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The Northern Shrimp (Pandalus borealis) Fishery in Division 0A, 1985

by

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Introduction

Preliminary quota reports to December 31, 1985 indicate that vessels fishing shrimp for Canada in Division 0A caught a total of 3071 t or 50% of the 6120 t quota. This represents an increase of approximately 800 t over the previous year's catch (2279 t). Ten vessels participated in this fishery but not concurrently. Four accounted for 87% (2662 t) of the total catch and three vessels caught less than 40 t in total. The fishery began on June 8, about a month earlier than in previous years, and continued into the third week of November.

Observer coverage for foreign-owned vessels was maintained at 100% in 1985 providing data for each month of the fishery. Also, an observer was onboard a Canadian vessel which fished briefly in Division 0A from August 8 to 10. Fishing logs were available for most vessels, both foreign and domestic. No samples were collected in 1985 from which detailed biological information could be obtained (i.e. sex and maturity stages). Included in this paper are distribution of catch and effort for 1984 and 1983 (updated), size composition of the catch and observations on by-catches and discards.

Materials and Methods

Monthly catch and effort data were compiled from observers' reports and vessel logs from 1979 to 1985. The 1984 (vessel logs) and 1985 (observers' reports and vessel logs) effort and the associated CPUE for each month were plotted by Danish statistical square. Length frequencies (0.5 mm CL) obtained by observers from the total catch and from discarded shrimp were summarized by month over 100 m depth intervals. Data on by-catch were summarized as a percentage of the total observed catch in each month. Estimates of the proportions of discarded shrimp also were derived from observers' reports and vessel logs.

Results

Effort and CPUE

The monthly catches (kg) per hour fished from 1981 to 1985 show a characteristic decline in catch rates over the season (Fig. 1, Table 1). From 1982 to 1985, the decline (June to September) was followed by a leveling off in catch rates during September to November. In 1985, there appears to have been a recovery of catch rates late in the season, approaching the July level. The recovery was most noticeable in October from the vessel log data series compared to November from observers' reports.

Weighted catch rates for the July to September period based on observers' reports were 315, 344, 409, 330, 338, and 321 kg per hour from 1980 to 1985, respectively. The decrease in catch rate between 1984 and 1985 was 5%. Data from vessel logs for the same months produced catch rates of 338, 374, 304, 294, and 290 kg per hour from 1981 to 1985, respectively. The decrease between 1984 and 1985 was only 1.4%.

The distribution of fishing effort in 1984 as determined from vessel logs (updated from Parsons et al. 1985) showed that most fishing occurred between 58° and 59°W, similar to previous years (Fig. 2). In July-August and November, most fishing occurred south of 68° and north of 67°22.5'N whereas in September and October more effort was expended north of 68°N.

Observers' reports and vessel logs for 1985 reflected the increased access to the fishing grounds over the previous year (Fig. 3 and 4). Some fishing occurred north of 68°N in all months but the general pattern of effort distribution was similar to that in 1984. In

October, most fishing occurred in the western portions of the grounds compared to other months when effort was typically concentrated near the median line. Data for the individual squares indicate that, generally, catch rates were higher in these western areas during this period.

Length Distributions

Size composition of the catch by 100 m depth intervals (Fig. 5) indicates similar sizes and abundance (number per hour) in both depths from June to August. The expected pattern of smaller shrimp in shallower water was not apparent. Two modal size groups occurred in the catches in all months, 21-22 mm (males) and 25-26 mm (females). The larger female mode dominated in June but subsequently decreased in abundance through to September when, in the deeper water, the male mode dominated. Most egg-laying occurred in September and data from October and November indicated a lower proportion of non-spawning females, relative to the levels observed in the 1984 fishery. Ovigerous shrimp also were present in June, the end of the previous ovigerous period.

After egg-laying, females again dominated in the catches and, apparently, were more abundant in deeper water. In November, catches consisted almost exclusively of females in both depth intervals. No smaller size group of males (about 19 mm) was obvious from the data as in the previous year and shrimp less than 18 mm were virtually absent.

Shrimp Discards

Estimates of shrimp discards in 1985 from observers' reports can be compared to those obtained for each of the previous five years (Table 2) and to amounts reported in vessel logs. Estimates ranged from 4.0% in June to 2.2% in November and except for October were lower than those observed in 1984. Discarding in 1985 appeared similar to the lower rates observed in 1982 and 1983. The vessel log records remain substantially lower than the observers' estimates and, with the apparent exception of 1981, inaccurate reporting of discards is a recurring problem in this fishery.

Length frequencies of discarded shrimp only were available for the month of July (Fig. 6). Generally, the sizes of discards were the same as those occurring in the total catch. Both male and female size groups are represented but they overlap and do not show clearly the bimodality occurring in the random catch samples. Smaller sizes are lacking from discard frequencies, as well.

By-catches

Data on by-catches were obtained by observers for each month of the fishery (Table 3). From June to September, the observed by-catch was around 10% of the total catch weight. The proportion of by-catch increased in October and November to around 25% and 28%, respectively, and is attributed to the increased catches of Greenland shark which characteristically occur at this time of year.

Again, redfish was the most important commercial finfish species occurring in the catches in all months, ranging from 4.15% to 5.91% of the total weight of all species. Greenland halibut comprised 0.51% of the observed catch in June, increasing to 2.12% in November. Other species occurred incidentally in the catches.

Catch rates from 1980 to 1985 show that by-catches of redfish declined during the first four years and then increased in 1984 and 1985. By-catches of Greenland halibut remained at very lower levels during the same period.

	Catch per hour (kg)					
	1980	1981	1982	1983	1984	1985
Redfish	63	32	20	9	16	20
Greenland halibut	2	3	4	5	6	4

Discussion and Conclusions

NAFO (1985) previously concluded that CPUE indices showed an increasing trend in the stock from 1979 to 1982 and stability since then. The 1985 and updated 1984 catch rate data for Division 0A indicate continued stability in abundance in this area. However, because the catch in Division 0A only accounts for a small portion of the total offshore catch, it would be unwise to extrapolate these results over the whole stock area.

The recovery of catch rates late in the season in 1985 apparently was due to a concentration of berried females rather than incoming recruitment. A weekly breakdown of CPUE data from vessel logs shows that the recovery began during the week of September 8-14 (Fig. 7). Length frequencies before and after September 7 show that the only substantial difference in catch composition was the proportion of berried females. There was no evidence of new recruitment but some growth is indicated.

Distribution of fishing effort in recent years has been similar in that most has occurred between 58° and 59°W, 67° and 68°N. Generally, from August to October, the northern areas are more accessible and effort extends north of 68°N during this period. Reasons for the apparent higher abundance in the western portions of the traditional fishing grounds in October, 1985 are unknown. Except for October, there are no other indications of stock migration or displacement over the season.

Length distributions of the catches in 1985 differed from those of the previous year in several ways. There was no indication of smaller shrimp in shallower water as is usually the case for this species and was evident in 1984. After eggs were laid, abundance increased in shallow water in 1984 compared to deeper water in 1985. In the later months of 1984, there appeared to be a greater dependency on male age groups than in the previous year (Parsons et al. 1985). In October and November 1985, females again dominated the catches as in 1983. Also in 1985, there was only one modal group of males evident in the catch sampling data, whereas in 1984 and previous years, at least two were present. The proportion of non-spawning females in 1985 is similar to observations made prior to 1984. A percentage estimate of the spawning failure is not possible, however, due to the lack of detailed sampling in 1985.

