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Observations and Studies on SA2 + Div. 3K Capelin in 1990

by

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Abstract

This paper documents recent information relevant to capelin in SA2 + Division 3K.

Part A contains results of the Canadian acoustic survey conducted during October 6-28, 1990. Total biomass for the survey was estimated at 96,339 tons, a large decrease from the estimates for the preceding most recent years. The 1987 and 1988 yearclasses were dominant in samples obtained during the survey.

Part B contains information on commercial catch rates and age compositions from the offshore fall fishery. The 1990 catch rate of 5.87 tons per hour was slightly lower than the 1989 rate of 6.12 tons per hour. Because the fishery was restricted in area by regulation since 1988, the catch rate may not reflect stock status.

Part C contains detailed information on the distribution of capelin catches during bottom trawl surveys in Divisions 2J3KL during the autumn in years 1978-90. Most capelin catches were small in 1990 and were recorded in 35% of sets made.

Résumé

Ce document présente certaines données récentes sur le capelan de SA2 et de la division 3K.

La partie A contient les résultats de relevés acoustiques effectués du 6 au 28 octobre 1990. On a estimé la biomasse totale à 96 339 tonnes, ce qui représente une forte diminution par rapport aux estimations des années antérieures les plus récentes. Les classes d'âge de 1987 et de 1988 dominaient les échantillons recueillis.

La partie B contient des renseignements sur les taux de prises commerciales dans la pêche hauturière d'automne ainsi que sur la composition de ces prises selon l'âge. Le taux de prises de 1990, soit 5,87 tonnes à l'heure, était légèrement inférieur à celui de 1989 (6,12 tonnes). Comme un règlement restreint la pêche dans ce secteur depuis 1988, le taux de prises ne reflète pas nécessairement l'état des stocks.

La partie C contient des renseignements détaillés sur la répartition des prises de capelan obtenues lors de relevés au chalut de fond réalisés durant l'automne, de 1978 à 1990, dans les divisions 2J3KL. En 1990, 35 % des traits ont produit des prises de capelan, faibles pour la plupart.

Introduction

The capelin fishery in NAFO Subarea 2 and Div. 3K was, until 1972, limited to inshore catches during the spawning season. In 1972, substantial catches were taken offshore by vessels from several countries, and these peaked in 1976 at 212,000 t before declining during the late 1970's to 11,000 t in 1979. Since then, 1980-90, the USSR has conducted the only directed fishery offshore. Throughout its history, the offshore fishery has generally been conducted during August-December with peak catches occurring in September-November. During 1979-82 and again in 1985 and 1988, the catches were taken in Div. 2J only, but in other years catches have also been made in Div. 3K.

In recent years, an inshore directed roe fishery during June and July has developed, primarily in Div. 3K.

The offshore fishery first came under quota regulation in 1974 and the inshore fishery in 1982. Catches and TAC's ('000 t) since 1980 are as follows:

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Offshore TAC	5	10	10	10	17	17	17	31	17	20	71[1]
Nominal catch	5	10	10	10	17	17	17	31	17	22	57[2,3]
Inshore											
TAC	-	-	3	11	8	8	19	9	22	25	29
Nominal Catch	1	2	4	4	7	7	12	11	26	27	33[3]

1) Comprised of 21,000 TAC and 50,000 SeaFreez allocation.

2) USSR catch comprised of 21,000 against TAC and 36,000 from SeaFreez allocation.

3) All 1990 catches are preliminary data.

This paper provides data pertaining to distribution of the fishery, age composition of the catch, and catch rates for the 1990 USSR offshore fishery.

Part A: Acoustic survey

Methodology

The survey was conducted from the research vessel GADUS ATLANTICA during the period October 6-28, 1990. The configuration of the acoustic data acquisition system was the same as in 1989 with the exception of the transducer which was changed. The calibration parameters of the system were as follows:

Combined source level/receive sensitivity	56.66 dB
Fixed receiver gain	1.24 dB
TVG gain	20 log R
Attenuation coefficient	.012 dB/m
Pulse length	600 microseconds
Bandwidth	3.3 kHz
Average beam pattern	-28.79 dB
Target strength	-34 dB/kg

The survey design was random parallel transects with a minimum allowable spacing of 1 nautical mile as recommended by the CAFSAC Pelagic Subcommittee (O'Boyle and Atkinson 1989). Strata outlines and transect locations and fishing set locations are shown in Figure 1. The area surveyed was identical to that covered in the 1989 with the addition of a strata (A) in the south. Estimates of mean biomass and backscatter and their standard error were calculated the same as for the 1989 survey. As noted for previous surveys, this variance accounts only for the sampling design and does not include any variance due to error in the target strength value used or the measurement of the calibration parameters of the acoustic data acquisition system.

