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The commercial shrimp fishery in Denmark Strait in 1991 and early 1992

by

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INTRODUCTION

STACFIS recommended that the total allowable catch of shrimp in the Denmark Strait in 1991 should be maintained at 10,000 tons. The total catch reported from the Greenland zone in Denmark Strait was 8,201 tons, of which Greenland vessels accounted for approximately 4,213 tons.

The fishery was carried out throughout the year, with most effort being spent from January to May and from September to December. Approximately 6,700 tons of shrimp were reported from the first half of the year and approximately 1,500 from the second half. From January through April 1992 a catch of about 3,500 tons has been reported.

Logbooks from all the 21 Greenland vessels fishing at East Greenland in 1991 are available to the Greenland Fisheries Research Institute, covering practically all the Greenland catches and about 50% of the total catches in the Greenland economic zone.

Shrimp samples from the commercial fishery in 1991 (217 samples) were analysed for length-frequency distribution in commercial catches.

The present paper updates information given by Carlsson & Kanneworff (1991) on catches and analysis of commercial fishery data.

MATERIALS AND METHODS

Total catches and number of vessels fishing in the Greenland zone were compiled by nation and month based on the compulsory weekly reporting to Greenland authorities by all vessels above 75 GRT (smaller vessels are not joining this fishery).

Logbook data were analysed to show the overall distribution of effort and catches, and of effort and catch-rates by month. Monthly mean catch-rates from 1980 to February 1992 were calculated from available logbook data.

Shrimp samples from the commercial fishery in January-May 1991 were analysed for size composition of catches. The samples were taken by observers in a project to estimate discards in the commercial fishery (Lehmann & Degel, 1991; Carlsson & Kanneworff, 1992) and were unfortunately not sorted by sexual characteristics.

RESULTS AND DISCUSSION

Reported catches in 1991 and 1992.

Tables 1a and 1b show reported catches in the Greenland zone by nation and month, and Tables 2a and 2b the corresponding total numbers of reporting vessels for the years 1991 and 1992, respectively. The given catch figures should be considered minimum figures due to unreported discard of shrimp (Carlsson & Kanneworff, 1992). Yearly catches have increased from about 4,000 tons in 1983 to a maximum of 12,500 tons in 1988. From 1989 the catches have decreased steadily to approximately 8,200 tons in 1991.

Since the start of the fishery in Denmark Strait the seasonal distribution has gradually levelled out from a pure winter-spring fishery to a fishery during most of the year except for June and July where only little effort has been spent. In 1991 about 18.5% of the reported catches were taken in the second half of the year.

In 1991 highest catches - especially by Greenland vessels - were taken in January through May, corresponding to 81% of the total for the year.

In January-April 1992 a total catch of approximately 3,500 tons was reported (Table 1b), which is much lower than the previous years for the same period. A total of 40 vessels participated in this fishery (Table 2b).

Geographical distribution of the fishery.

Fig. 1 shows the distribution of total catches by Greenland vessels in 1991, and Fig. 2 gives the monthly distribution of CPUE and effort from January to December 1991 by statistical rectangle.

The geographical distribution of the shrimp fishery in Denmark Strait has changed substantially between years, depending primarily on variations in ice coverage and the distribution of shrimp over the area. As in 1990, a considerable part of the fishery in 1991 was located southwest of the traditionally most important areas, in the northern part of the so-called 'redfish-box' (Carlsson and Kanneworff, 1991). This box is an area that was originally pointed out in the early eighties by the ICES Redfish Working Group as an important nursery area for especially small redfish and as such was closed for trawling. In March 1990 Greenland authorities opened a minor part of the area for the shrimp fishery (south of 66°N, east of 33°10'W), resulting in high catch rates and at the same time very little by-catch of redfish. Substantial catches were taken from this area in April and May in 1990 and in January through May in 1991.

The monthly distribution of the fishery in 1991 was in general similar to 1990. Taken by month the distribution was similar in the two years, apart from the January-March fishery in the 'redfish-box' in 1991. In June and July there was - as in 1990 - very little fishing. In August no fishing took place, and in September and October there was a displacement of the fishery to the northeastern part of the fishing ground, as in the previous year. In November and December 1991 the fishery spread out over the area as in 1989 and 1990.

Catch and effort.

The mean catch rates for the first six months of 1991 were significantly lower than those earlier recorded (Table 4, Fig. 3b). Also, the catch rates from January-February 1992 were lower than normal. Catch rates did not exhibit a spring peak value, as has been the case in earlier years. In the last part of the year mean catch rates reached the level of the two foregoing years.

The effort spent by the Greenland vessels in the period January-May 1991 was the highest on record, and made up for 93% of the total effort for the year, compared to an average level of 64% during 1988-90. The relatively high catch rates in September-December 1991 were only based on 6% of the annual effort.

The overall development in mean catch rates from 1987 to 1991 (Table 4) is a decline from 1987 to 1989 and a presumable stabilization from 1989 to 1990, primarily due to the opening of the area west of 32°W. The lack of data from this area in earlier years makes it difficult to judge, whether the catch rates reflect a stabilization of the stock or it is only the effect of a fishery on a hitherto unexploited part of the stock. Catch rates decreased significantly from 1990 to 1991, despite of the continued fishery in the 'redfish-box'.

In general there are problems in defining the total stock distribution area as shown by the lack of small shrimp (less than about 18 mm CL) in samples and by the unsuccessfull trawl survey by the Greenland Fisheries Research Institute in 1990 (Kanneworff & Lehmann, 1991). No survey was carried out in 1991.

It is in general difficult to draw firm conclusions from the reported catch rate figures due to variations in ice cover over the fishing grounds from year to year, improvement in gear technology, and changes in discarding procedures.

Biological samples.

Shrimp samples from the commercial fishery in 1990 and 1991 were not sorted by sexual characteristics. Based on analysis of samples from the commercial fishery in 1988 (Carlsson and Kanneworff, 1989) shrimp with carapace length (CL) less than 28 mm are mainly males. Primiparous females form a peak around 30 mm CL, and multiparous females group from 26 to 36 mm CL. Fig. 5 (a-e) show length-frequency diagrams for pooled commercial samples from 1991 by month and statistical units as used by Iceland (Fig. 4). Table 5 (a-c) gives the numbers of shrimp by length group in these samples.

The samples show some variation in size composition between months and areas. All samples show a female mode around 30 mm CL. There is a great varition in peaks of smaller shrimp (males and juveniles), but in many samples peaks at 21-22 mm and 24-25 mm CL are indicated. In all months where samples are available from the southwestern part of the area (unit 582) males are dominating, as they were in samples from 1990 (Carlsson & Kanneworff, 1991). Females are dominating to the east of this area (units 579-581).

Table 6 shows the size distribution in production categories by six months periods in 1990 and 1991 based on the same commercial samples and the use of weight-at-length keys. The table reflects a decreasing mean size of shrimp in the commercial catches over the period.

CONCLUSIONS

Reported catches of shrimp in 1991 from the Greenland part of Denmark Strait totalled 8,201 tons, a decrease of about 20% compared to 1990. The total number of participating vessels was around 50, lower than in the years before. The mean catch per vessel increased slightly to about 170 tons, compared to about 150 tons in 1989 and 1990. No fishery took place in July, and very low activity took place in June and August. 81% of the catches were taken in the first half of the year.

In 1991 the geographical distribution of the fishery was similar to the two previous years. However, the opening in March 1990 of a part of an area previously closed for trawling resulted in a displacement of the fishery to the west in some months in 1990 and 1991.

Semiannual mean catch rates in 1991 were in the first half of the year lower than, and in the second half similar to the level of 1990.

Biological samples from the commercial fishery show a decrease in mean size of shrimp from 1990 to 1991. Female shrimp dominate in the southeastern parts of the fishing grounds, while males dominate in the southwestern part.

Mean size of shrimp has decreased from 1990 to 1991.

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Table 1a. Catches of *shrimp (tons)* in Denmark Strait in 1991 by division, nation and month as reported to the Greenland authorities.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Greenland	1021	954	581	1078	356	26	0	0	28	30	43	96	4213
Denmark	0	61	86	116	24	0	0	0	10	18	33	13	361
Faroe Island	230	279	110	42	0	0	0	0	21	17	76	236	1011
France	0	32	27	54	0	0	0	0	0	0	0	0	113
Norway	331	375	203	467	230	0	0	11	66	221	371	228	2503
TOTAL	1582	1701	1007	1757	610	26	0	11	125	286	523	573	8201

Table 1b. Catches of shrimp (tons) in Denmark Strait in 1992 by division, nation and month as reported to the Greenland authorities.

	Jan	Feb	Mar	Apr	Total
Greenland	368	410	685	227	1690
Denmark	4	52	71	4	131
Faroe Island	180	99	161	15	455
France	0	0	0	0	0
Norway	254	275	441	230	1200
TOTAL	806	836	1358	476	3476

Table 2a. No. of vessels in the shrimp fishery in Denmark Strait in 1991 by division, nation and month as reported to the Greenland authorities.

East Greenland	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Greenland	17	19	19	19	14	2	0	0	2	1	1	4	21
Denmark	0	1	2	2	1	0	0	0	0	0	0	1	2
Faroe Islands	3	3	3	1	0	0	0	0	1	2	3	3	3
France	0	1	1	2	0	0	0	0	0	0	0	0	2
Norway	12	16	17	15	12	0	0	1	7	16	16	16	19
TOTAL	42	40	42	39	27	2	0	1	10	19	20	24	47

Table 2b. No. of vessels in the shrimp fishery in Denmark Strait in 1992 by division, nation and month as reported to the Greenland authorities.

East Greenland	Jan	Feb	Mar	Apr	Total
Greenland	11	16	15	9	17
Denmark	1	1	2	1	2
Faroe Islands	3	3	3	4	5
France	0	0	0	0	0
Norway	11	15	16	15	16
TOTAL	26	35	36	29	40

Table 3. No. of hours trawled by year and month from April 1990 to February 1992 in the main fishing area in Denmark Strait as reported in available logbooks.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1980	-	-	-	35	1297	315	59	31	482	1166	464	-	3849
1981	-	-	-	1343	914	7	-	-	-	-	-	-	2264
1982	-	-	763	1570	1394	-	-	-	-	-	-	-	3727
1983	-	-	484	457	-	-	-	-	-	-	-	-	957
1984	105	312	281	-	-	-	-	-	-	-	-	-	698
1985	647	610	570	625	-	-	-	-	-	51	360	643	3506
1986	1565	2593	2413	1032	602	-	-	-	-	77	686	1160	10128
1987	3608	4471	2965	951	406	-	-	81	400	753	1915	4067	19617
1988	6951	7950	6408	1121	550	-	-	1019	1487	2586	3207	4903	36182
1989	6865	6361	3905	3505	2322	137	15	713	2290	2600	7031	7107	42851
1990	8602	8289	8299	1050	2133	116	82	352	710	1734	2121	5160	38648
1991	6793	7192	6393	7681	5045	471	38	-	404	371	505	892	35785
1992	1005[1]	317[1]	-	-	-	-	-	-	-	-	-	-	1322[1]

[1] preliminary data

Table 4. Monthly and semi-annual mean catch rates, efforts and catches from 1987 to February 1992, based on logbooks from the Greenland fishery. Semi-annual efforts are calculated from total catches and CPUEs.