The interpretation of ages by Parsons et al. (1985) can be applied to the size composition of the catches in 1985. The modal group of males around 21 mm likely represents the 1980 year-class and the female mode is made up of a number of year-classes, primarily 1978 and 1979. The age four males, present in sampling data of previous years, are lacking in 1985, indicating that the 1981 year-class is weak. The contributions of the 1978 and 1979 year-classes can be expected to decrease in 1986 and the success of the fishery likely will depend on the strength of the 1980 year-class. In the absence of a time-series of catch-at-age data, it is not possible to speculate on the relative strength of the 1980 year-class and the remaining contribution of the 1979 year-class in 1986. However, if the 1981 year-class is weak, decreases in the fishable stock can be anticipated in 1986 and 1987 provided that the observations in Division 0A in 1985 are consistent with other components of the stock.

Discarding of shrimp was also reduced in 1985 over levels observed in 1984. This could be a reflection of a reduction of smaller shrimp in the catches. Even length frequencies of the discards in July showed very few shrimp which might be interpreted as the 1981 year-class, thus reinforcing the possibility that this year-class might be weak.

By-catches of finfish remain at very low levels in this fishery. The increased incidence of Greenland sharks late in the season does cause difficulty, however, resulting in damage to the catch. In some instances, the damage has been minimized by the use of double cod ends.

References

NAFO 1985. Provisional Report of Scientific Council, January 1985. NAFO SCR Doc. 85/I/2, 35 p.

Parsons, D. G., P. J. Veitch and G. E. Tucker. 1985. Catch, Effort, CPUE and Biological Data from the Canadian Fishery for Shrimp (Pandalus borealis) in Division 0A, 1984. NAFO SCR Doc. 85/I/4, Ser. No. N938, 19 p.

Table 1. CPUE (tons per hour fished) by month for Division 0A, 1979-85.

	1979		1980		1981		1982		1983		1984		1985	
Month	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE
A. OBSERVER REPORTS														
May			1	0.496										
June			26	0.481	364	0.487			17	0.518			332	0.555
July			13	0.410	862	0.413	588	0.561	547	0.391	430	0.451	698	0.458
Aug.	48	0.346	177	0.328	795	0.322	653	0.384	503	0.330	203	0.314	453	0.270
Sept.			48	0.261	728	0.306	398	0.317	397	0.272	399	0.275	340	0.236
Oct.	5	0.121			784	0.256	471	0.287	452	0.274	419	0.257	452	0.328
Nov.			22	0.671	798	0.248	421	0.318	181	0.261	117	0.277	262	0.380
Dec.			74	0.343	75	0.161								
TOTAL	53	0.294	360	0.340	4406	0.305	2531	0.363	2097	0.310	1568	0.307	2537	0.347
B. VESSEL LOGS														
June					347	0.465			9	0.405			290	0.487
July			54	0.445	756	0.419	373	0.603	752	0.389	379	0.448	924	0.369
Aug.					665	0.307	650	0.354	1241	0.303	354	0.260	604	0.251
Sept.	42	0.512			585	0.297	458	0.305	798	0.253	398	0.243	414	0.232
Oct.	64	0.220			833	0.258	335	0.268	992	0.248	324	0.237	443	0.309
Nov.	248	0.231			743	0.249	249	0.261	257	0.239	40	0.311	46	0.287
Dec.	16	0.140	62	0.306	72	0.149								
TOTAL	370	0.237	116	0.358	4001	0.299	2064	0.335	4057	0.284	1495	0.300	2721	0.306

Table 2. Shrimp discards in Division 0A, 1980-85.

	1980		1981		1982		1983		1984		1985	
Month	Observed catch (tons)	% Discards	Observed catch (tons)	% Discards	Observed catch (tons)	% Discards	Observed catch (tons)	% Discards	Observed catch (tons)	% Discards	Observed catch (tons)	% Discards
A. OBSERVER REPORTS												
May	1.4	18.0										
June	25.6	15.5	363.9	2.7			16.8	0.6			332.3	4.0
July	12.6	15.7	862.4	2.6	587.8	2.4	547.0	1.6	430.4	6.5	698.4	2.9
Aug.	176.5	6.0	795.1	4.4	653.3	3.3	502.6	3.0	203.2	4.9	453.0	3.3
Sept.	48.5	2.5	727.9	5.6	398.3	3.4	396.5	3.3	398.8	5.8	338.9	2.9
Oct.			784.4	5.7	471.0	3.4	452.3	4.6	419.3	2.8	448.5	3.8
Nov.	21.6	0.0	797.7	3.3	420.7	2.9	181.2	5.3	117.3	6.0	165.1	2.2
Dec.	74.2	1.3	74.8	4.2								
B. VESSEL LOGS												
June			347.4	2.3			16.8	0.3			290.4	1.0
July	53.9	0.2	755.8	1.5	372.6	0.4	752.2	1.0	378.6	0.7	923.9	1.6
Aug.			664.9	1.4	650.3	0.5	1240.9	1.0	353.6	0.5	604.2	1.5
Sept.			585.2	3.0	457.7	1.7	798.3	1.1	398.4	1.3	413.8	1.4
Oct.			833.0	5.1	334.6	2.3	992.1	1.5	324.0	0.6	442.8	1.6
Nov.			742.8	3.7	248.7	1.0	256.6	2.2	40.1	0.9	46.1	1.0
Dec.	62.0	0.0	71.9	4.1								

Table 3. Observed by-catch for Division 0A, 1985

	June		July		August		September		October		November	
	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%	Wt (t)	%
Shrimp (P. borealis)	300.153	90.00	608.456	90.70	417.064	91.61	300.265	90.25	404.911	75.29	142.988	71.87
American plaice	0.237	0.07			0.517	0.11	1.146	0.34	1.227	0.23	0.366	0.18
Cod	0.005	0.00	0.005	0.00	0.048	0.01	0.278	0.08	0.177	0.03	0.142	0.07
Arctic cod	0.155	0.05	0.791	0.12	1.977	0.43	1.065	0.32	4.959	0.92	1.623	0.82
Halibut	0.003	0.00	0.170	0.03	0.131	0.03	0.029	0.01	0.129	0.02	0.119	0.06
Redfish spp.	15.182	4.55	39.623	5.91	22.504	4.94	14.728	4.43	22.344	4.15	10.250	5.15
Greenland halibut	1.714	0.51	3.543	0.53	5.487	1.21	3.505	1.05	6.195	1.15	4.210	2.12
Eelpouts/blennies	0.002	0.00			0.651	0.14	0.673	0.20	0.818	0.15	0.291	0.15
Long-horn sculpin	0.005	0.00			1.239	0.27	0.876	0.26	1.262	0.23		
Skate (unspecified)	3.855	1.16	3.083	0.46	1.915	0.42	2.585	0.78	3.289	0.61	2.470	1.24
Wolffish (broadhead)			0.120	0.02			0.039	0.01	0.553	0.10	0.535	0.27
(striped)	0.235	0.07	0.040	0.01	0.290	0.06	0.960	0.29	0.565	0.11	0.860	0.43
(spotted)	0.115	0.03	0.315	0.05	0.423	0.09	0.345	0.10	0.093	0.02	0.075	0.04
Squid (Gonatus)					0.057	0.01	0.006	0.00				
Shark (unspecified)							0.500	0.15				
Greenland shark	8.665	2.60	9.025	1.35	2.230	0.49	4.930	1.48	87.474	16.27	31.255	15.71
Other	3.227	0.97	5.830	0.87	1.006	0.22	0.876	0.26	3.904	0.73	3.759	1.89
By-catch totals	33.359	10.00	62.414	9.30	38.198	8.39	32.424	9.74	132.883	24.70	55.954	28.12
Grand totals	333.511	100.00	670.869	100.00	455.261	100.00	332.688	100.00	537.794	100.00	198.943	100.00