Fishing sets were made on an opportunistic basis throughout the survey. It was attempted to have at least one set for each twelve hour watch and at least one set for each transect. A random sample of 200 capelin was obtained from each midwater trawl set for length, sex, and maturity observations and a stratified age sample was selected from each length/sex/maturity sample. Length composition and an age/length key was constructed for each stratum from the samples obtained in that stratum.

Results and Conclusions

Table 1 gives estimates of acoustic backscatter and biomass for each strata and for the total survey. Total biomass was estimated at 96,339 tons with a coefficient of variation of 0.170. Table 2 provides estimates of backscatter and biomass for each acoustic transect and shows the distribution of the biological sampling amongst the acoustic transects. Table 3 gives the total age composition for the historical period of acoustic biomass estimates. Table 4 provides for each strata, the percent at age by number, the mean length at age, total numbers and mean length and the number of samples used. Figures 2 to 10 show the distribution of capelin encountered during acoustic surveys over the period 1981 to 1990. The data were gridded and contoured using the PC software package 'SURFER'. The minimum contour level (10g's/sq. m) and interval (20g's/sq. m) are the same for all years.

The biomass estimate of 96,339 tons is comparable in size to the 1987 and 1983 estimates (Table 3) but is greatly reduced from the 1989 estimate of 1,744,100 tons. Preliminary results from the USSR acoustic survey carried out during November, 1990 indicate a biomass estimate of approximately 600,000 tons (Bakanev, pers. comm.). Qualitative examination of the echograms from the USSR survey indicate that significantly more capelin were observed than during the Canadian survey. The large drop in the estimated biomass from 1989 to 1990 from the Canadian surveys is probably not a true reflection in actual biomass but instead reflects a change in distribution of capelin during the Canadian survey period.

Part B: Offshore Capelin Fishery

Discussion

The TAC allocated to the USSR fleet in 1990 was 21,000 tons. Preliminary catch figures indicate a total catch of 21,087 tons against this allocation. Subsequent to TAC allocations to both the USSR and Canada for 1990, an additional TAC allocation of 50,000 tons was made to the Canadian company 'SeaFreez' which they transferred to the USSR in return for an agreement with the USSR to provide frozen cod from the Barents Sea for processing in SeaFreez fish plants. The USSR caught an additional 36,508 tons of capelin from this allocation transfer. Table 5 indicates catch by month, division, and allocation for the USSR in 1990. Tables 6,7,8 give historical catches by Division and in total since 1972. Figures 11a,b show the distribution of the offshore commercial fishery catch over time for each NAFO division. The pattern of fishing is most similar to that of 1986 and 1987 before an area was closed to fishing in 1988 because of complaints of gear conflicts with Canadian gillnet/longline fishermen. The area, designated A and B (Figure 12) has been closed to all USSR trawlers between August 1 and October 31 since 1988. All areas were open to USSR trawlers after October 31 and the fishery moved into and south of the closed area during November and December in 1990.

Offshore Catch Rates

As in past years, catch rates are available from two sources, NAFO statistics and a combination of USSR/observers. The NAFO data (Table 9) are available only up to 1989. The second series (Table 9) is a combination of USSR estimates (Seliverstov and Serebrov 1979) for 1971-78 and observers (Foreign Cooperative Research Section, D. Kulka, pers. comm.) Monthly catch rate estimates from observers are given in Table 10.

With the addition of the 1989 NAFO data, the discrepancy between the catch rate series continues (Fig. 13). In theory, there should be no difference in the trends between the FCR series and the NAFO series since the FCR series is essentially a subset of the NAFO series. The observers have usually observed a significant portion of the catch, especially in recent years when efforts have been made to place an observer on each vessel (Table 11).

Age-compositions from the Offshore Fishery

Age-compositions from the offshore fishery are given in Table 12. A relatively high contribution of three-year-olds is usually indicative of a strong year-class (compare to the years 1976 and 1986 for 1973 and 1983 year-classes respectively). Thus, the pattern in 1989 indicates that the 1986 year-class is probably stronger than average while the 1987 may be weaker than the 1986 year-class.

