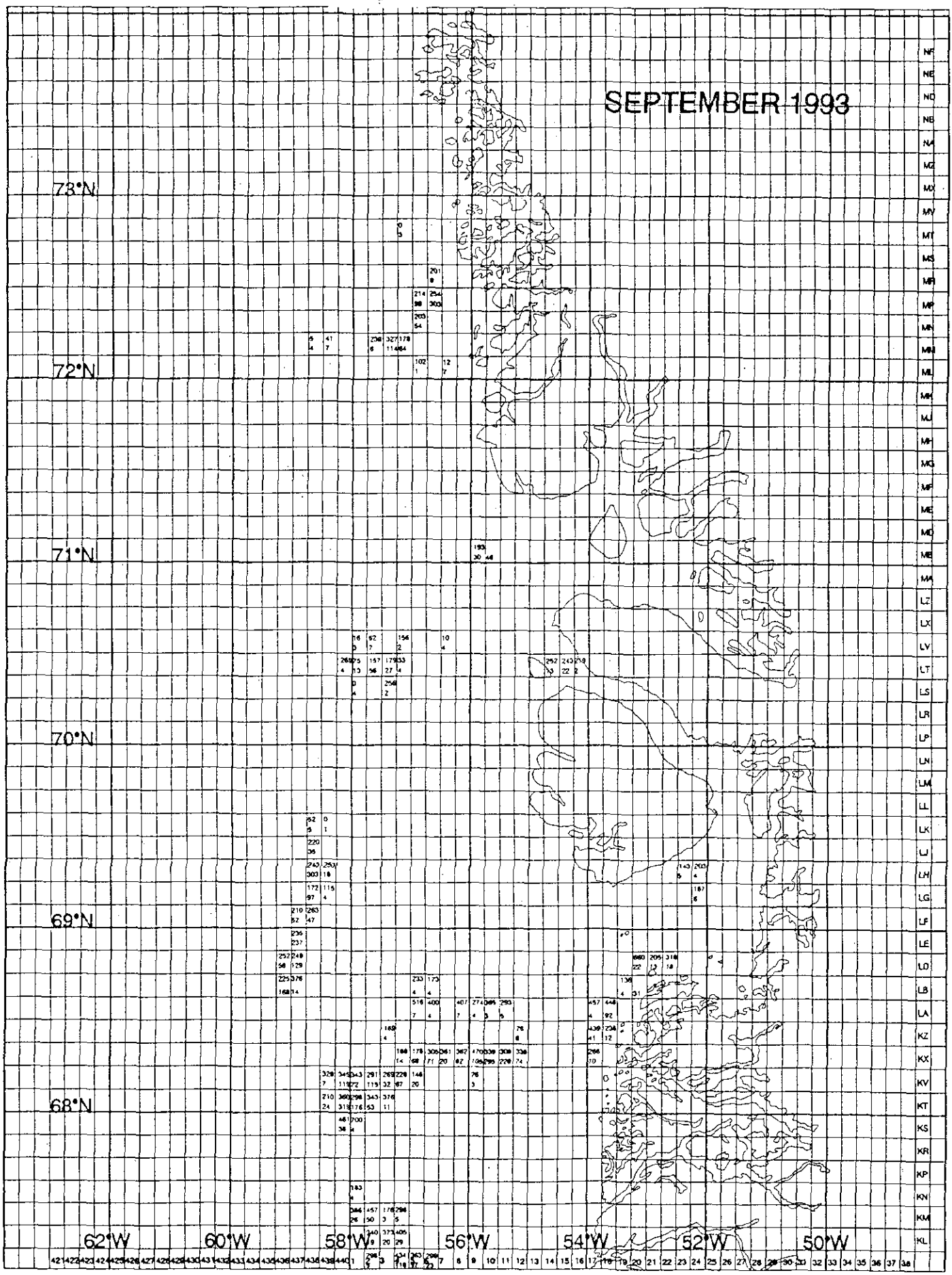


Figure 2b continued. Data from September 1993.