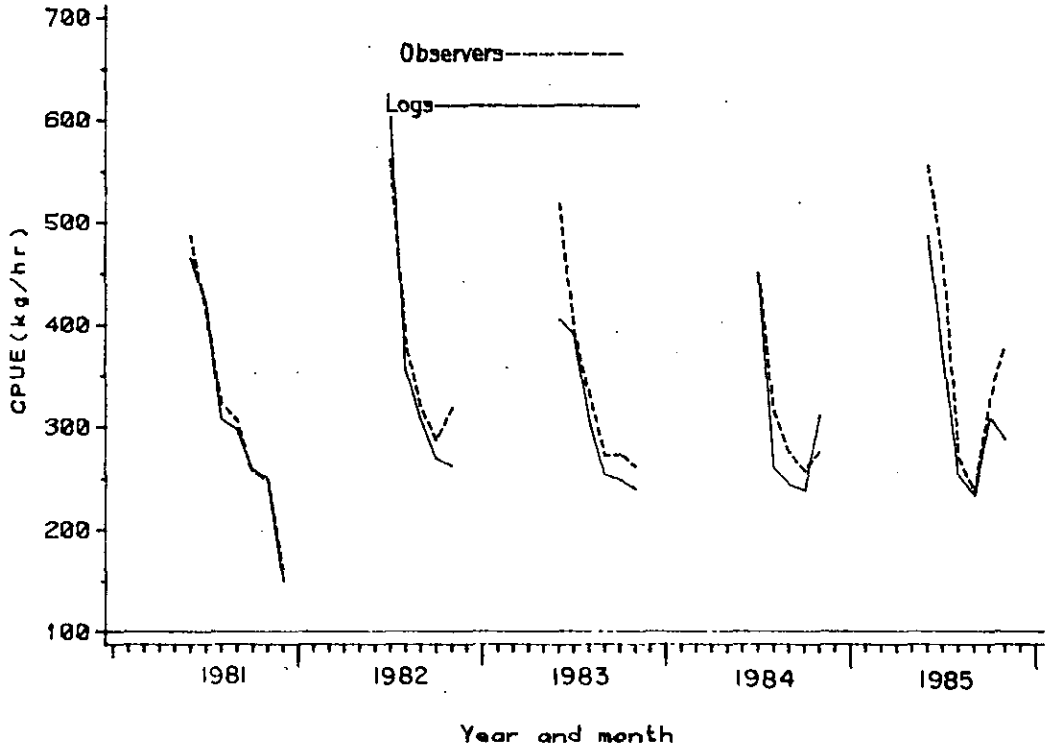


Fig.1. Monthly CPUE (kg/hr) for vessels of tonnage classes 4,5 and 6 in Division 0A,1981-1985.

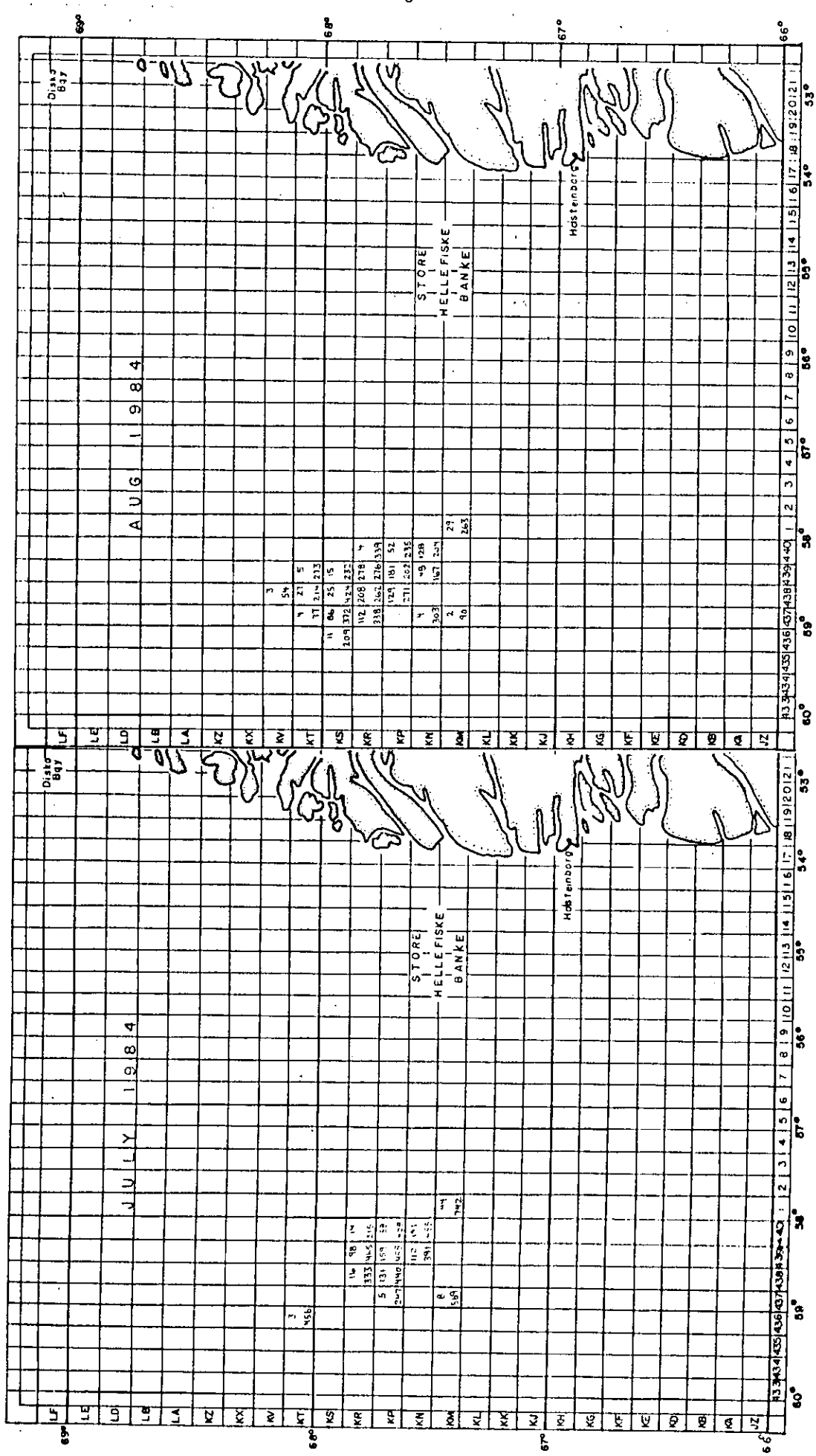
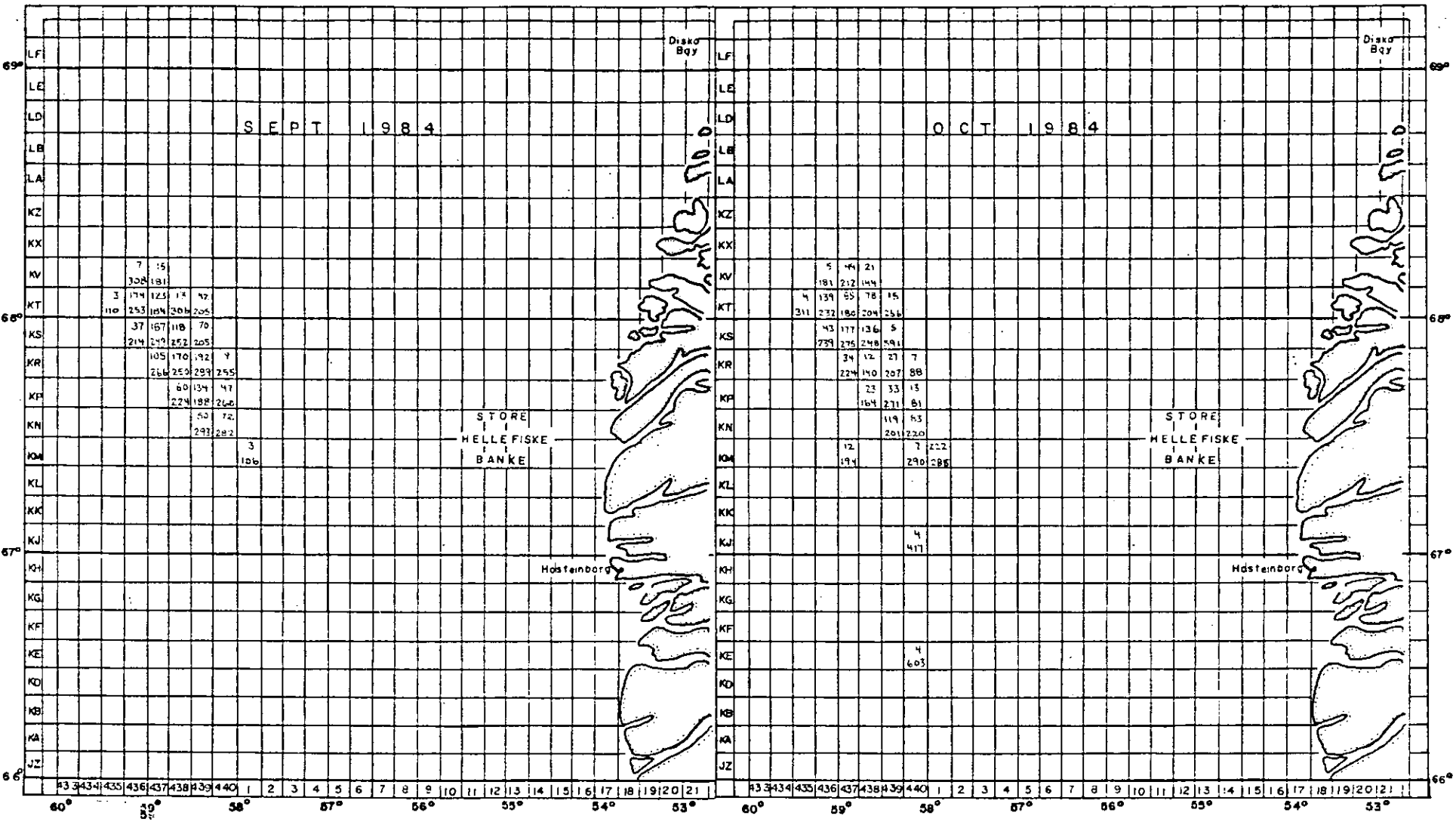