Part C: Canadian Bottom-Trawl Surveys

By-catches of capelin during autumn bottom-trawl surveys in NAFO Div. 2J3K have been compared with geographic coverage by Canadian acoustic surveys for capelin to help determine whether coverage by the acoustic survey has been adequate (Carscadden et al. 1989, 1990). Such comparisons must be treated with caution because in each year the bottom-trawl survey requires about 6 weeks (Carscadden et al. 1989) and does not start until the acoustic survey has been completed. Thus, for any point in space, the duration between coverage by the two surveys could range from one week to two months. It is possible that the capelin move during this period, with the most likely movement being toward the south and east (Carscadden et al. 1988).

The Canadian bottom-trawl survey in 1990 was conducted from November 3 to December 19, with a median date of fishing of November 25. This is almost identical to 1989. In contrast to years prior to 1989, a 2-phase survey design was adopted in both 1989 and 1990. In the first phase, sets were allocated on a stratified-random basis. In the second phase, additional sets were allocated randomly to strata where variation in cod catch was high during the first phase. In 1990 these additional sets were added primarily on the northern and eastern slopes of Hamilton Bank in Div. 2J (N = 35) and southeast of Funk Island Bank in Div. 3K (N = 33).

Capelin were recorded in 35% of the first-phase sets. This is the fourth highest frequency of occurrence in the period 1981-90 (Table 13). Catches tended to be small (95th percentile = 1 kg; maximum = 11 kg).

Very few capelin were caught on Hamilton Bank and toward the coast off southern Labrador and northeastern Newfoundland (Fig. 14). Most catches were in the southeastern part of Div. 2J and the eastern half of Div. 3K. The large catch on the northern edge of Funk Island Bank was the most easterly large catch in the time-series.

All large catches occurred within the block covered by the Canadian acoustic survey (Fig. 14). Small catches occurred outside the acoustic survey area, most notably in Hawke Saddle and in the extreme southeast of Div. 3K.

References

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Table 1. Statistics for each strata and total survey

Strata	Transects sampled	Number of possible transects	Transect area (km^2)	Transect area scattering coefficient (sr^{-1}) Mean	S.E.	Strata total backscatter (m^2/sr)	Biomass per transect (tons) Mean	S.E.	Total biomass (tons)
I	4.	25.	237.0	372.	128.7	9302.	934.6	323.2	23365.
H	4.	25.	319.7	600.	211.2	15001.	1507.2	530.4	37680.
G	4.	25.	343.0	177.	124.0	4431.	445.2	311.5	11129.
F	4.	25.	309.7	69.	16.7	1730.	173.8	42.0	4346.
E	4.	30.	189.7	77.	33.1	2321.	194.3	83.1	5829.
D	4.	45.	432.5	41.	23.0	1838.	102.6	57.7	4618.
C	4.	30.	534.4	8.	5.9	234.	19.6	14.9	587.
B	4.	90.	574.8	22.	5.6	1959.	54.7	14.1	4921.
A	2.	55.	217.4	28.	1.7	1538.	70.2	4.3	3863.
Total	34.	350.		110.	3.2	38353.	275.3	8.0	96339.
						.170			.170

Table 2. Backscatter, biomass, and biological sampling for each transect.