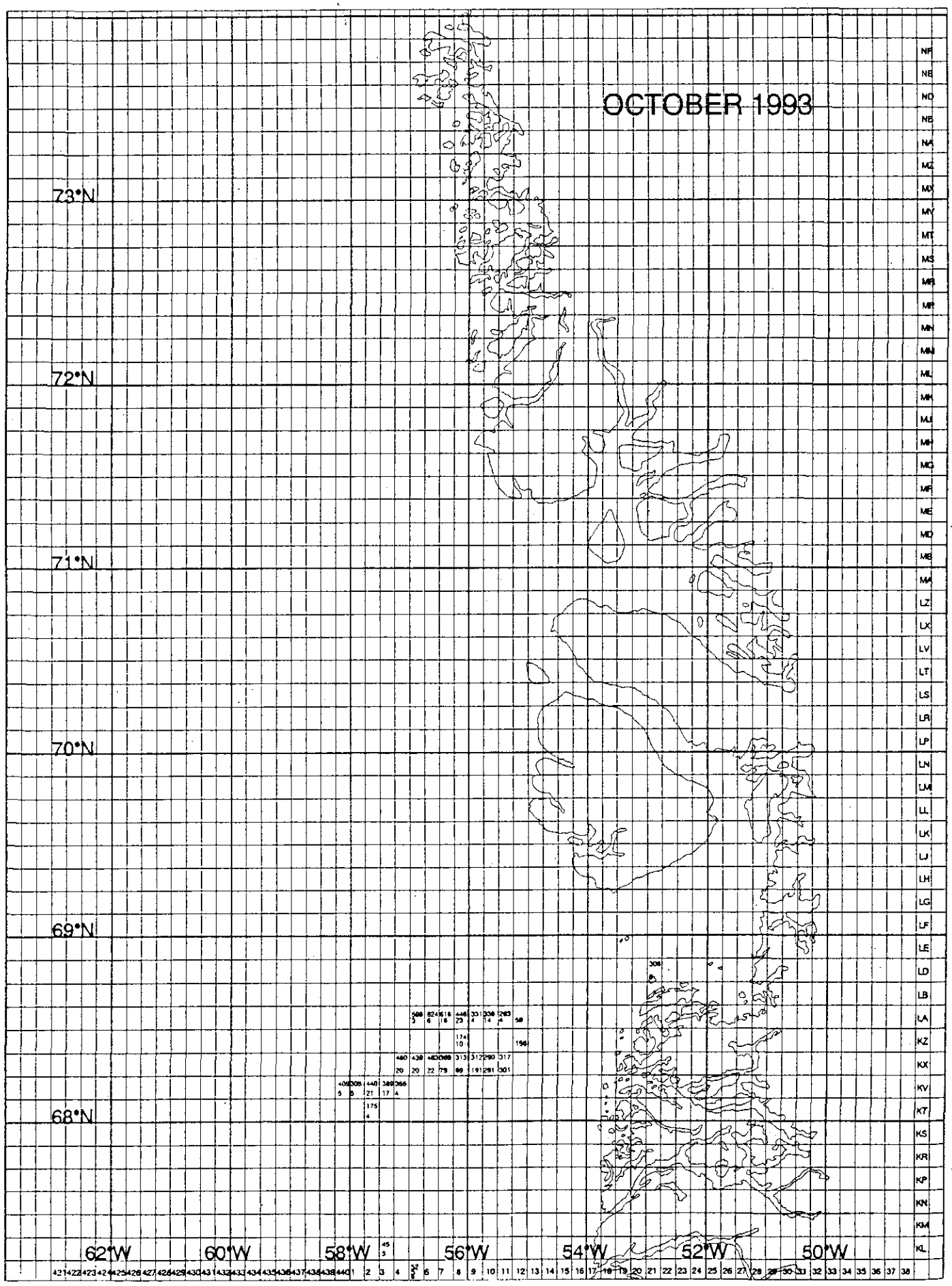


Figure 2b continued. Data from October 1993 (incomplete).