Year	Month	CPUE	Effort	Catch	Month	CPUE	Effort	Catch
1987	JAN	318	3608	1257.3	AUG	113	81	9.2
	FEB	322	4471	1439.0	SEP	253	400	101.4
	MAR	296	2965	878.6	OCT	199	753	149.7
	APR	208	951	197.6	NOV	162	1915	309.6
	MAY	298	406	121.0	DEC	115	4067	468.9
Subtotal		314	12401	3893.5		144	7216	1038.8
Total		314	17667	5547.0		144	7502	1080.0
1988	JAN	301	6951	2089.8	AUG	117	1019	119.6
	FEB	226	7950	1793.2	SEP	121	1487	179.4
	MAR	152	6408	975.1	OCT	105	2586	270.5
	APR	104	1121	116.0	NOV	157	3207	503.3
	MAY	114	550	62.9	DEC	203	4903	995.1
Subtotal		219	22980	5037.0		157	13202	2067.9
Total		219	24111	5285.0		157	13822	2165.0
1989	JAN	249	6865	1707.5	JUL	27	15	0.4
	FEB	214	6361	1361.0	AUG	44	713	31.3
	MAR	131	3905	512.1	SEP	59	2290	135.3
	APR	197	3505	690.6	OCT	96	2600	248.7
	MAY	68	2322	157.5	NOV	67	7031	474.1
	JUN	39	137	5.4	DEC	84	7107	598.9
Subtotal		192	23095	4434.1		75	19756	1488.7
Total		192	23287	4471.0		75	20039	1510.0
1990	JAN	139	8602	1196.8	JUL	94	82	7.7
	FEB	185	8289	1533.1	AUG	59	352	20.6
	MAR	143	8299	1186.1	SEP	64	710	45.2
	APR	473	1050	496.9	OCT	58	1734	101.4
	MAY	455	2133	971.5	NOV	65	2121	138.7
	JUN	45	116	5.2	DEC	79	5160	408.5
Subtotal		189	28489	5389.6		71	10159	722.1
Total		189	28956	5478.0		71	10298	732.0
1991	JAN	141	6793	956.9	JUL	0	38	0.0
	FEB	128	7192	919.1	AUG	0	0	0.0
	MAR	101	6393	643.8	SEP	73	404	29.6
	APR	128	7681	982.3	OKT	64	371	23.8
	MAY	85	5045	430.8	NOV	91	505	45.8
	JUN	72	471	33.9	DEC	105	892	93.8
Subtotal		118	33575	3966.8		87	2210	193.0
Total		118	33991	4016.0		87	2256	197.0
1992	JAN	102	1005	102.4				
	FEB	168	317	53.2				
Subtotal		118	1322	155.6				
Total		118	6610	778.0				

Table 5a. No. of shrimp per length group in commercial samples from 1991, pooled by month and area (Iceland area units, see Fig. 4). The entry 'Corresponding catch' is the catch represented by the samples.

	Year Month and Statistical Unit							
CL,mm	9101 580	9101 581	9101 582	9102 580	9102 581	9102 582	9103 579	9103 580
13.5	1	0	0	0	0	1	0	1
14.0	0	0	1	0	2	0	0	2
14.5	0	0	0	0	1	3	0	2
15.0	2	2	2	0	2	3	0	2
15.5	2	0	1	0	3	6	0	6
16.0	6	2	2	0	1	5	0	7
16.5	3	6	2	0	3	5	0	9
17.0	6	8	2	0	5	11	0	2
17.5	5	11	5	0	6	15	0	9
18.0	11	11	3	0	7	30	0	9
18.5	13	44	10	0	14	37	0	19
19.0	29	63	19	0	27	51	0	24
19.5	40	93	37	0	32	94	0	29
20.0	44	152	58	0	47	132	0	65
20.5	67	172	66	2	68	185	0	71
21.0	92	217	79	1	82	199	0	79
21.5	115	285	103	1	87	265	0	106
22.0	112	274	94	2	91	293	0	103
22.5	132	248	127	1	86	427	0	131
23.0	129	281	153	2	80	513	0	141
23.5	141	229	142	1	66	570	1	148
24.0	119	234	175	2	66	559	1	115
24.5	103	216	180	2	49	636	0	118
25.0	103	206	236	3	57	598	0	105
25.5	83	183	208	5	42	606	1	76
26.0	74	170	200	4	50	589	2	100
26.5	51	201	211	6	64	660	0	78
27.0	70	222	192	7	62	595	3	92
27.5	67	196	198	12	65	582	1	109
28.0	67	263	232	11	113	695	5	118
28.5	112	275	269	16	131	803	9	200
29.0	94	376	288	27	207	877	22	214
29.5	129	492	326	49	337	1012	25	277
30.0	141	552	337	74	401	965	21	285
30.5	150	619	332	65	474	889	27	286
31.0	139	565	316	78	405	781	25	233
31.5	100	481	225	62	343	575	26	175
32.0	89	347	190	62	214	491	12	133
32.5	75	236	123	38	155	377	12	90
33.0	51	135	106	28	111	246	8	66
33.5	41	61	51	15	63	165	6	39
34.0	17	46	30	10	30	84	0	21
34.5	13	15	15	8	13	48	2	5
35.0	3	14	9	3	13	16	1	6
35.5	2	6	4	0	5	12	0	1
36.0	2	1	1	0	0	6	0	1
36.5	0	0	0	0	1	3	0	0
37.0	0	0	1	1	1	0	0	0
ALL	2849	8215	5365	605	4181	15615	210	3898
No. of samples	5	14	14	1	8	20	1	12
Σ sample weight	30.1	91.7	66.6	9.2	63.3	172.8	4.6	62.2
Corresp. catch	3008	12515	9603	303	2339	11515	293	2136

Table 5b. No. of shrimp per length group in commercial samples from 1991, pooled by month and area (Iceland area units, see Fig. 4). The entry 'Corresponding catch' is the catch represented by the samples.

	Year Month and Statistical Unit							
CL, mm	9103 581	9103 582	9103 630	9103 631	9104 580	9104 630	9104 631	9104 680
7.0	0	0	0	0	0	1	0	0
7.5	0	0	0	0	0	0	0	0
8.0	0	0	0	0	0	0	0	0
8.5	1	0	0	0	0	0	0	0
9.0	0	1	0	0	0	0	0	0
9.5	0	0	0	0	0	0	0	0
10.0	0	0	0	0	0	0	0	0
10.5	0	0	0	0	0	1	0	0
11.0	0	0	0	0	0	0	0	0
11.5	0	0	0	0	0	2	0	0
12.0	0	1	0	0	0	0	0	0
12.5	0	0	0	3	0	0	0	0
13.0	0	0	0	0	0	4	0	0
13.5	0	1	0	1	0	2	0	0
14.0	2	0	0	4	2	12	0	2
14.5	3	0	0	6	2	10	0	4
15.0	0	4	1	4	10	17	0	1
15.5	4	1	0	5	3	26	0	4
16.0	8	7	0	16	4	36	0	3
16.5	3	9	2	14	2	38	0	6
17.0	8	13	0	16	8	30	0	4
17.5	8	13	1	14	8	46	1	5
18.0	10	13	2	16	13	52	1	8
18.5	9	22	1	32	18	74	0	14
19.0	15	32	1	49	17	139	4	13
19.5	26	66	4	53	35	184	4	39
20.0	23	87	3	84	49	283	3	37
20.5	38	102	11	113	58	376	6	52
21.0	50	134	16	151	95	495	6	51
21.5	61	156	17	178	88	600	15	70
22.0	76	192	15	208	128	662	11	85
22.5	71	222	20	257	160	769	17	84
23.0	99	246	29	272	169	737	13	103
23.5	93	282	24	289	142	806	18	99
24.0	92	298	27	309	178	800	15	80
24.5	82	298	14	310	137	721	20	65
25.0	70	277	15	305	152	602	12	65
25.5	62	226	12	269	118	541	19	55
26.0	57	221	15	235	108	471	16	38
26.5	42	177	12	196	99	419	10	36
27.0	34	168	12	174	88	402	10	34
27.5	50	178	12	150	93	441	14	45
28.0	68	189	15	163	101	549	14	51
28.5	77	167	27	153	146	663	13	64
29.0	88	220	24	182	139	921	18	75
29.5	100	201	52	178	206	1016	19	97
30.0	108	197	50	163	214	1148	28	99
30.5	96	191	49	151	213	1051	24	89
31.0	78	137	36	146	201	866	23	74
31.5	68	112	35	104	122	702	11	57
32.0	47	100	26	76	107	549	14	41
32.5	40	60	13	55	96	403	8	24
33.0	26	49	4	45	51	244	3	22
33.5	15	30	2	28	31	149	9	8
34.0	12	12	2	18	20	88	5	4
34.5	5	6	0	14	10	38	3	1
35.0	2	3	0	3	1	12	0	1
35.5	0	0	0	1	0	9	0	1
36.0	0	1	0	0	2	0	0	0
36.5	0	1	0	0	0	1	0	0
37.0	0	0	0	1	0	0	0	0
37.5	0	0	0	0	0	0	0	0
38.0	0	0	0	0	0	0	0	0
38.5	0	0	0	0	0	0	0	0
39.0	0	0	0	0	0	1	0	0
ALL	1927	5143	602	5214	3644	18209	404	1810
No. of sample	5	14	2	11	12	57	1	5
Σ sample weight	25.7	65.2	8.8	59.4	50	249.2	5.5	22.4
Corresp. catch	4025	539	5	4859	1860	6972	5	22

Table 5c. No. of shrimp per length group in commercial samples from 1991, pooled by month and area (Iceland area units, see Fig. 4). The entry 'Corresponding catch' is the catch represented by the samples.

CL, mm	Year Month and Statistical Unit 9105 580	9105 582	9105 630	9105 680
9.0	0	0	1	0
9.5	1	0	0	0
10.0	0	1	1	0
10.5	0	0	0	0
11.0	0	0	0	0
11.5	0	0	0	0
12.0	0	0	0	0
12.5	0	0	1	0
13.0	0	0	0	0
13.5	0	1	0	0
14.0	0	2	5	0
14.5	0	4	3	0
15.0	0	0	3	1
15.5	0	2	8	2
16.0	0	9	11	2
16.5	1	9	6	1
17.0	1	7	12	4
17.5	1	11	14	1
18.0	1	18	15	3
18.5	0	22	19	4
19.0	0	31	36	7
19.5	2	40	51	10
20.0	3	52	61	16
20.5	2	71	108	21
21.0	4	59	150	31
21.5	3	84	149	32
22.0	4	70	213	28
22.5	4	101	221	39
23.0	6	76	222	38
23.5	4	109	210	58
24.0	11	109	217	38
24.5	6	94	196	28
25.0	4	100	172	24
25.5	2	73	155	19
26.0	9	53	166	22
26.5	4	65	146	27
27.0	4	46	155	22
27.5	5	30	185	17
28.0	5	28	235	31
28.5	11	35	325	41
29.0	16	26	487	66
29.5	18	29	600	57
30.0	14	25	673	77
30.5	28	28	663	58
31.0	19	34	556	57
31.5	21	14	438	42
32.0	7	13	339	34
32.5	9	8	227	17
33.0	6	6	142	13
33.5	5	2	92	8
34.0	4	1	49	5
34.5	1	3	29	1
35.0	3	0	11	1
35.5	1	0	9	1
36.0	1	0	1	0
36.5	0	0	4	0
37.0	1	0	1	0
37.5	0	0	1	0
38.0	0	0	0	0
38.5	0	0	0	0
39.0	0	0	2	0
ALL	252	1601	7795	1004
No. of samples	1	4	27	3
Σ sample weight	4.2	16.1	121.8	14.1
Corresp. catch	7	7	1074	16

Table 6. Distribution (percentage of weight) of production categories in the shrimp fishery in 1990 and 1991, based on length-weight distributions in observer samples from the commercial catches.