Fig. 2. Hours fished (upper) and kg/hr (lower) by statistical square, 1984, from vessel logs.



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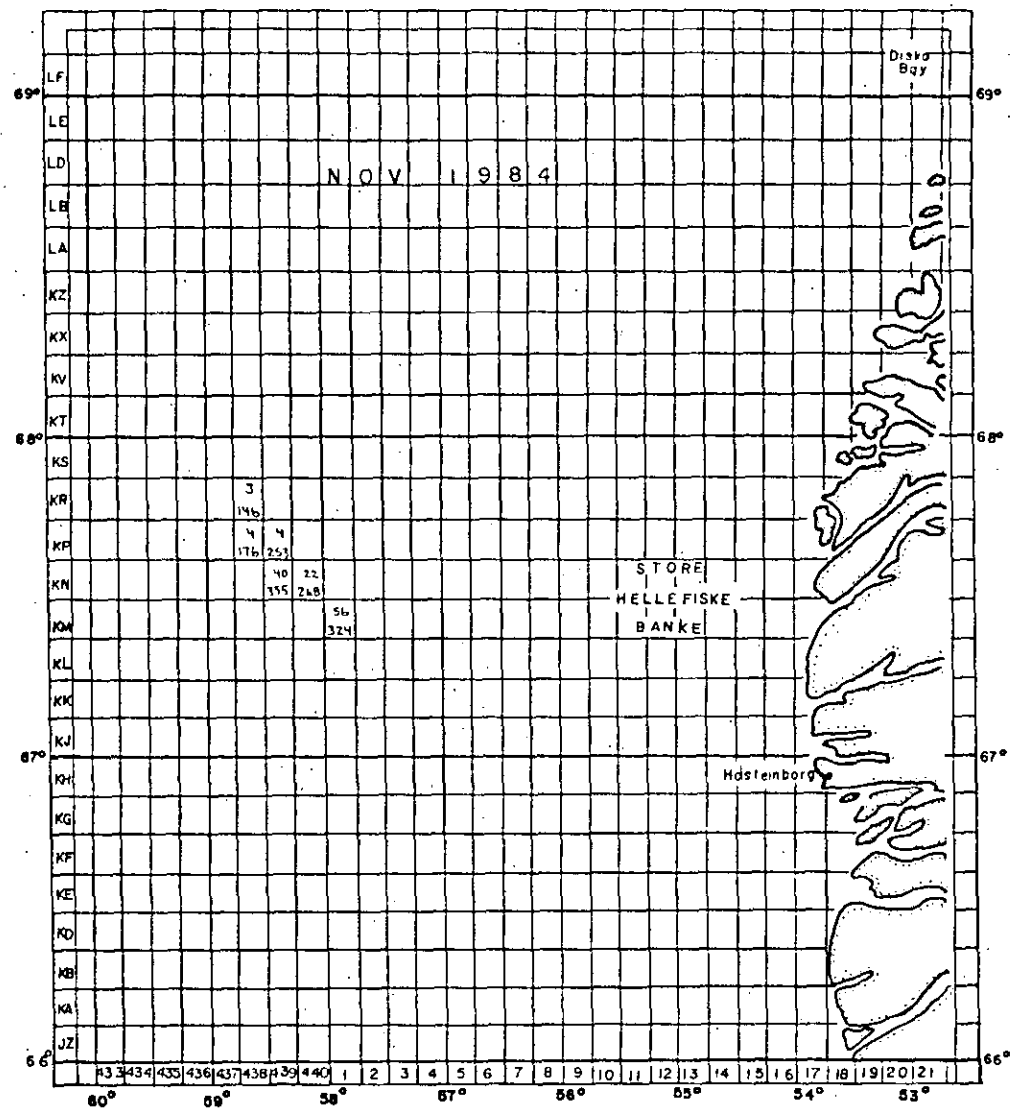