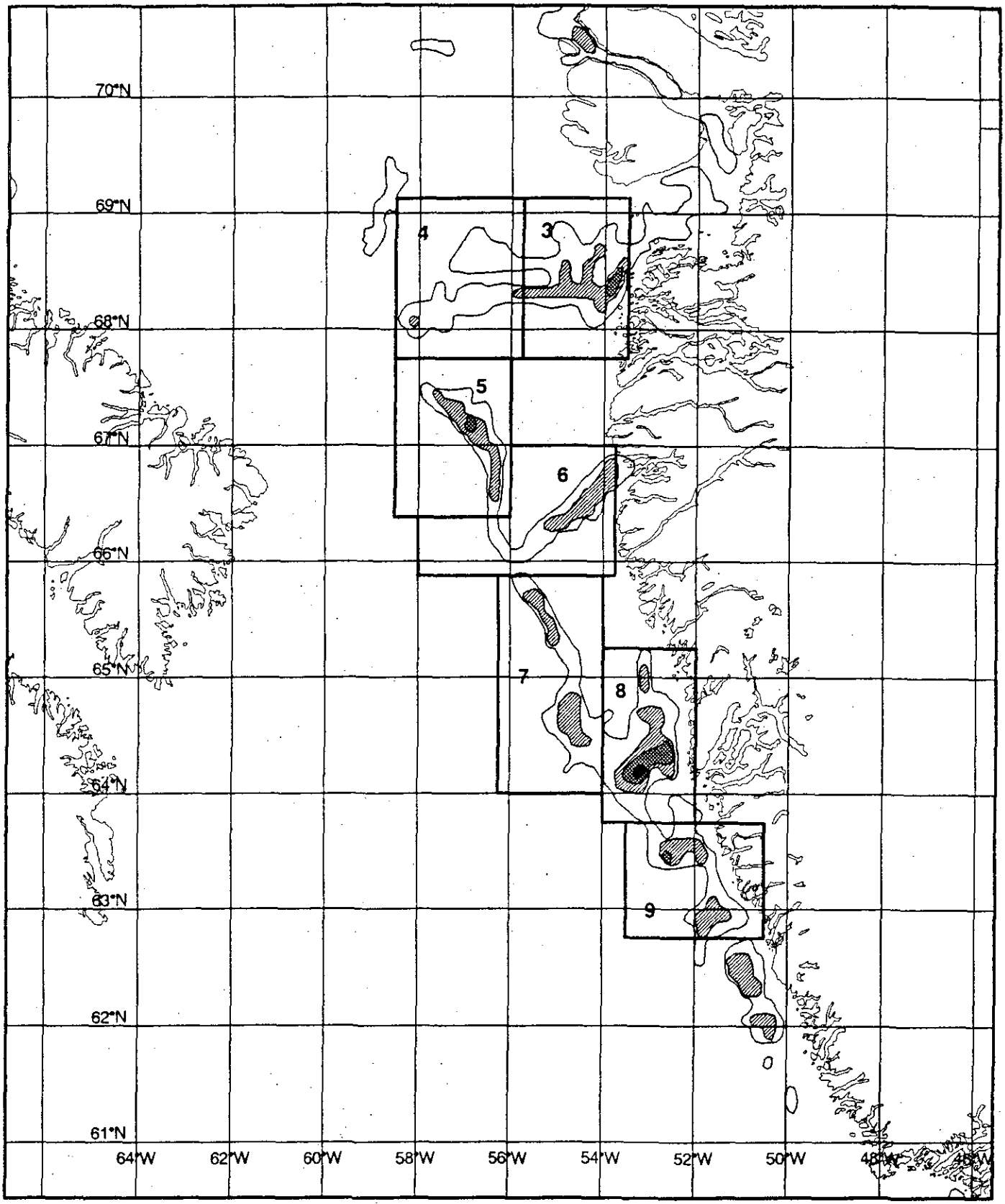


Figure 3. Map showing areas used in the multiplicative model. Div. 1B includes areas no. 3-6, and Div. 1CD include areas 7-9.