YEAR	PERIOD	COUNT (No. per kg.) > 70	70-90	90-120	120-150	> 150
1990	JAN-JUN	68.4	16.6	6.1	4.4	4.6
1990	JUL-DEC	54.3	20.7	10.1	8.6	6.3
1991	JAN-JUN	52.1	19.4	10.4	10.1	8.0
1992	JUL-DEC	-	-	-	-	-

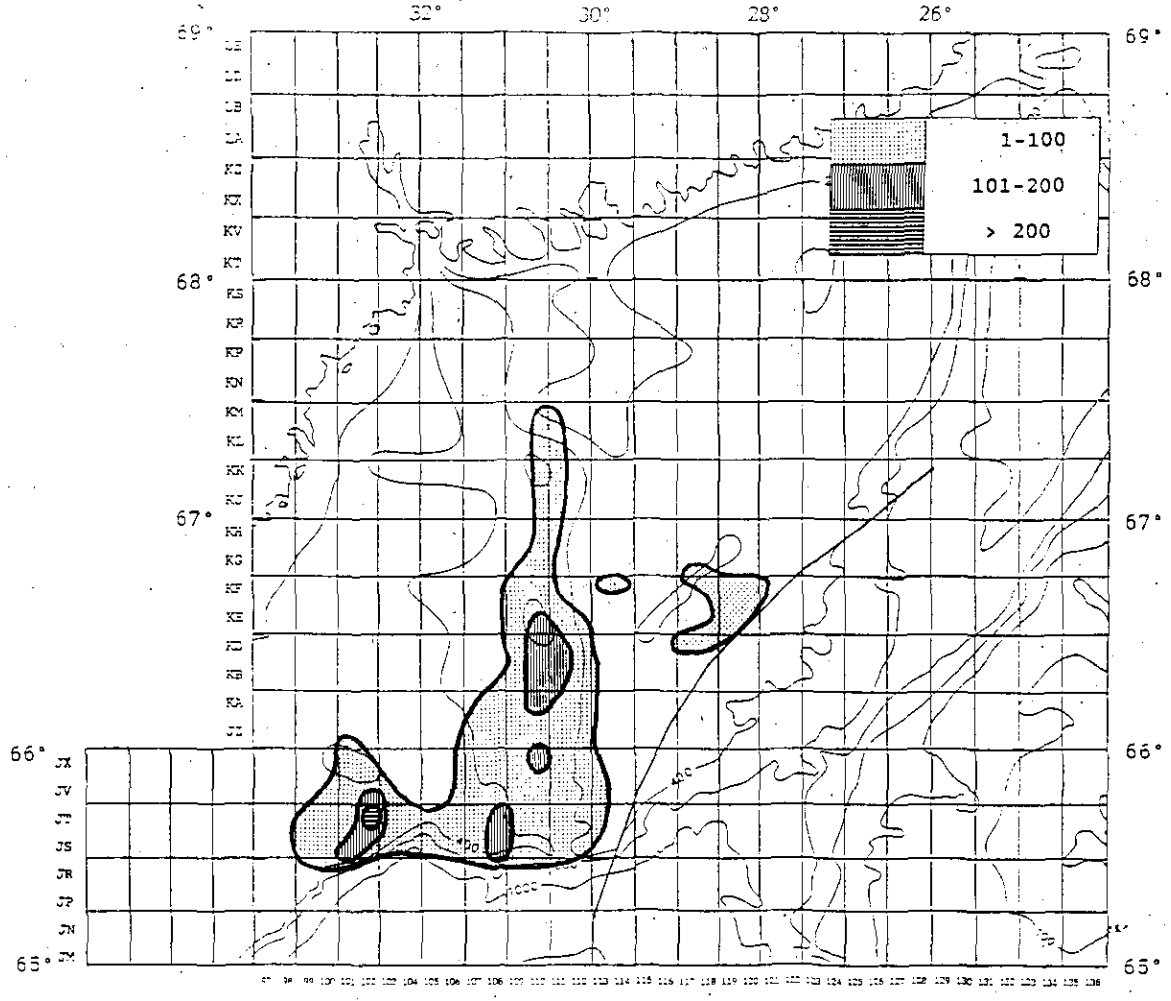


Figure 1. Distribution of catches of shrimp (tons per statistical unit) in the fishery in Denmark Strait in 1991, based on logbooks from the Greenland fishery.

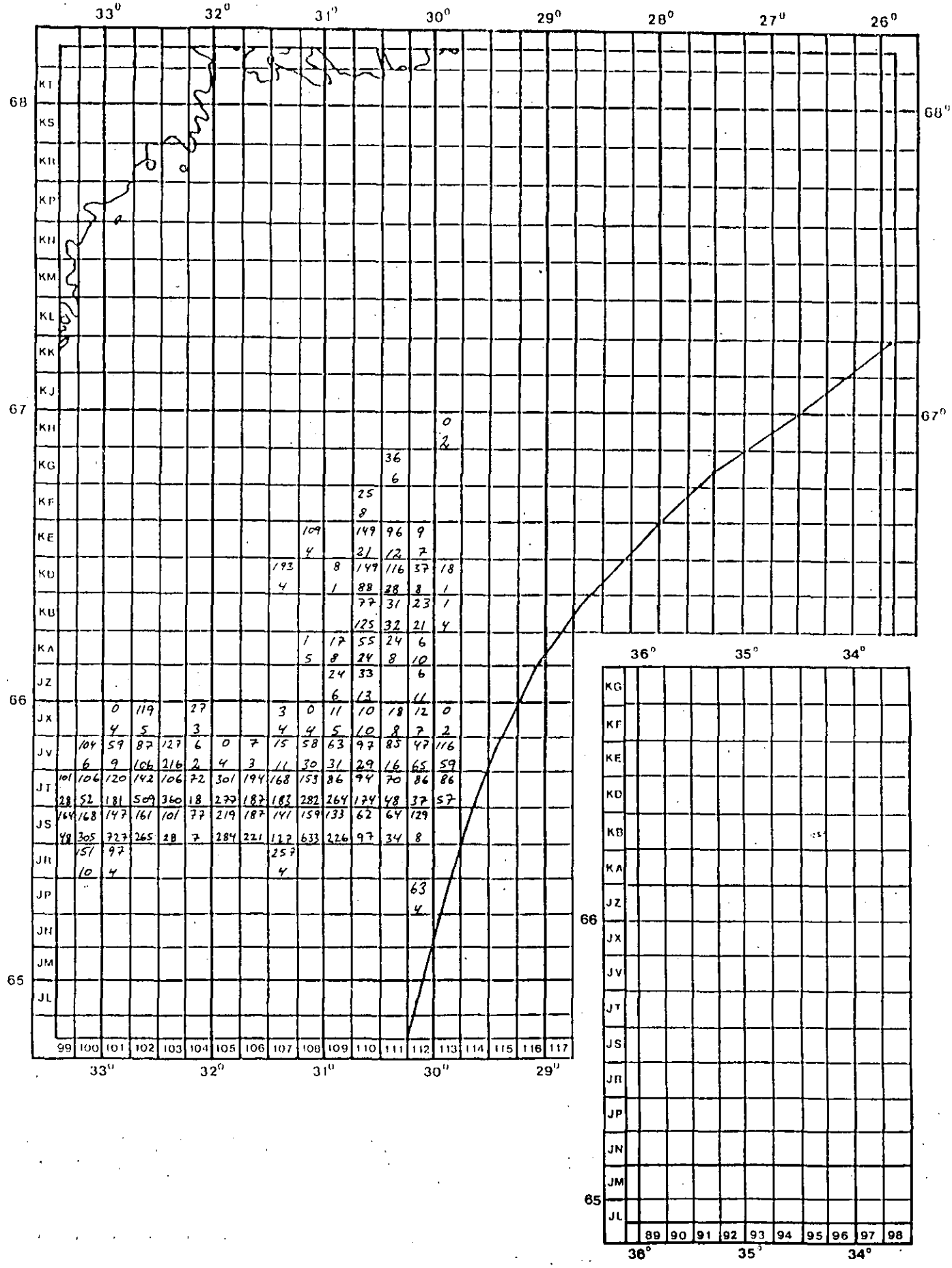


Figure 2. Distribution of mean catch of shrimp (kg/hour) and effort (hours) in the shrimp fishery in Denmark Strait in January 1991, based on logbook information from the Greenland fishery.

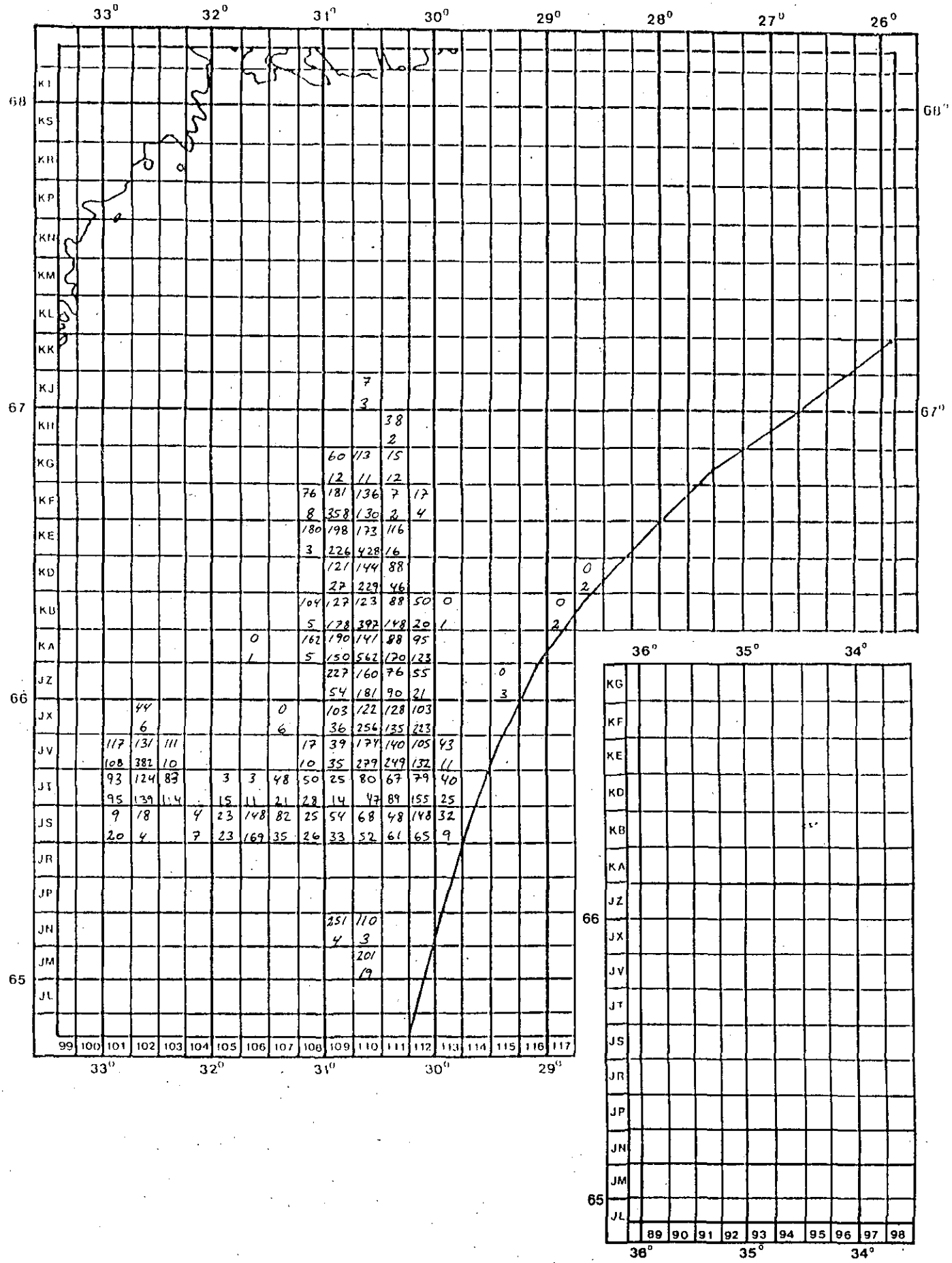


Figure 2 continued. Data from February 1991.