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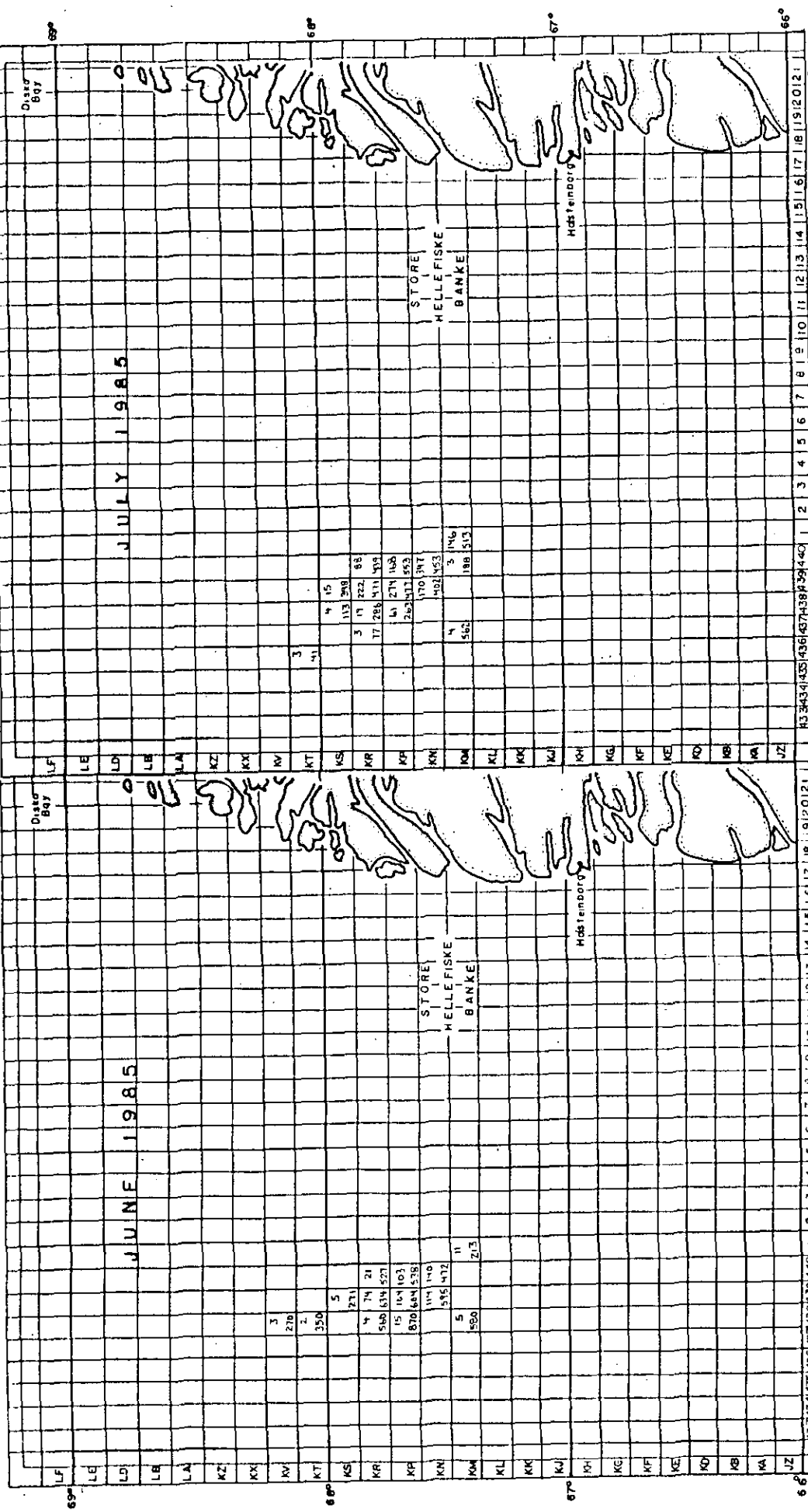
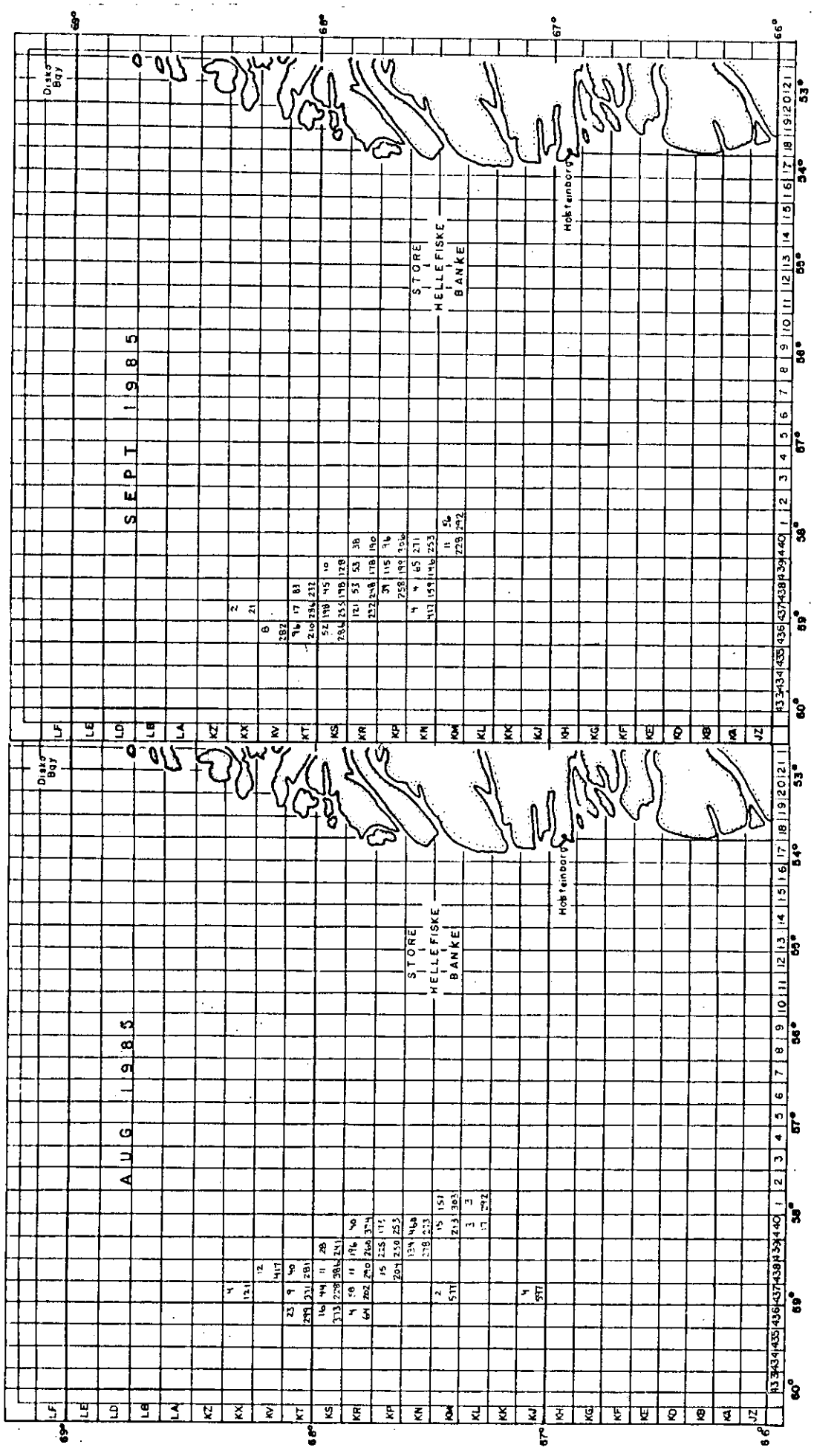


Fig.3. Hours fished (upper) and kg/hr (lower) by statistical square, 1985, from observer reports.