Strata	Transect Number	Transect length (km)	Transect area (km^2)	Area scattering (sr^{-1})	Total backscattering (m^2/sr)	Density (g/m^2)	Transect biomass (tons)	# of sets	Lsms	Ages
I	1	128.0	237.0	0.	118.	1.25	295.	1	200	33
	2	128.0	237.0	1.	270.	2.86	679.	1	200	35
	3	128.0	237.0	3.	723.	7.67	1817.	1	200	41
	4	128.0	237.0	2.	377.	4.00	947.	1	200	39
H	1	172.6	319.7	1.	300.	2.35	753.	1	200	37
	2	172.6	319.7	1.	251.	1.98	632.	1	200	30
	3	172.6	319.7	2.	687.	5.40	1726.	1	200	41
	4	172.6	319.7	4.	1162.	9.13	2919.	1	200	40
G	1	185.2	343.0	2.	542.	3.97	1362.	2	200	41
	2	185.2	343.0	0.	123.	.90	309.	1	200	45
	3	185.2	343.0	0.	26.	.19	65.	1	200	38
	4	185.2	343.0	0.	17.	.13	44.	1	200	39
F	1	167.2	309.7	0.	26.	.21	64.	0	0	0
	2	167.2	309.7	0.	101.	.82	255.	1	200	46
	3	167.2	309.7	0.	62.	.50	155.	1	200	37
	4	167.2	309.7	0.	88.	.71	221.	1	200	39
E	1	102.4	189.7	1.	175.	2.31	439.	1	200	45
	2	102.4	189.7	0.	55.	.73	138.	1	200	49
	3	102.4	189.7	0.	52.	.69	132.	1	200	51
	4	102.4	189.7	0.	27.	.36	68.	1	200	44
D	1	233.5	432.5	0.	24.	.14	59.	1	0	0
	2	233.5	432.5	0.	22.	.13	55.	2	306	76
	3	233.5	432.5	0.	109.	.63	274.	2	200	38
	4	233.5	432.5	0.	9.	.05	22.	1	200	24
C	1	288.6	534.4	0.	1.	.01	3.	0	0	0
	2	288.6	534.4	0.	3.	.02	8.	0	0	0
	3	288.6	534.4	0.	1.	.01	3.	1	0	0
	4	288.6	534.4	0.	25.	.12	64.	1	200	50
B	1	310.4	574.8	0.	26.	.11	65.	1	200	65
	2	310.4	574.8	0.	31.	.14	79.	0	0	0
	3	310.4	574.8	0.	6.	.02	14.	0	0	0
	4	310.4	574.8	0.	24.	.10	60.	1	200	24
A	1	117.4	217.4	0.	30.	.34	75.	0	0	0
	2	117.4	217.4	0.	26.	.30	66.	0	0	0

Table 3. Numbers (billions) and biomass (thousands of tons) at age of capelin from NAFO Division 2J3K hydroacoustic surveys.

Year	Cruise	Age	1	2	3	4	5+	Total
1990	189	Numbers	1.4	2.6	1.6	0.6	<0.1	6.2
		Biomass	1.8	43.8	36.2	14.1	0.5	96.4
1989	173	Numbers	1.9	59.0	35.3	2.5	0.5	99.2
		Biomass	15.4	850.1	791.2	68.9	18.5	1744.1
1988	158	Numbers	15.8	96.0	13.6	2.0	3.9	131.3
		Biomass	76.2	1208.7	336.9	55.1	127.0	1803.9
1987	144	Numbers	0.7	4.4	0.5	0.6	0.1	6.3
		Biomass	3.9	77.8	12.0	15.1	3.0	111.8
1986	130	Numbers	0.1	6.6	12.1	1.1	0.2	20.1
		Biomass	0.7	109.9	284.1	30.2	6.0	430.9
1985	115	Numbers	1.5	54.0	13.5	1.5	0.6	71.1
		Biomass	8.4	686.6	286.3	36.7	17.8	1035.4
1984	100	Numbers	6.2	34.7	7.1	4.1	0.4	52.5
		Biomass	25.5	497.9	181.9	109.8	11.3	826.4
1983	85	Numbers	2.6	2.5	1.3	0.2	0.0	6.6
		Biomass	17.6	41.1	31.2	4.3	0.0	94.2
1981	56	Numbers	67.8	59.3	7.4	2.8	0.7	138.0
		Biomass	337.8	891.2	172.4	71.9	20.8	1494.1

Table 4. Age composition and mean length at age, total number in billions, total mean length, and number of samples for each survey block.

Strata	Age	1	2	3	4	5+	Total N/L	Number of samples
A+B	%	65.2	26.3	6.2	2.3	0.0	1.5	2
	L	73	142	153	162	-	98	
C	%	92.5	5.3	1.8	0.5	0.0	0.2	1
	L	88	133	150	148	-	92	
D	%	47.5	25.1	18.7	7.6	1.0	0.3	4
	L	94	160	174	176	173	131	
E	%	3.8	72.6	16.9	6.7	0.0	0.4	4
	L	98	146	164	172	-	149	
F	%	0.0	42.6	42.5	14.9	0.0	0.2	3
	L	-	157	169	174	-	165	
G	%	0.0	66.0	25.0	8.4	0.5	0.6	4
	L	-	150	166	174	181	156	
H	%	0.0	48.2	39.7	11.7	0.4	1.9	4
	L	-	153	163	178	184	159	
I	%	0.0	43.2	38.6	18.2	0.0	1.1	4
	L	-	158	170	172	-	165	