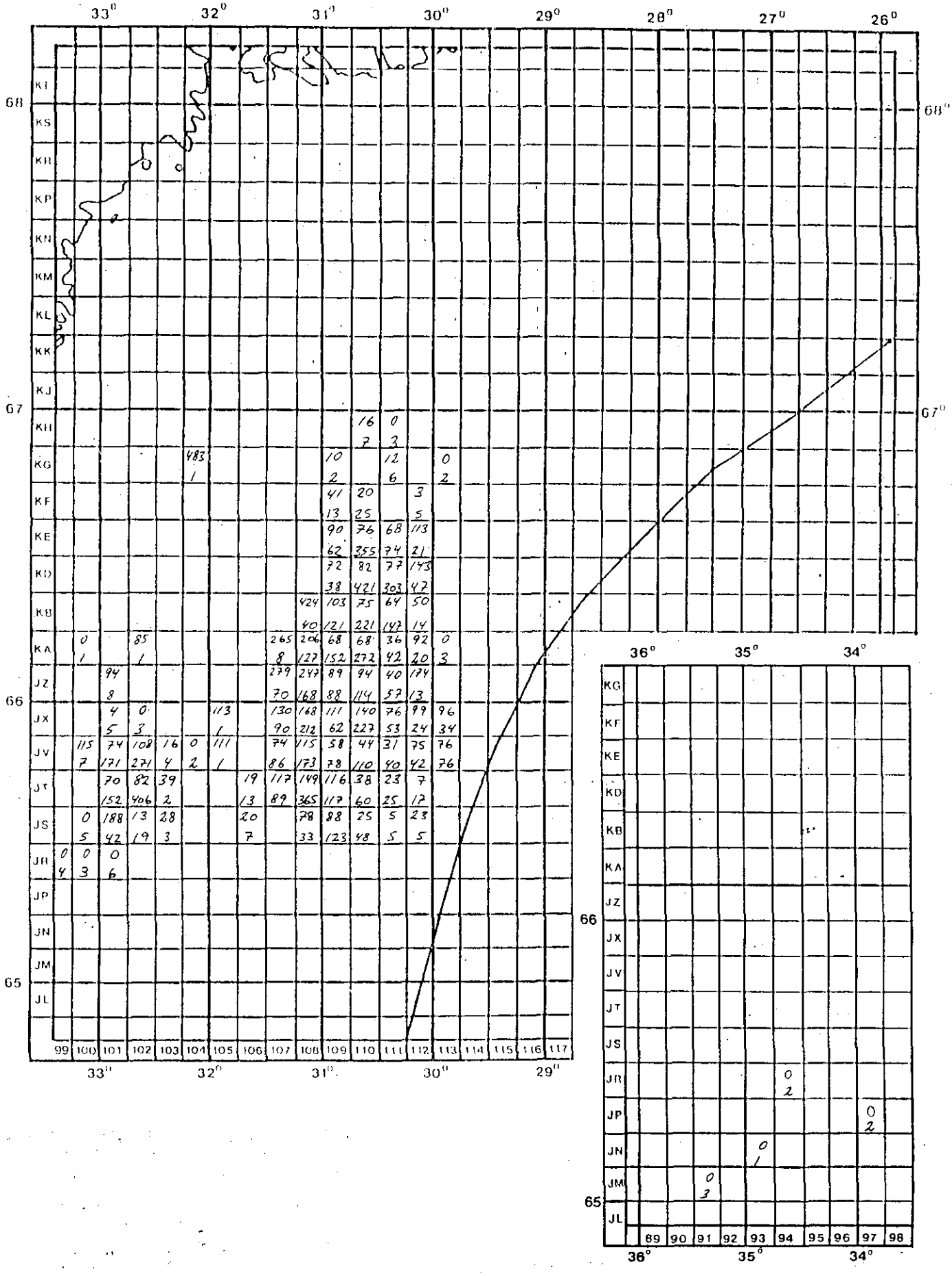


Figure 2 continued. Data from March 1991.

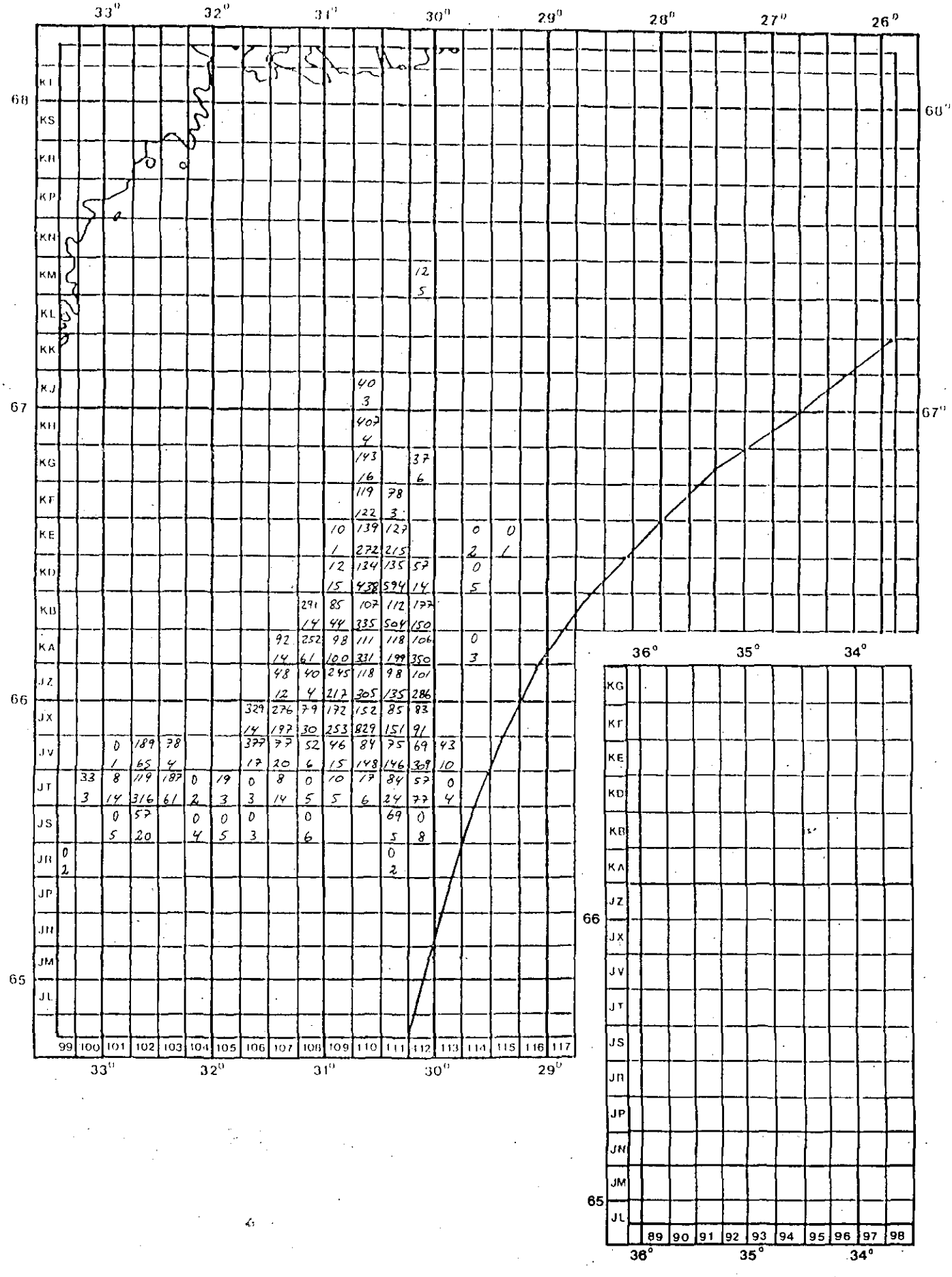


Figure 2 continued. Data from April 1991.

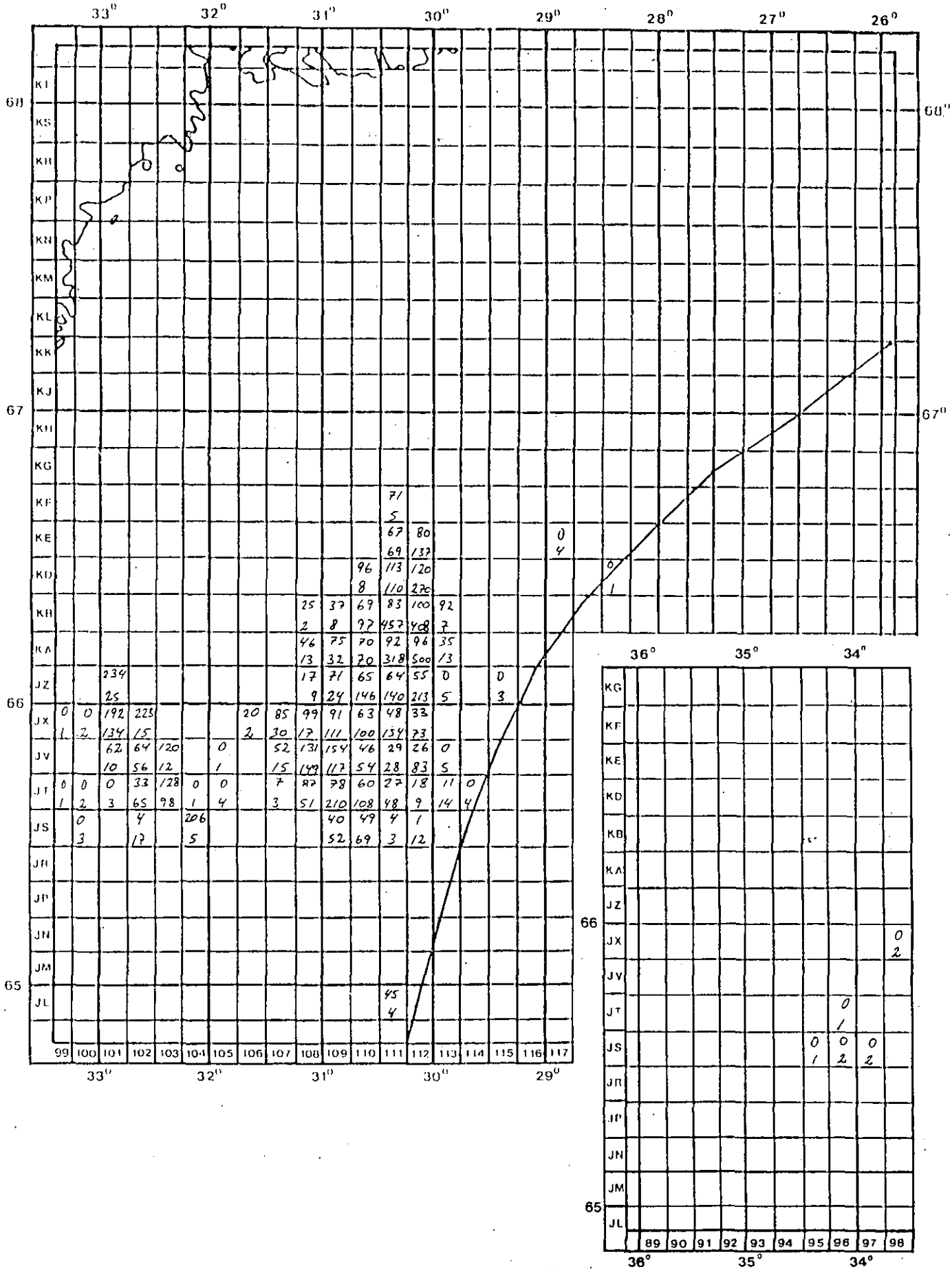


Figure 2 continued. Data from May 1991.