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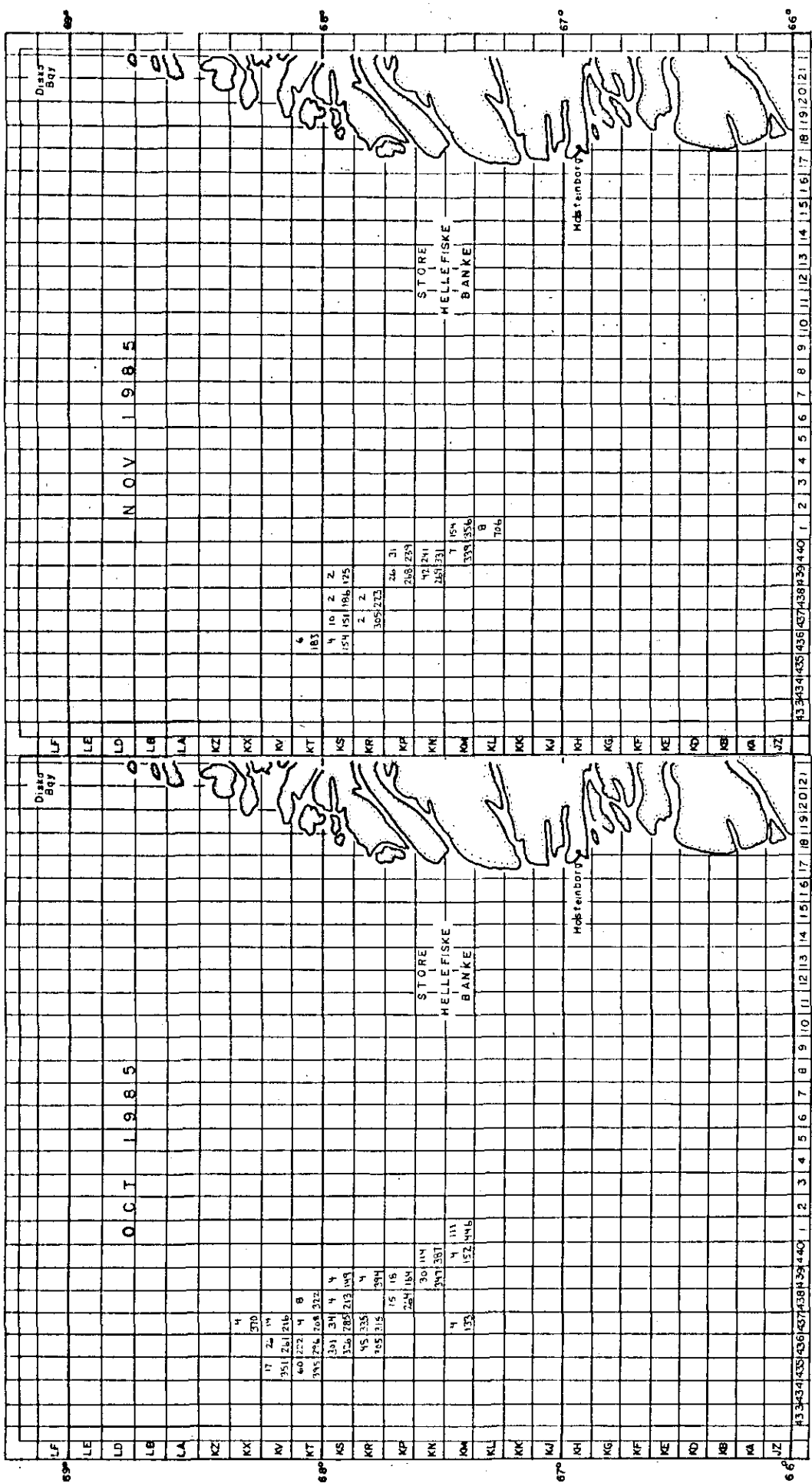

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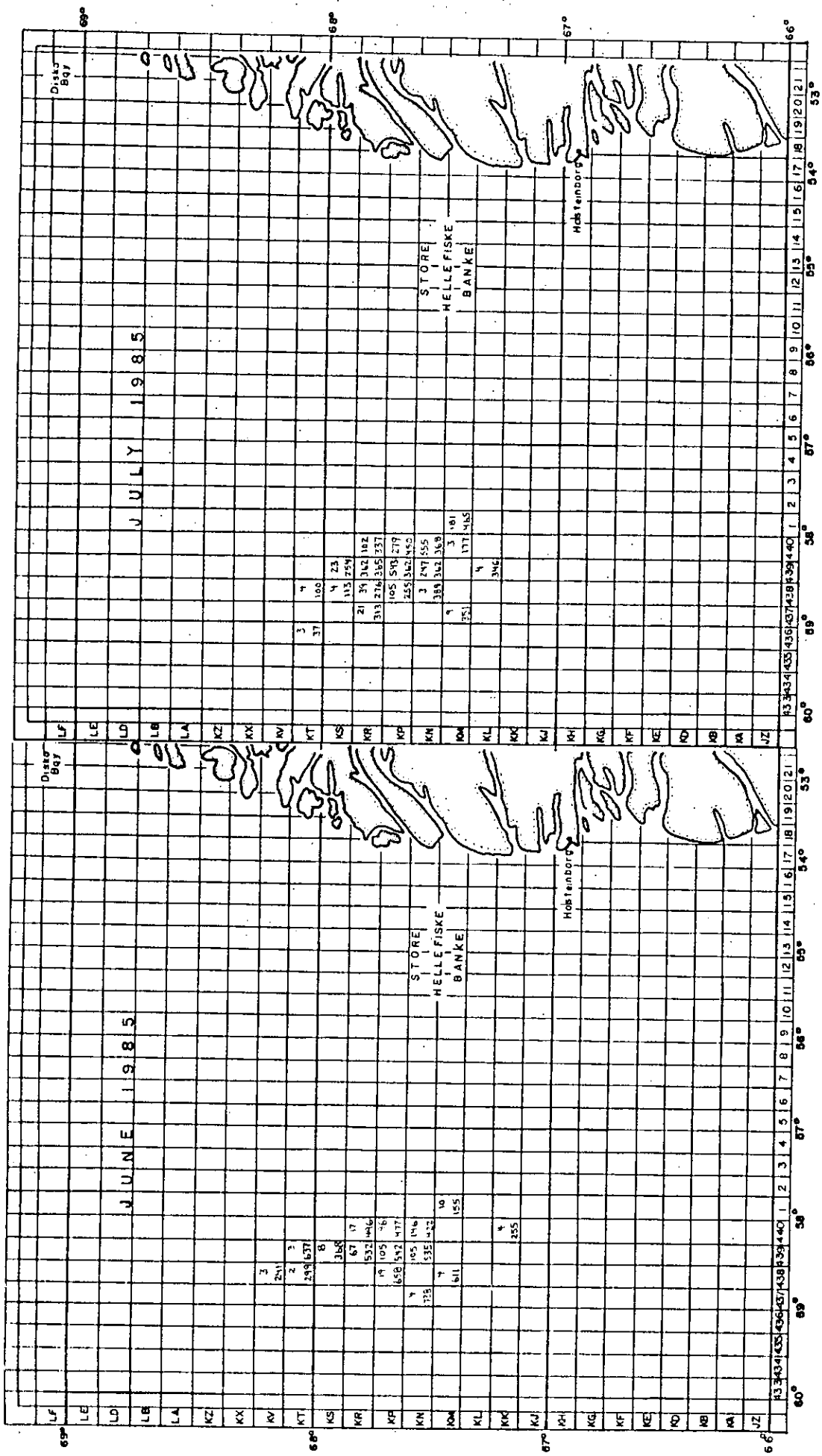
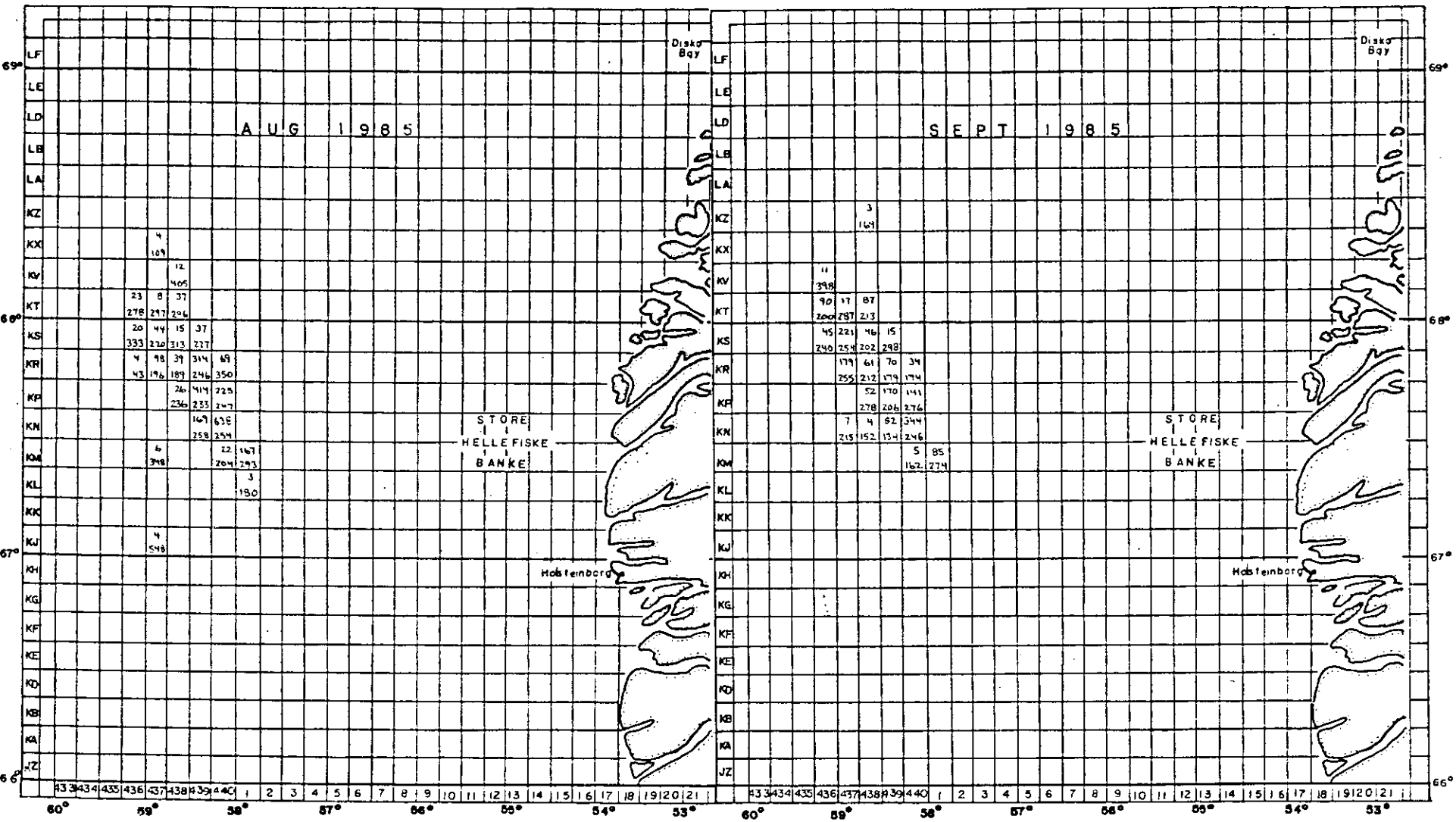