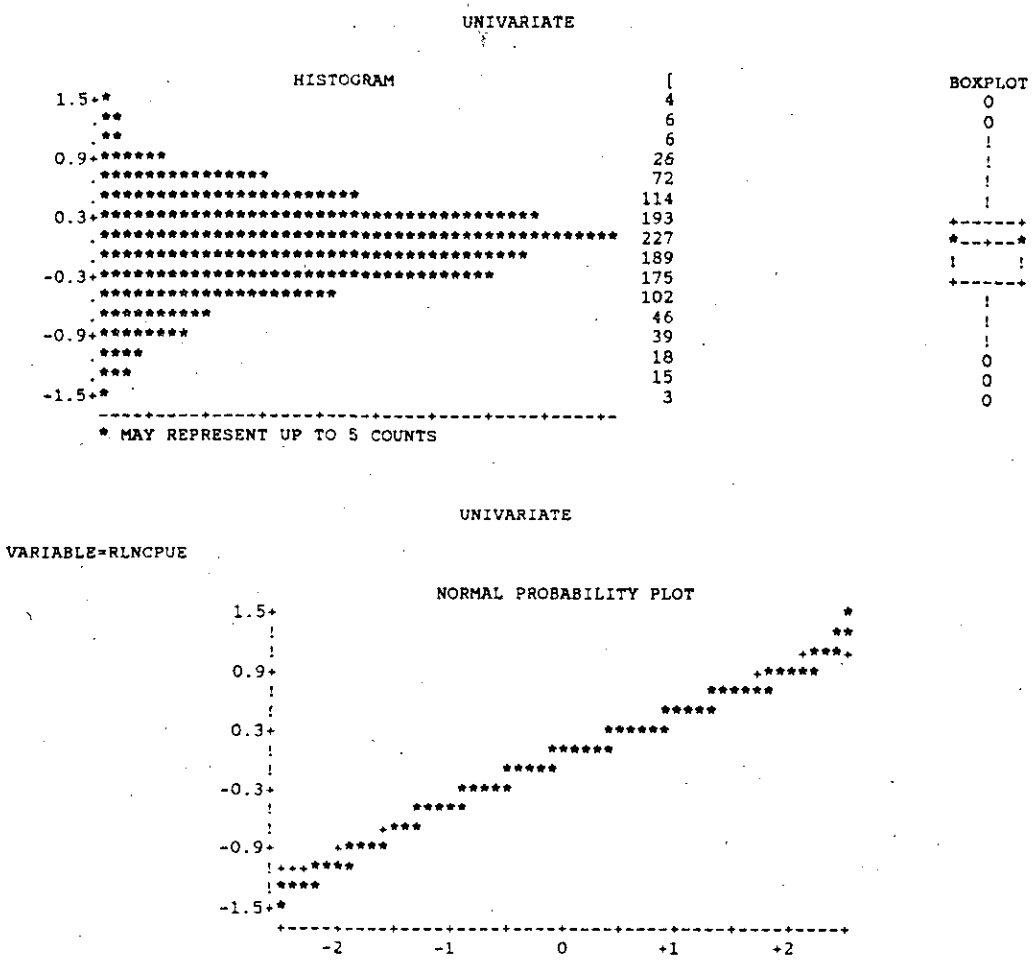


Figure 4a. Histogram, box- and probit plot of the residuals from the multiplicative analysis in Table 5a (shrimp >8.5 g).