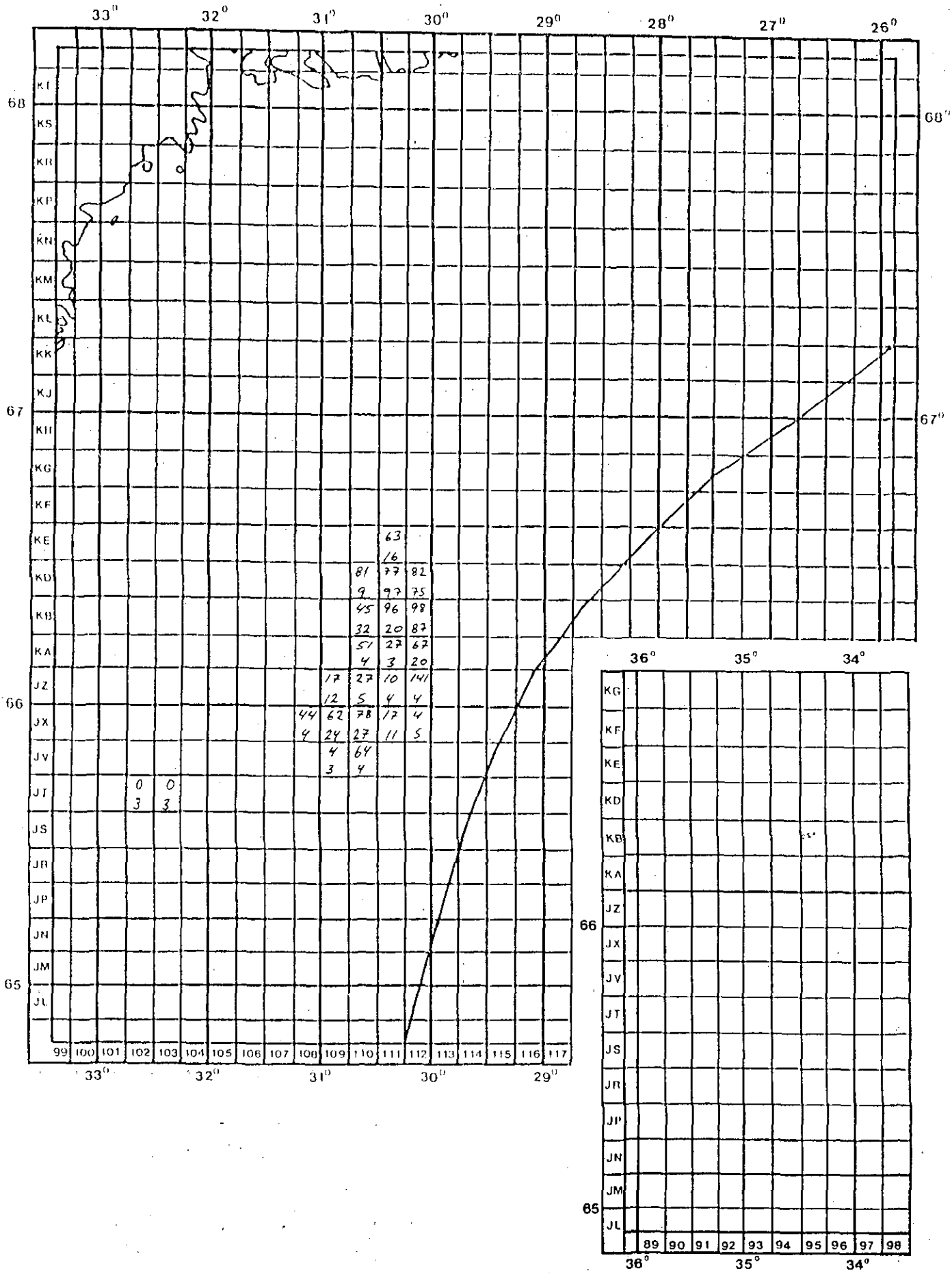


Figure 2 continued. Data from June 1991.

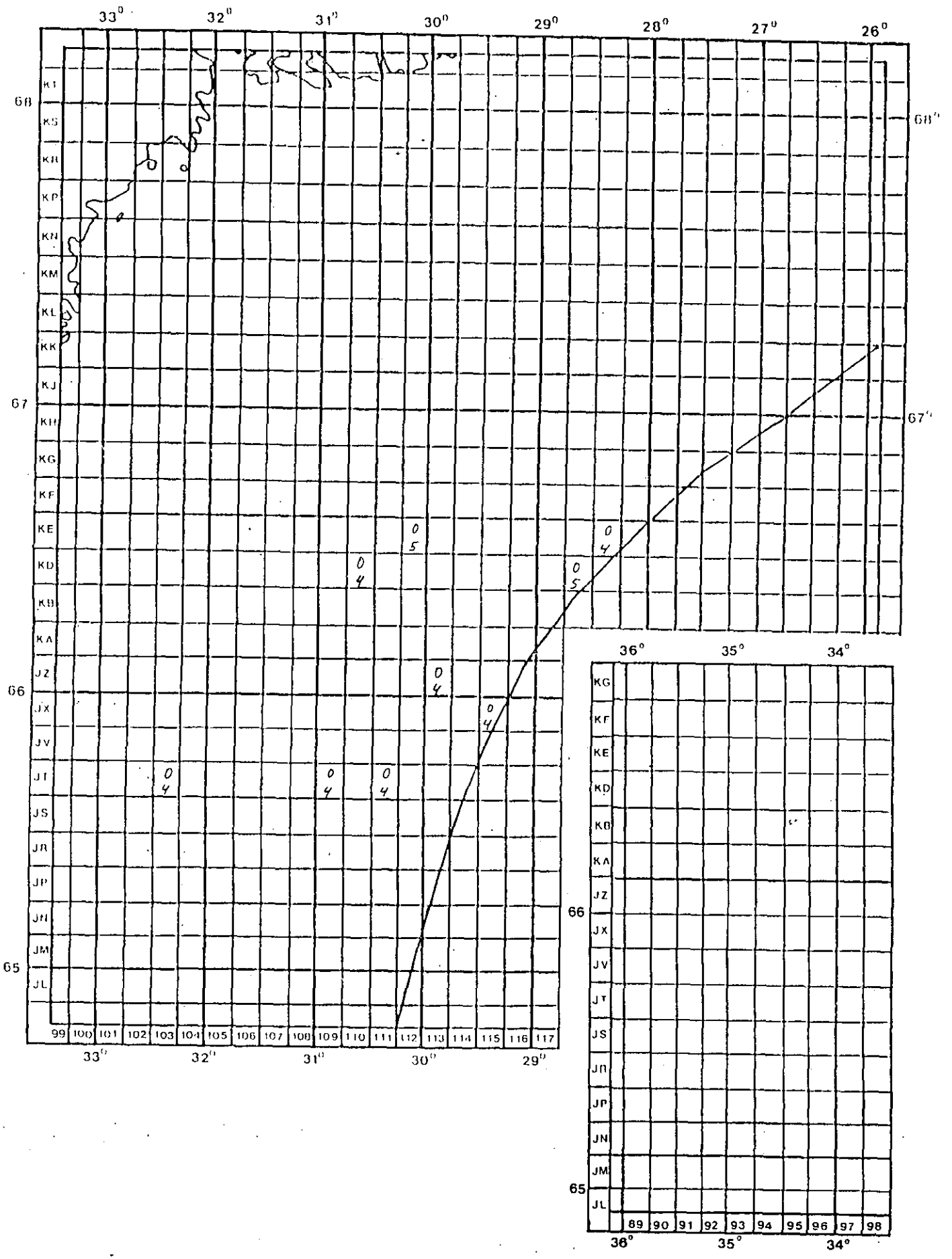


Figure 2 continued. Data from July 1991.

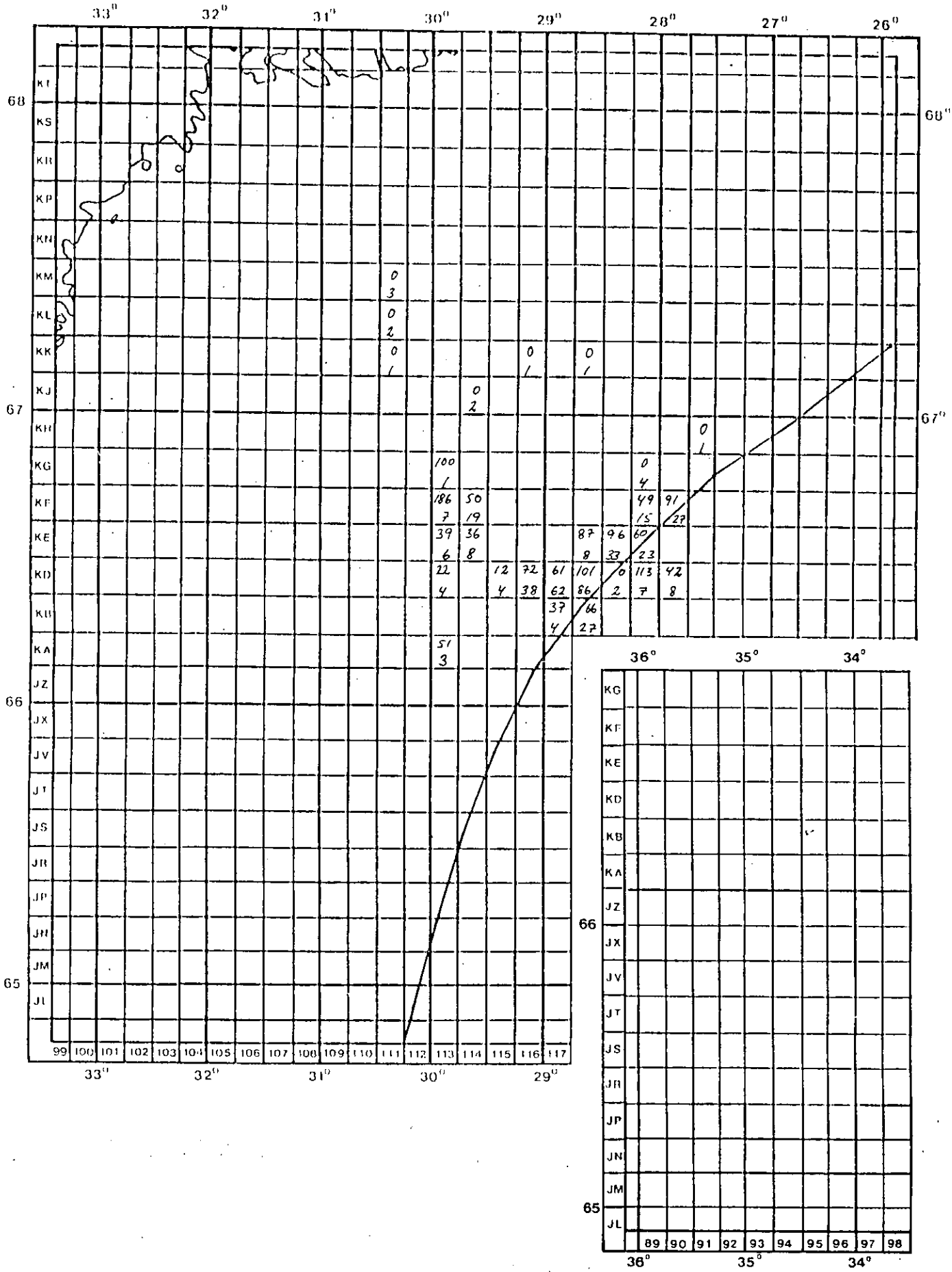


Figure 2 continued. Data from September 1991.

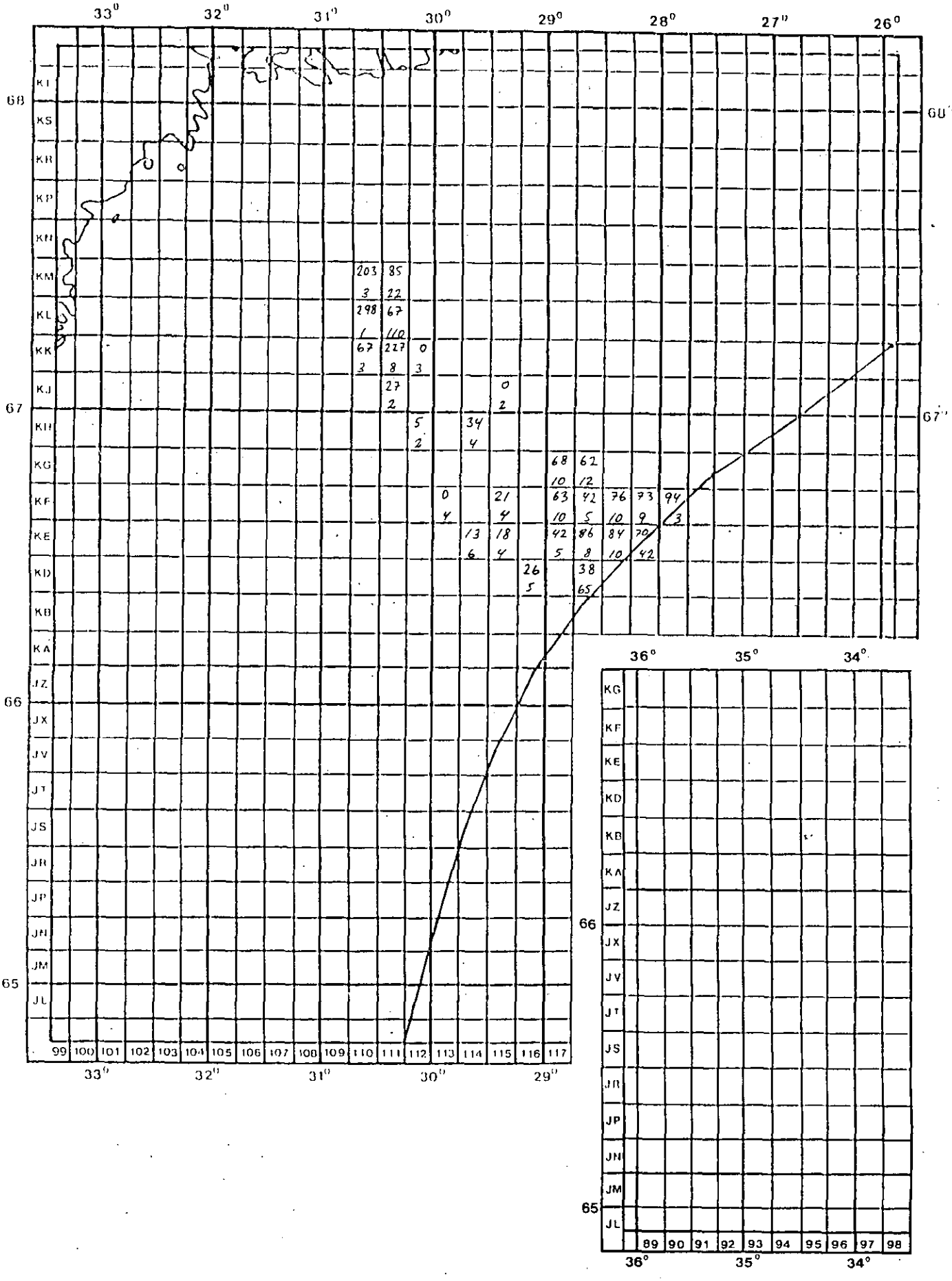


Figure 2 continued. Data from October 1991.