Fig.4. Hours fished (upper) and kg/hr (lower) by statistical square, 1985, from vessel logs.



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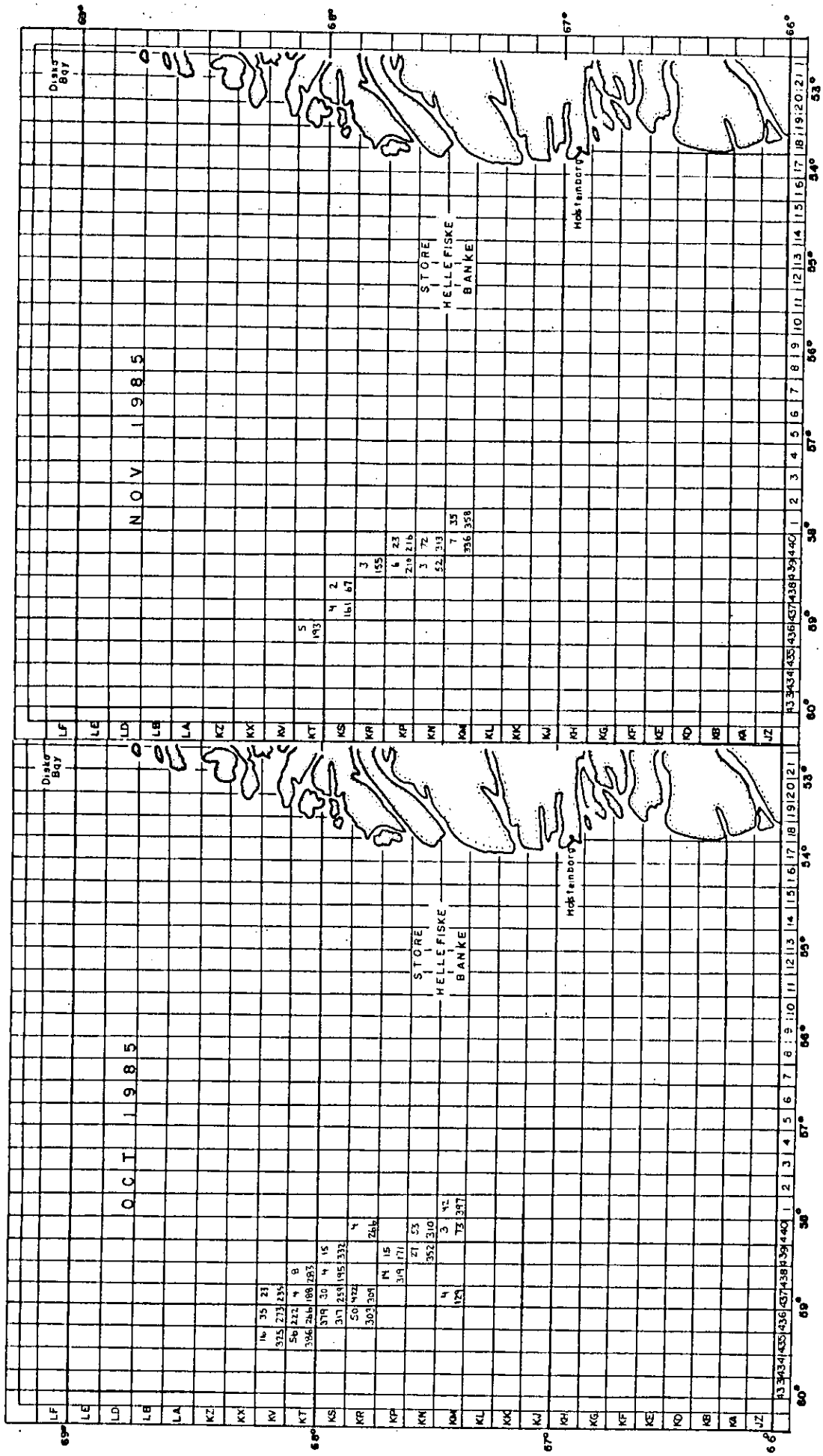