Table 5. 1990 offshore comercial capelin catch by allocation, month, and Division

	Sept	Oct	Nov	Dec	Total
Division 2J					
USSR TAC	13826	6863	116	-	20805
SeaFreeze	1794	17327	5950	-	25071
Total	15620	24190	6066	-	45876
Division 3K					
USSR TAC	-	-	-	-	
SeaFreeze	-	-	9205	2232	11437
Total	-	-	9205	2232	11437

Table 6. Capelin catches for Subarea 2.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1972									586	10297	6955		17838
1973								930	25577	32055	904	372	59838
1974					84	172	20816	5079	32110	20568	6560		85389
1975			200	2713		1402	2818	3152	70798	31969	30932	875	144859
1976						201	504	3761	37148	26299	17021	9665	94599
1977								10890	35498	23144	28431	10879	108842
1978								3046	7636	195	37		10914
1979								645	2078	6444	1155	265	10587
1980									1547	3248			4795
1981									1947	6793	1117	292	10149
1982						4	3	1287	4435	3357	599		9685
1983						1	2	299	2326	3898	1786	1561	9873
1984							1	481	3948	7366	3385		15181
1985							1	333	2763	8129	5341	272	16839
1986						2	1		3352	6885			10240
1987							3	237	10908	14117	3246		28511
1988						1	2		3161	11982	1682		16828
1989									5787	13637	2520		21944
1990									15620	24190	6066		45876

Table 7. Capelin catches for Division 3K.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1972						226	230	5		39	15319	11966	27785
1973						103	338	130	86	12703	40565	22659	76584
1974					36	320	9880	1274	15317	9874	4849		41550
1975			85	1214		757	1440	1009	26484	11144	11479	30	53642
1976	112				1386	1206	506			25501	48463	44553	121727
1977	19				12	1781	354		234	24666	10318	6183	43567
1978				15	6	1386	1014	2220	13395	18338	7660		44034
1979						581	90	56	43	85	5	41	901
1980						208	1146						1354
1981					18	1584	201				31	15	1849
1982						3029	825	5		1			3860
1983						2673	1091			55		573	4392
1984						2693	4420	3	1			2186	9303
1985						102	7302	7					7411
1986						8134	3666			1027	4764	729	18320
1987						8818	133	41		11	1851	721	11575
1988					12	19237	7568						26817
1989						26853			39	333	158		27383
1990						8335	25068				9205	2232	44840

Table 8. Capelin catches for Subarea 2 and Division 3K combined.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1972						226	230	5	586	10336	22274	11966	45623
1973						103	338	1060	25663	44758	41469	23031	136422
1974					120	492	30696	6353	47427	30442	11409		126939
1975			285	3927		2159	4258	4161	97282	43113	42411	905	198501
1976	112				1386	1407	1010	3761	37148	51800	65484	54218	216326
1977	19				12	1781	354	10890	35732	47810	38749	17062	152409
1978				15	6	1386	1014	5266	21031	18533	7697		54948
1979						581	90	701	2121	6529	1160	306	11488
1980						208	1146		1547	3248			6149
1981					18	1584	201		1947	6793	1148	307	11998
1982						3033	828	1292	4435	3358	599		13545
1983						2674	1093	299	2326	3953	1786	2134	14265
1984						2693	4421	484	3949	7366	3385	2186	24484
1985						102	7303	340	2763	8129	5341	272	24250
1986						8136	3667		3352	7912	4764	729	28560
1987						8818	136	278	10908	14128	5097	721	40086
1988					12	19238	7570		3161	11982	1682		43645
1989						26853			5826	13970	2678		49327
1990						8335	25068		15620	24190	15271	2232	90716

Table 9. Commercial catch rate series for Div. 2J3K capelin, 1972-90.