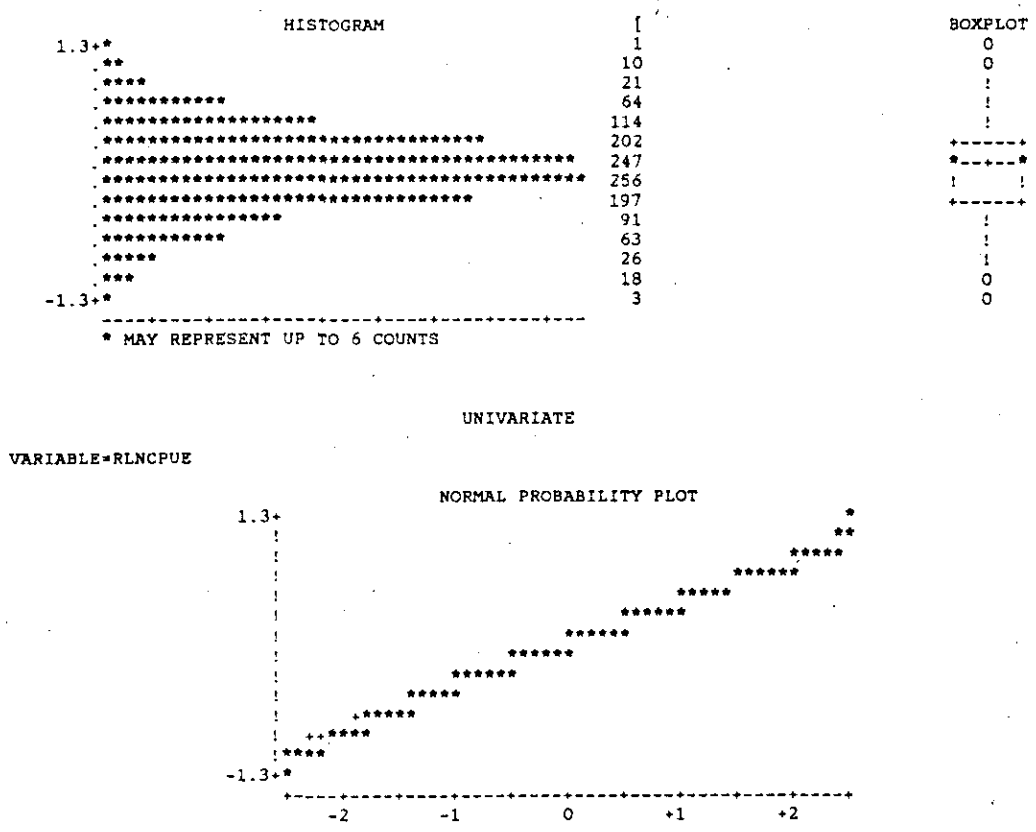


Figure 4b. Histogram, box- and probit plot of the residuals from the multiplicative analysis in Table 5b (shrimp >8.5 g).