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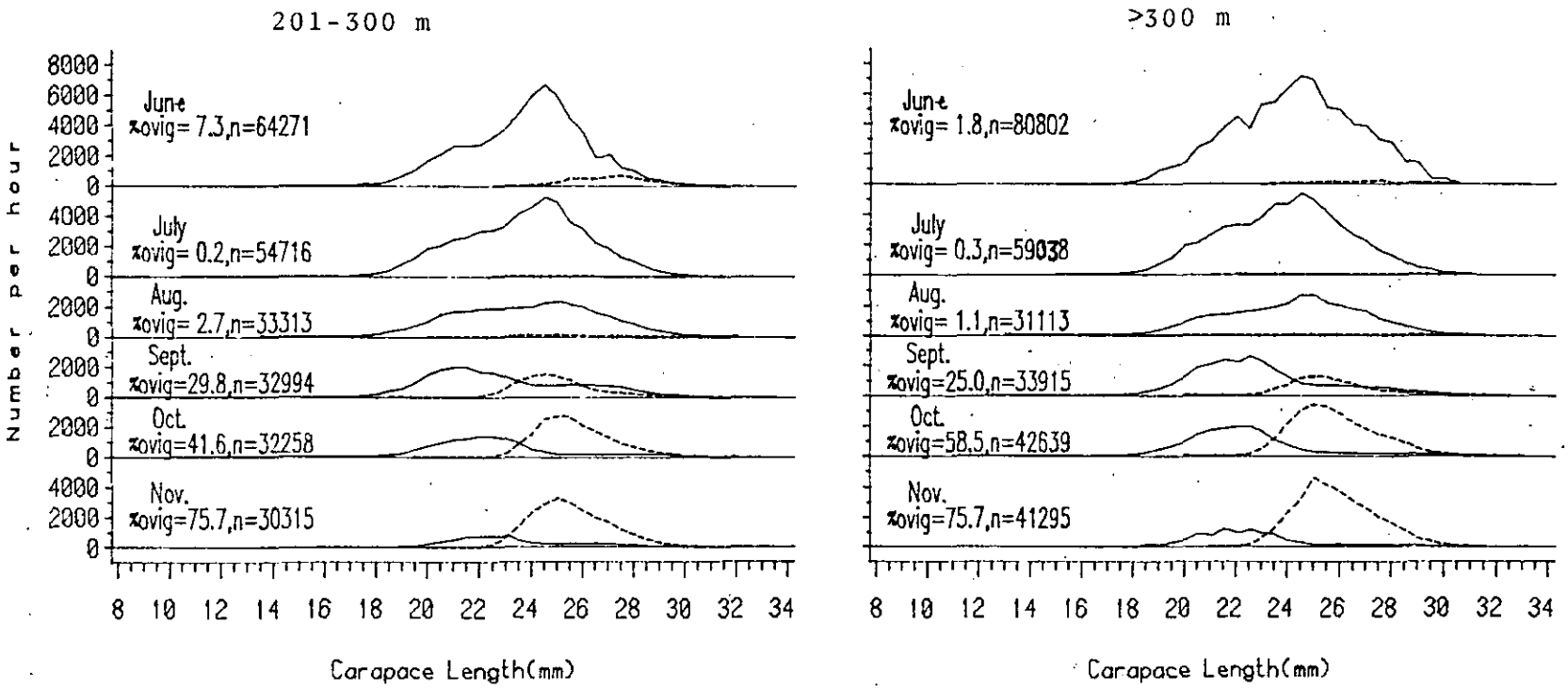

Fig.5. Commercial length frequencies by month and depth interval, Division OA,1985.(Ovigerous represented by broken line.)
n = number per hour.

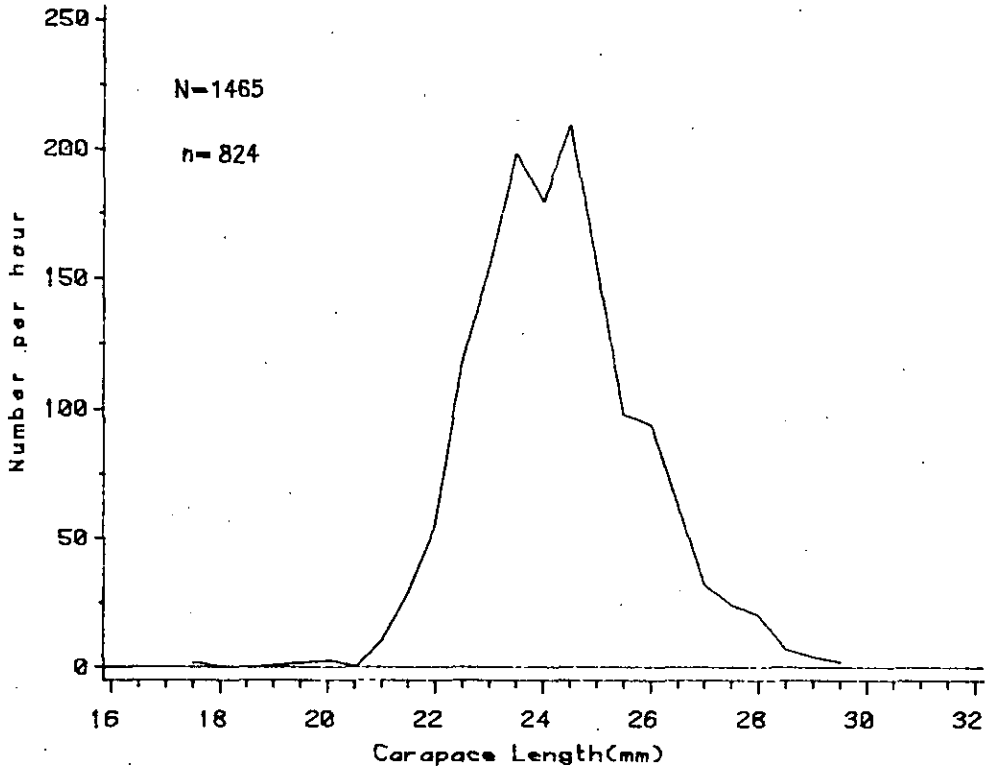

Fig.6. Length frequency for discarded shrimp, Division OA, July, 1985.
N = number per hour.
n = number measured.

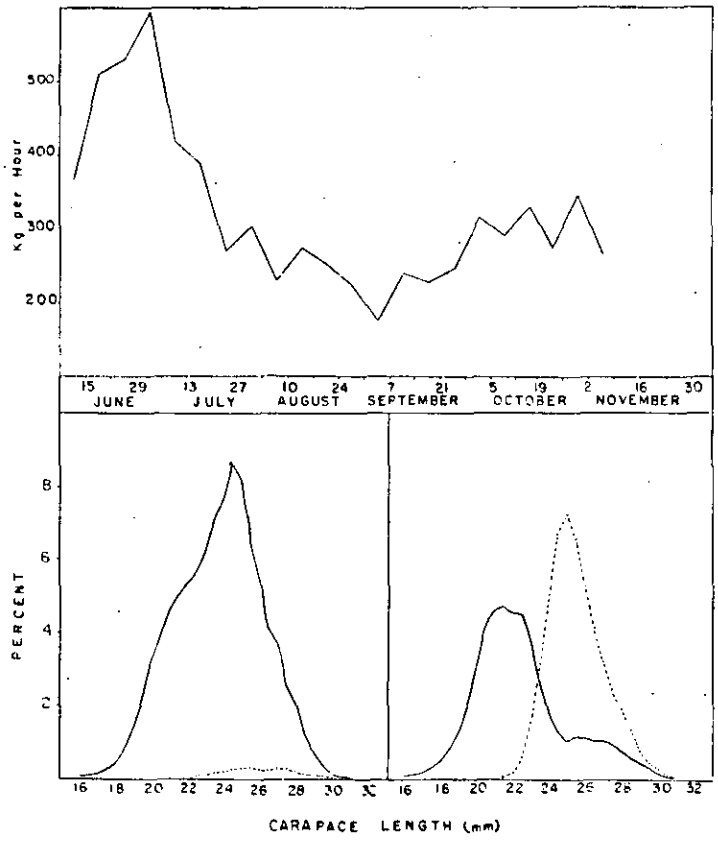

Fig.7. Weekly CPUE (kg/hr). Division OA, 1985 and length frequencies before and after September 7.