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
USSR/FCR (t/hr)	2.81	3.29	4.56	6.47	5.27	4.14	2.29	1.34	4.57	3.68	3.19	5.31	4.24	6.96	6.05	7.70	5.97	6.12	5.87
TC7 (t/hr)	2.65	2.75	3.62	4.51	3.62	4.00	2.34	1.35	4.92	3.72	3.36	4.51	3.86	4.16	4.38	4.71	4.47	4.70	

Table 10. Monthly catch rates (t/hr) of tonnage class 7, USSR trawlers from observer data.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Div. 2J												
Aug.				2.42					8.46			
Sept.	0.98	5.26	2.26	3.26	3.34	6.73	5.09	4.83	8.04	4.81	4.51	8.90
Oct.	1.58	4.25	4.20	2.81	7.41	7.43	7.50	6.72	7.67	6.43	8.02	6.59
Nov.	0.96		4.38	12.16	6.16	3.22	6.67	9.02	9.38	6.28	5.95	6.08
Dec.	1.20				7.96							
Div. 3K												
Aug.												
Sept.												
Oct.								7.43				
Nov.	0.26					3.14		6.08	7.56		6.96	4.77
Dec.						2.96		5.90	2.92		1.91	1.58

Table 11. Number of samples by month, proportion of catch observed by FRC personnel, and monthly catch for commercial USSR fishery in Div. 2J3K.

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Div. 2J												
Aug.	0/0/645			4/25/1286	0/0/253	0/0/481	0/0/333	12/49/3352	4/208/236			15/90/15620
Sept.	14/12/1616	12/100/1547	9/50/1947	16/55/4435	11/56/2326	10/49/3948	2/17/2763	18/46/6885	17/83/10908	10/102/361	22/90/6453	19/89/24189
Oct.	37/38/5676	17/92/3248	29/67/6793	7/21/3357	11/48/3898	6/22/1366	12/42/8129		32/70/14117	32/81/11982	27/85/13342	7/91/6065
Nov.	10/67/1155		3/43/1117	3/50/599	6/47/1731	17/66/3385	10/29/5341		5/79/3246	11/82/1665	10/91/2020	
Dec.	1/49/265		0/0/292		2/23/1561		0/0/272					
Div. 3K												
Aug.	0/0/56								0/0/41			
Sept.	0/0/43										0/0/7	
Oct.	0/0/85				0/0/55			4/42/1027	0/0/11			
Nov.	0/100/5					3/100/0*		12/43/4764	2/81/1851		0/94/563	7/93/9205
Dec.					0/0/573	9/53/2186		1/21/729	0/70/721		4/83/341	4/88/2231

* no catch in NAFO stats but 570.5 t observed

Table 12. Commercial age compositions for Div. 2J3K, 1972–89.

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	0.0	0.0	0.1	0.0	0.5	0.1	3.8	2.5	1.0	8.6	1.8	3.6	9.6	0.1	0.3	0.6	0.8	0.3	0.0
2	11.8	25.1	20.2	61.8	8.8	3.0	16.6	78.3	45.1	67.4	77.3	40.5	61.9	66.7	21.1	44.1	72.0	40.5	35.5
3	64.0	30.0	48.9	27.7	82.9	29.9	31.1	10.6	40.4	16.1	19.1	48.2	18.2	28.7	69.3	19.5	18.7	54.2	47.8
4	21.0	40.0	17.6	8.2	6.8	60.0	42.3	2.4	10.8	4.0	1.5	7.3	9.1	2.8	8.3	32.2	2.3	4.3	16.1
5	2.8	5.0	12.2	1.8	0.9	6.2	5.9	3.2	1.6	3.6	0.4	0.5	1.2	1.5	0.7	3.5	5.6	0.3	0.5
6	0.4	0.3	1.0	0.5	0.2	0.9	0.3	3.0	1.1	0.2	0.1	0.1	0.0	0.1	0.3	0.1	0.5	0.4	0.0

Table 13. Statistics for by-catches of capelin during bottom-trawl surveys in NAFO Div. 2J3K during the autumns of 1978 to 1990.

Year	GADUS ATLANTICA trip number	Number[a] of sets	Sets with capelin		Percentiles of capelin catches (kg)[b]			
			No.	%	50	75	95	Max.
1978	15	125	2	2	0.03			<<1
1979	29	124	42	34	0.09	0.3	9	185
1980	44	134	25	19	0.50	1.8	149	172
1981	58,59	214	53	25	0.30	1.0	24	345
1982	71,72	291	97	33	0.20	0.5	3	18
1983	86-88	248	58	23	0.10	0.3	2	24
1984	101-103	251	67	27	0.15	0.4	2	3
1985	116-118	297	127	43	0.12	0.4	3	10
1986	131-133	210	50	24	0.18	0.8	12	24
1987	145-147	276	94	34	0.20	1.0	18	117
1988	159-161	233	84	36	0.15	0.8	3	39
1989	174-176	273[c]	134	49	0.12	0.3	2	32
1990	190-192	232[c]	82	35	0.09	0.3	1	11

[a] Sets in depths >750 m are not included. Sets in strata 618 and 619 on the coastal shelf off northern Newfoundland are included. These strata were not fished prior to 1984.