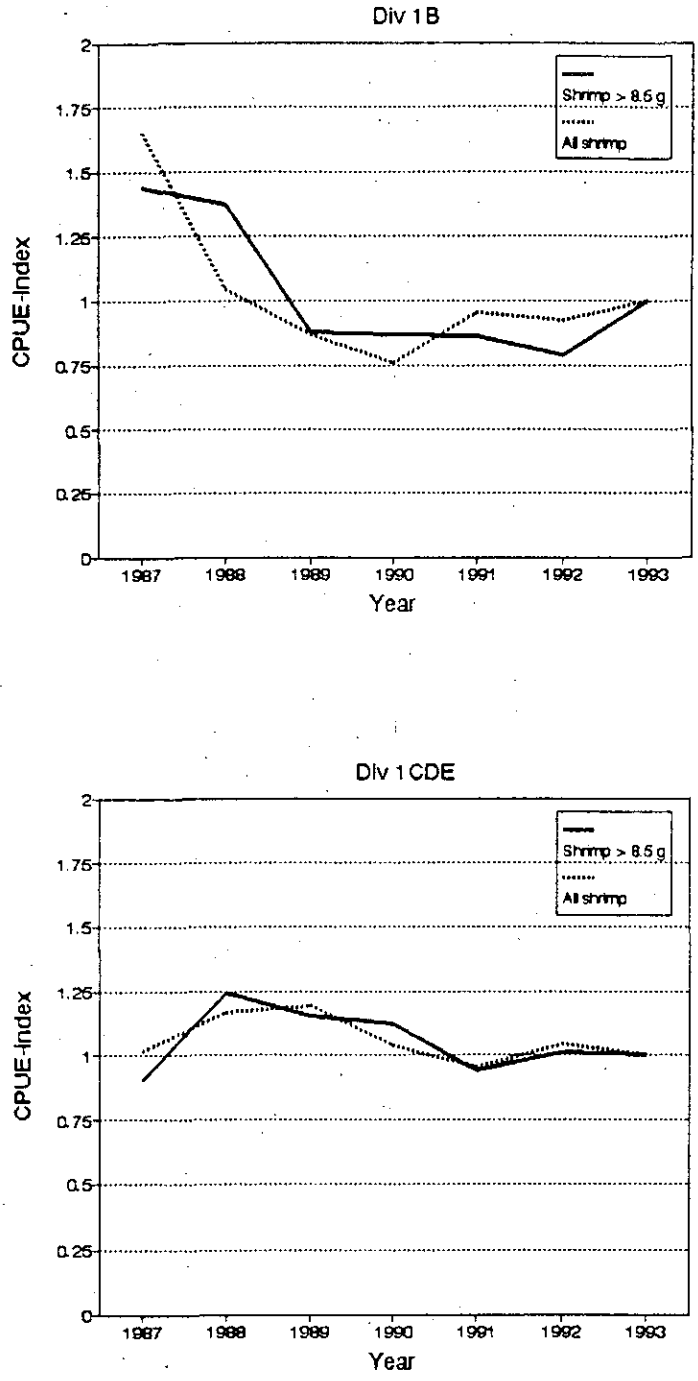


Figure 5. Annual CPUE-indices calculated for catch of shrimp >8.5 g and for total catch by 27 Greenland trawlers in Div. 1B (upper diagram) and Div. 1CDE (lower diagram) from 1987 to 1993.

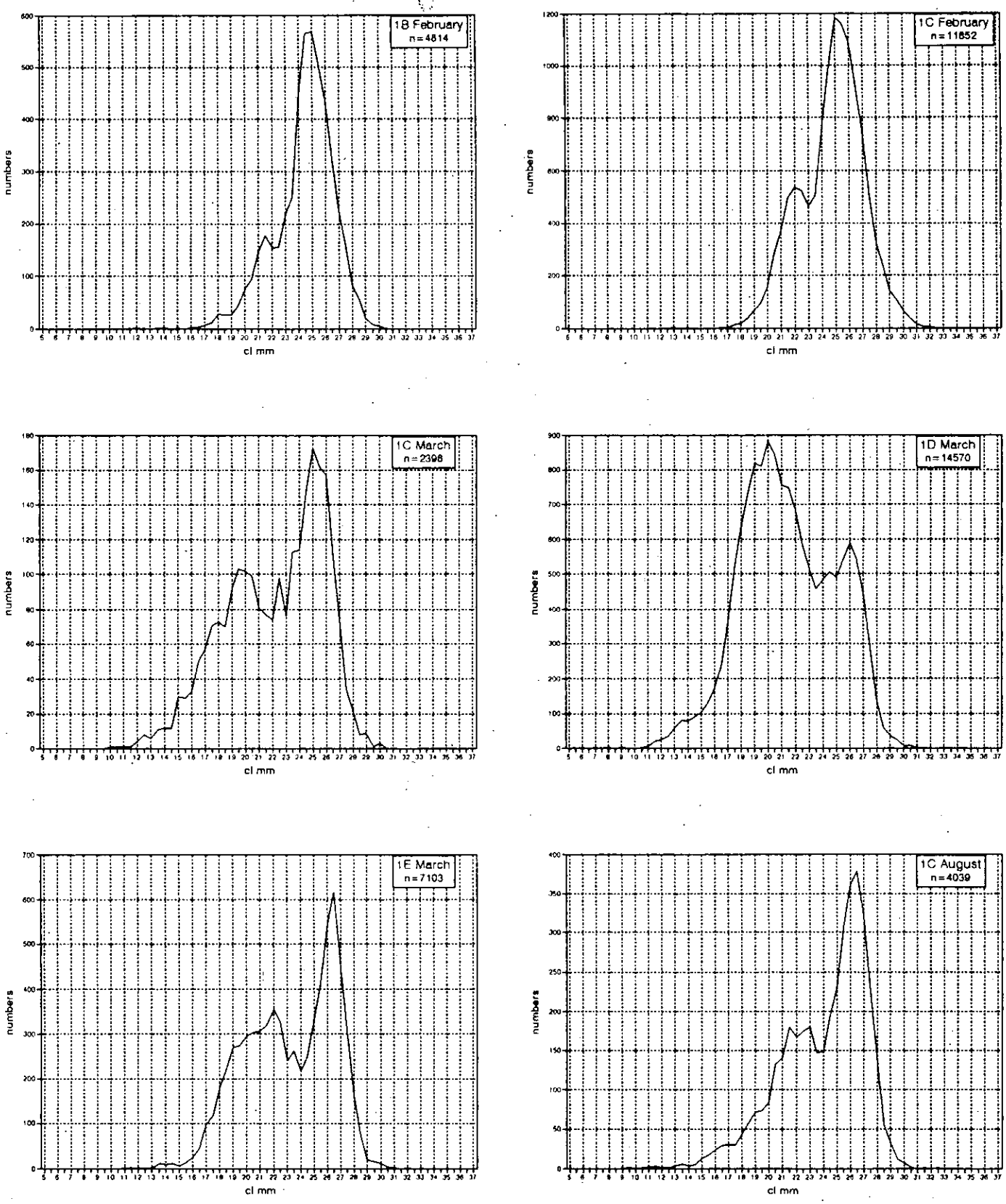