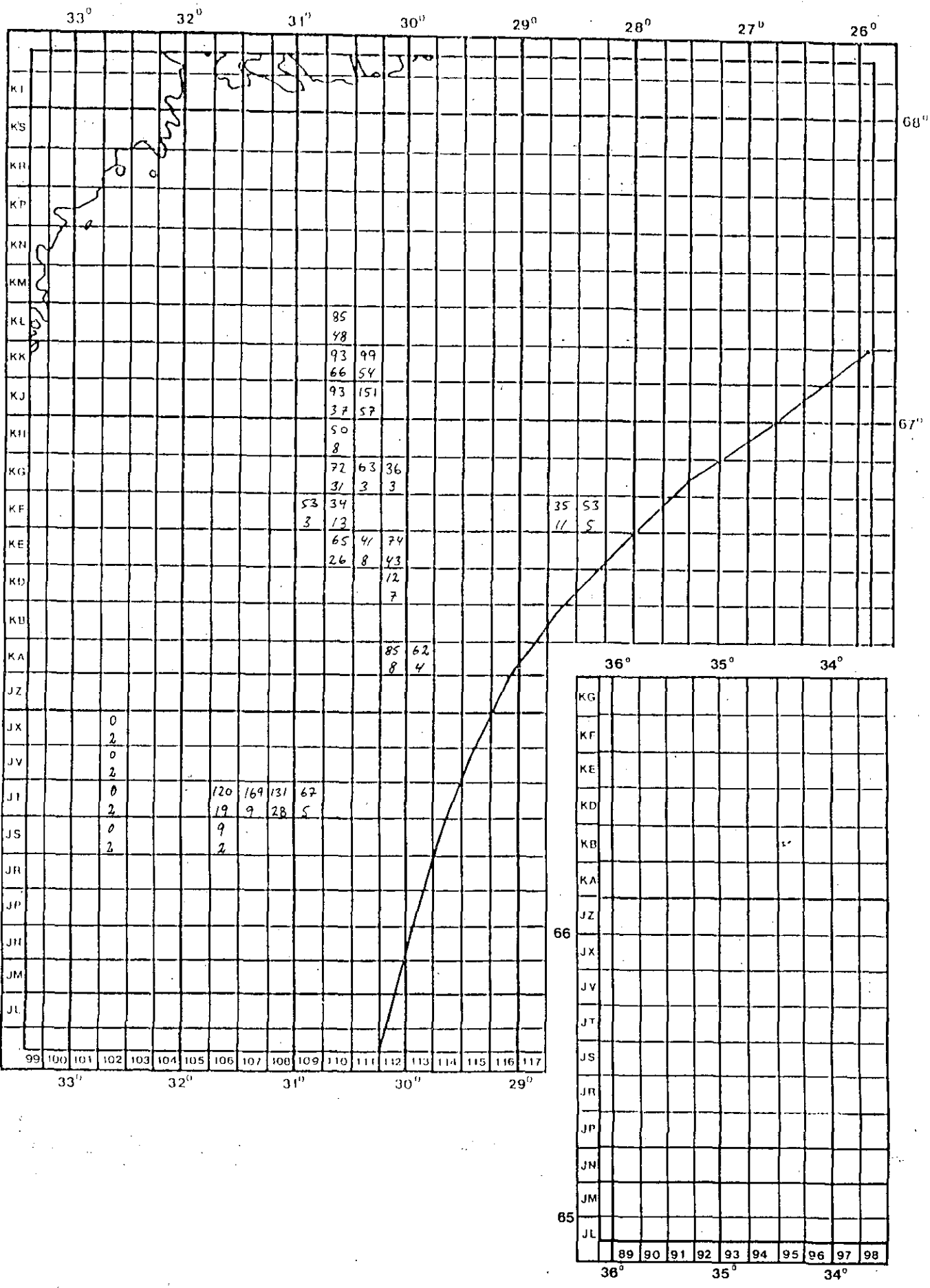


Figure 2 continued. Data from November 1991.

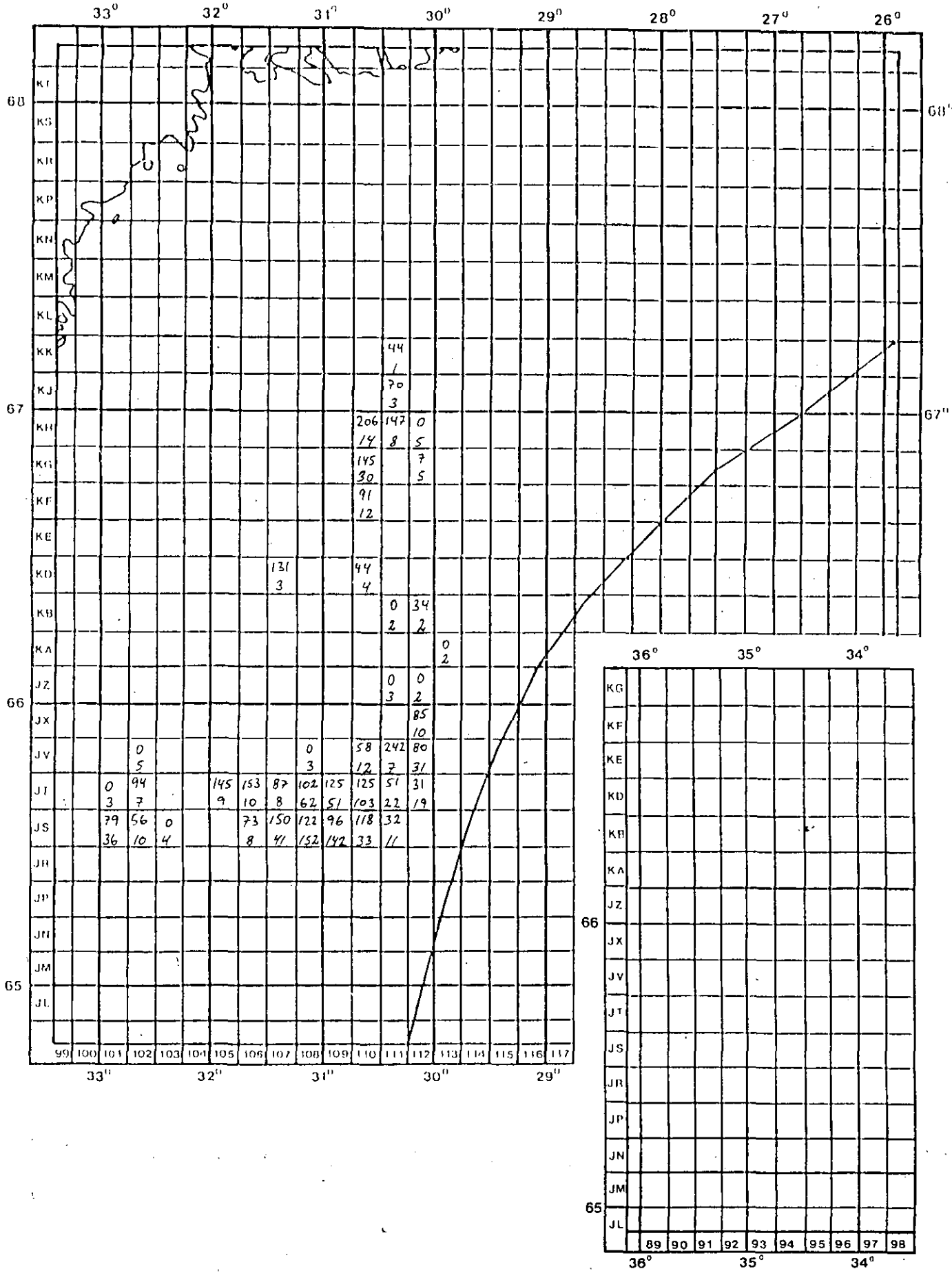


Figure 2 continued. Data from December 1991.

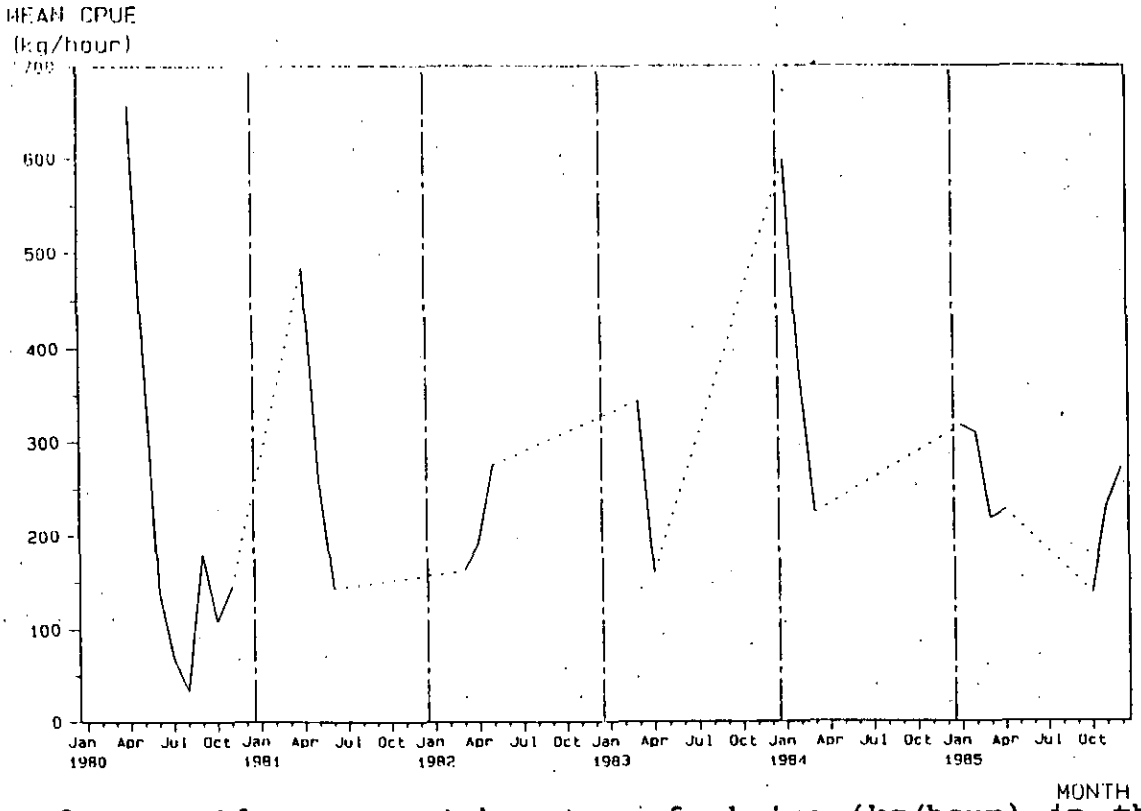


Figure 3a. Monthly mean catch rates of shrimp (kg/hour) in the main fishing area in Denmark Strait from April 1980 to December 1985, based on logbook information from the Greenland fishery (and in 1980-82 also in the Danish fishery).