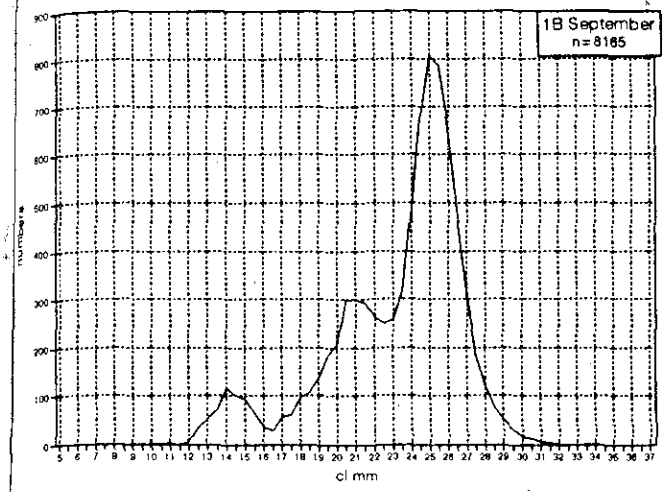
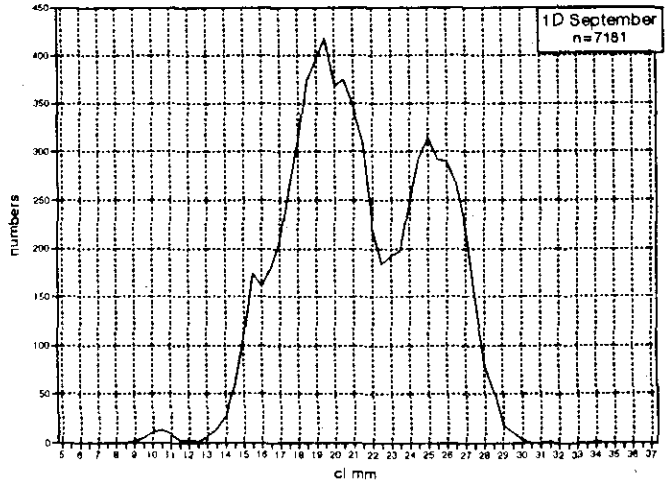


Figure 6. Commercial shrimp samples from Subarea 1 1993, pooled by Division and month.





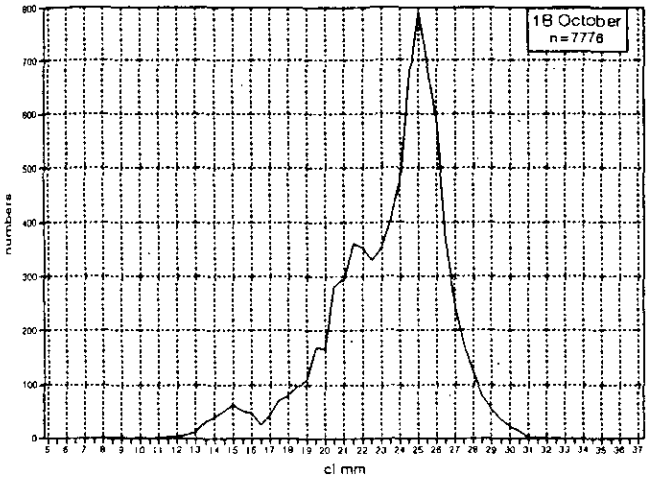


Figure 6. Continued.