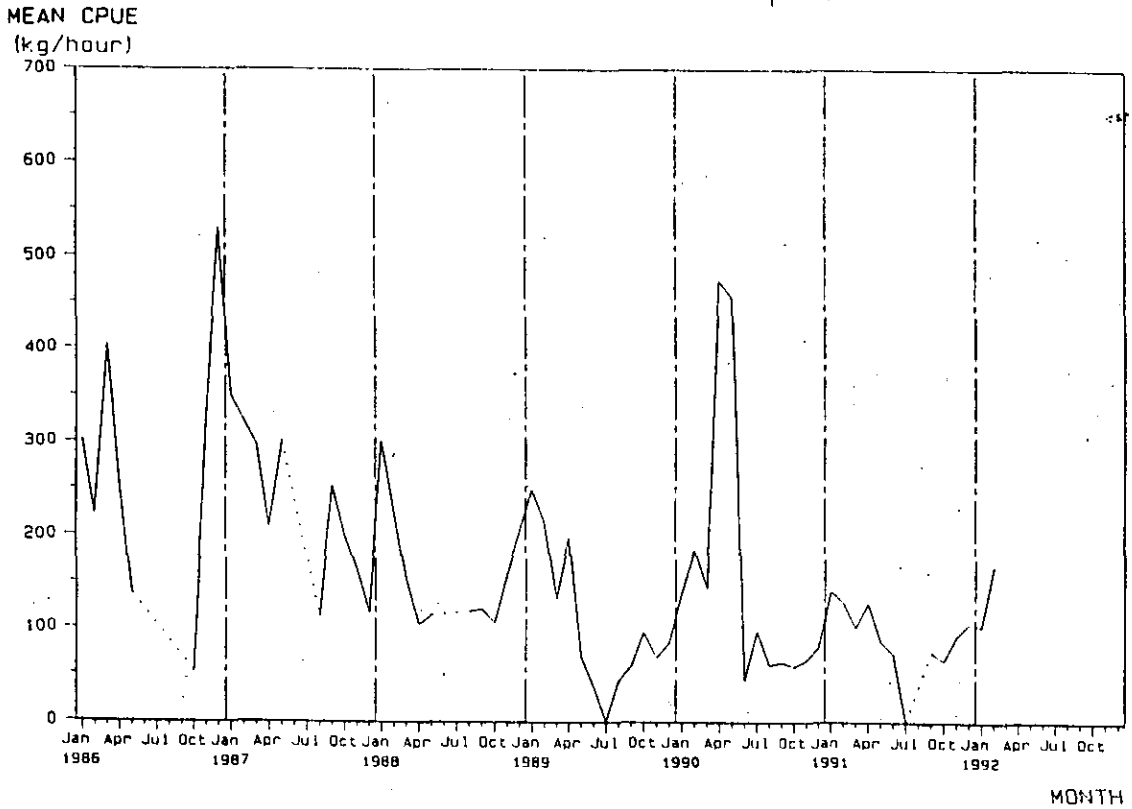


Figure 3b. Monthly mean catch rates of shrimp (kg/hour) in the main fishing area in Denmark Strait from January 1986 to February 1992, based on logbook information from the Greenland fishery.

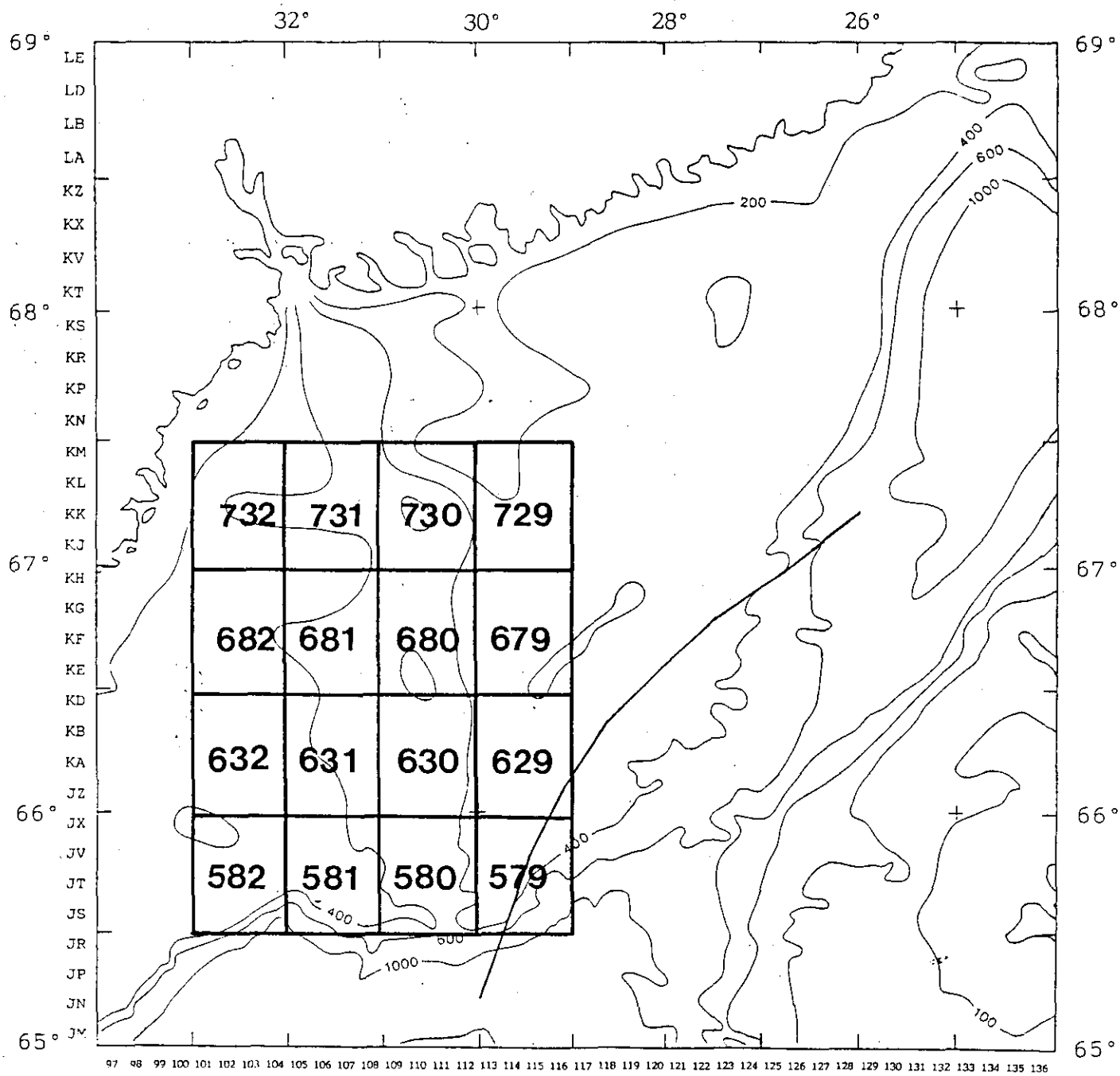
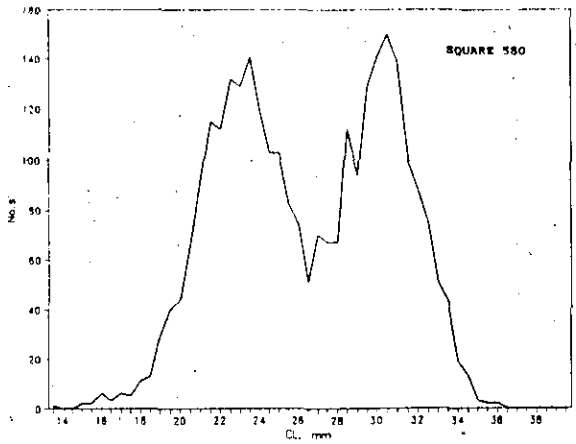
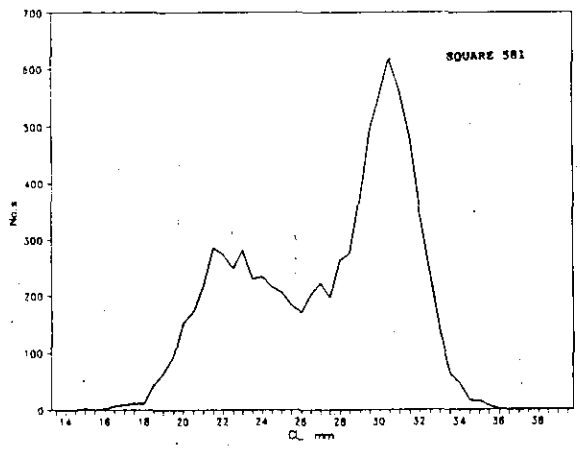


Figure 4. Map showing numbering of statistical units (Iceland system).





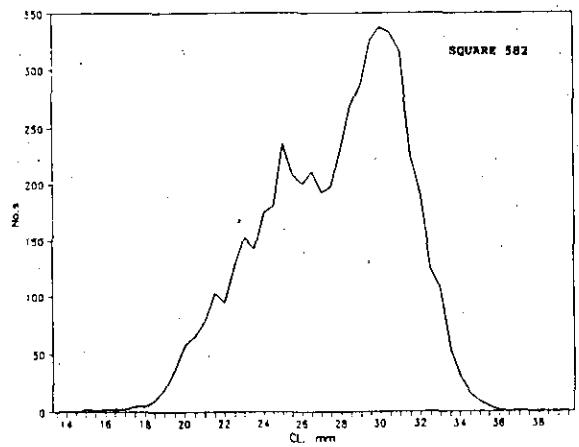


Figure 5a. Pooled shrimp samples from January 1991 sampled in different statistical units (see Fig. 4).

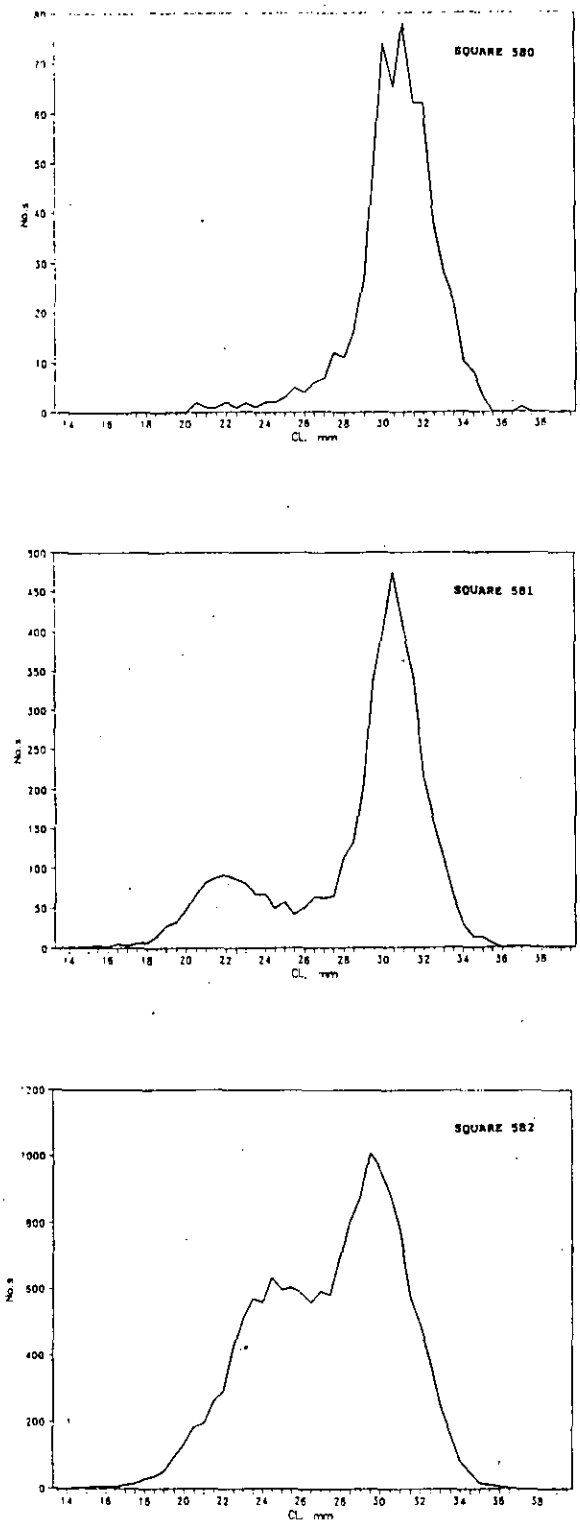


Figure 5b. Pooled shrimp samples from February 1991 sampled in different statistical units (see Fig. 4).

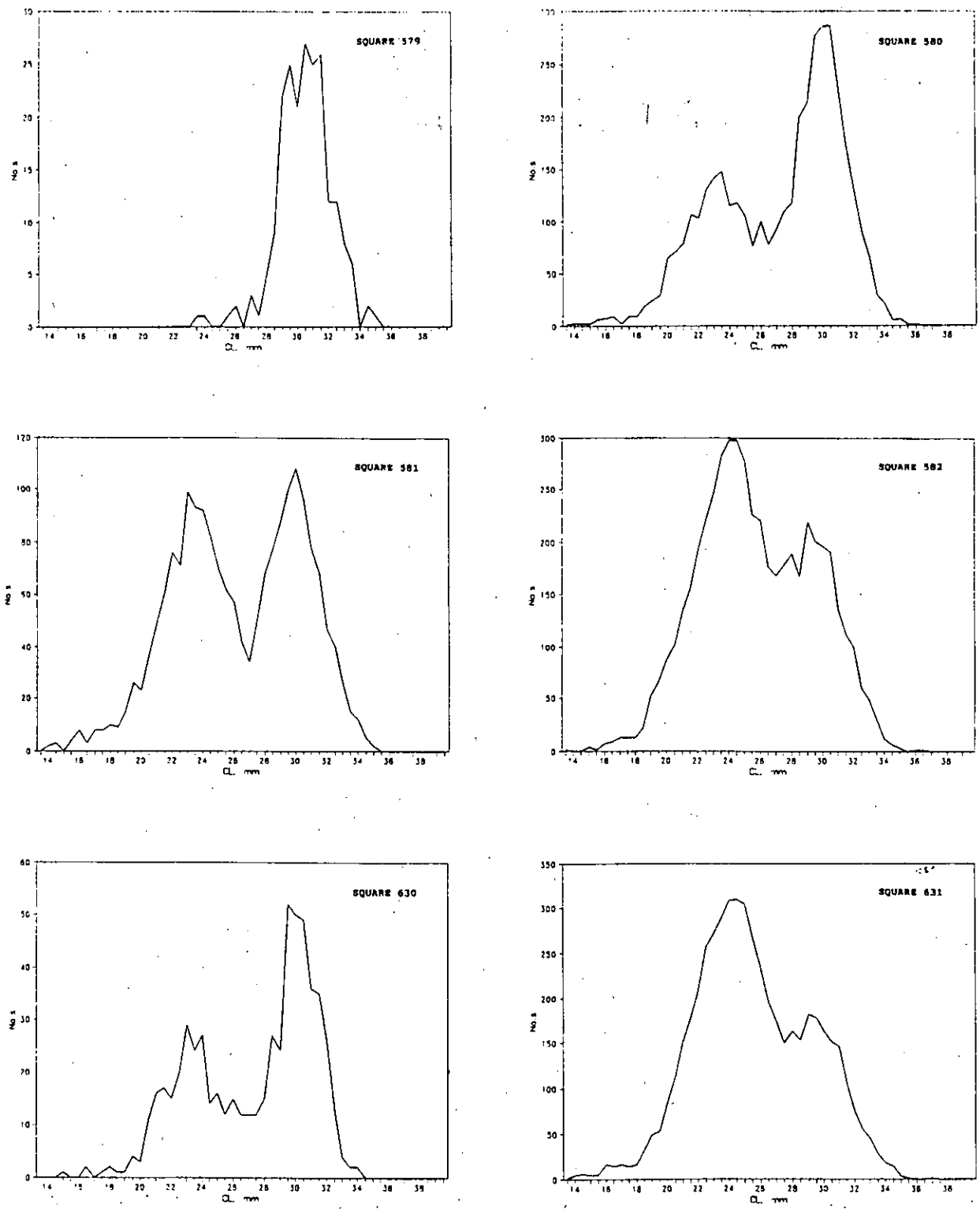


Figure 5c. Pooled shrimp samples from March 1991 sampled in different statistical units (see Fig. 4).

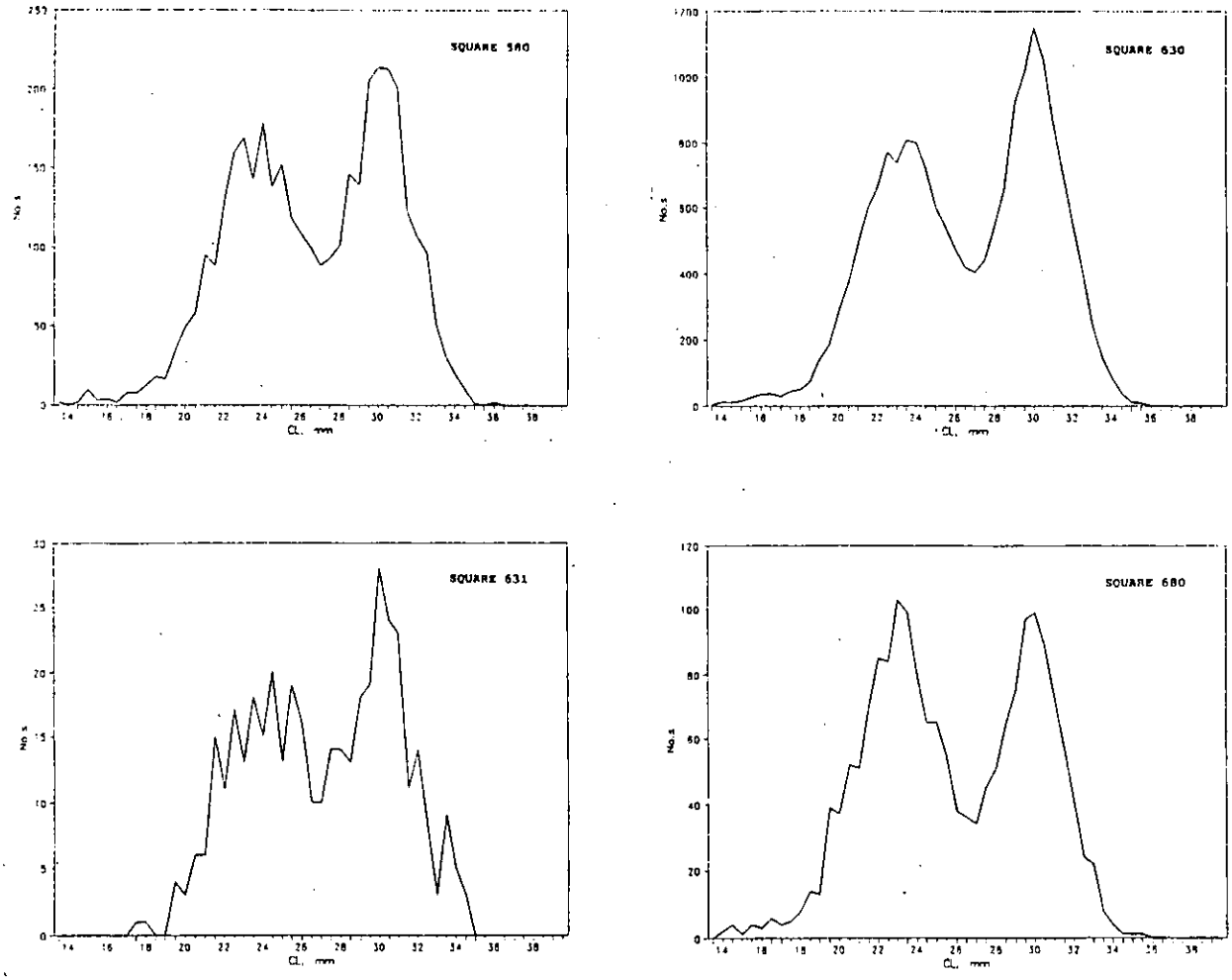


Figure 5d. Pooled shrimp samples from April 1991 sampled in different statistical units (see Fig. 4).

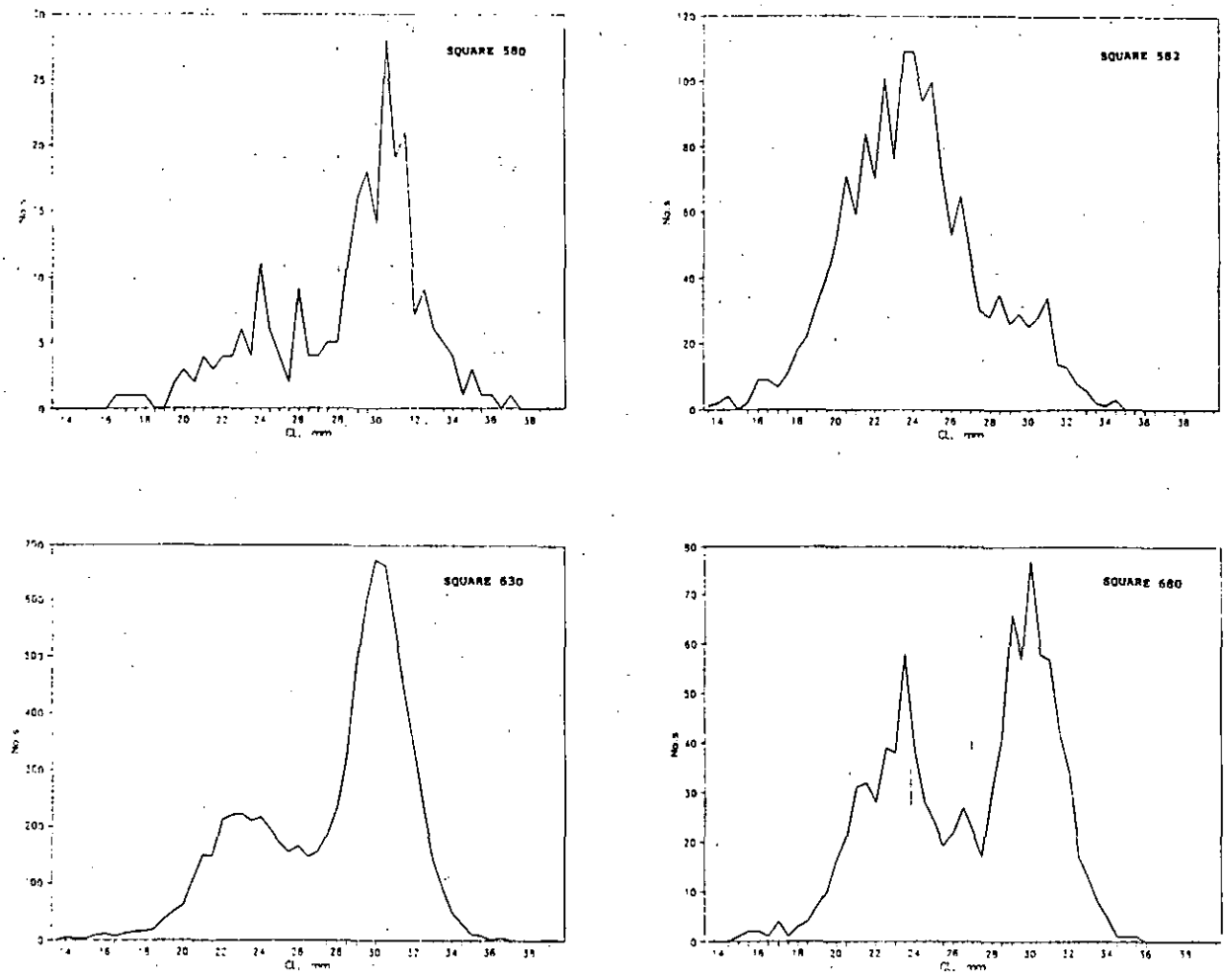


Figure 5e. Pooled shrimp samples from May 1991 sampled in different statistical units (see Fig. 4).