[b] Percentiles are calculated for those sets in which capelin were recorded in the catch.

[c] Only sets from first-stage sampling are included.

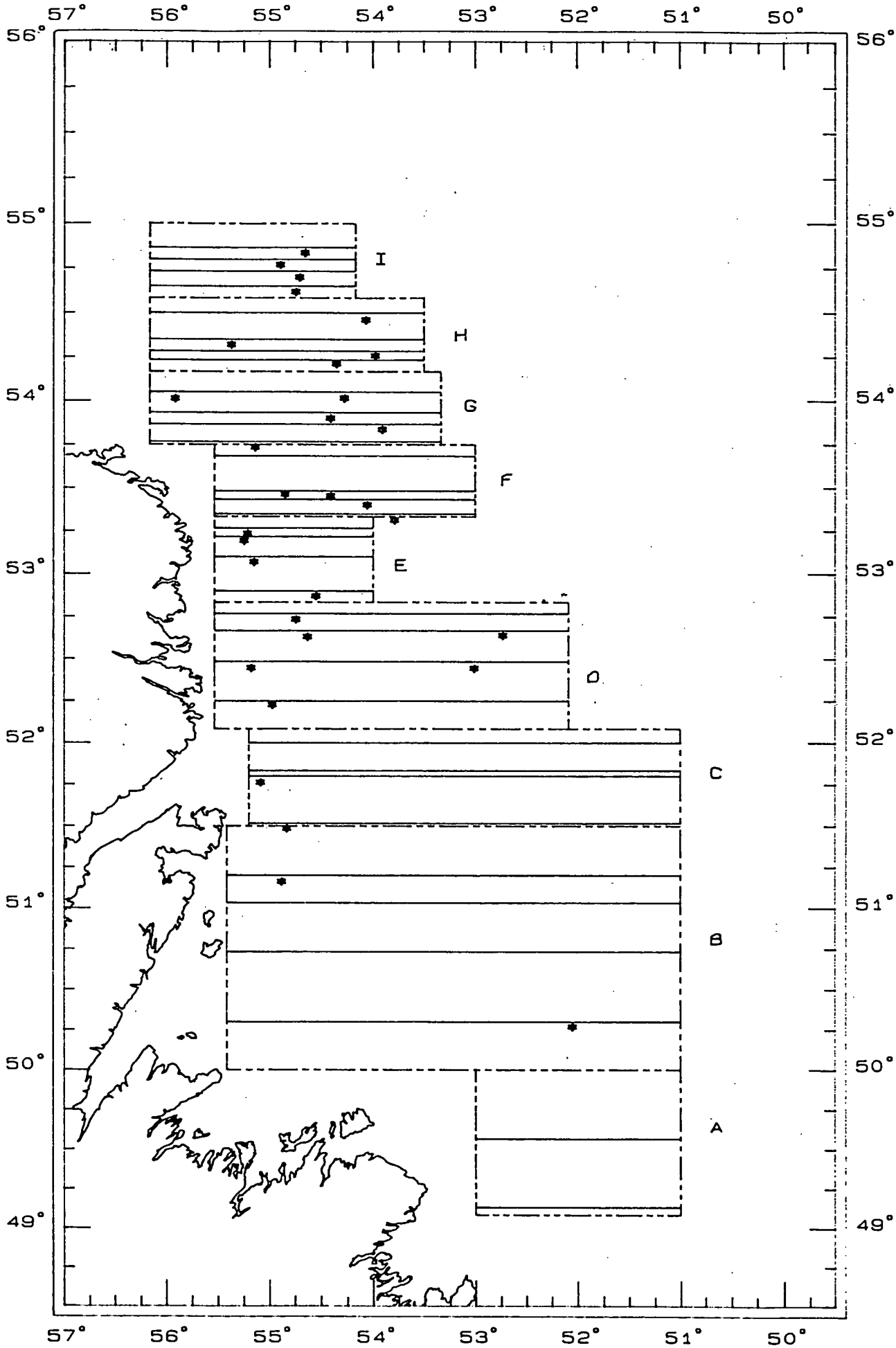


Figure 1. Acoustic survey strata, transect, and set locations, October 1990

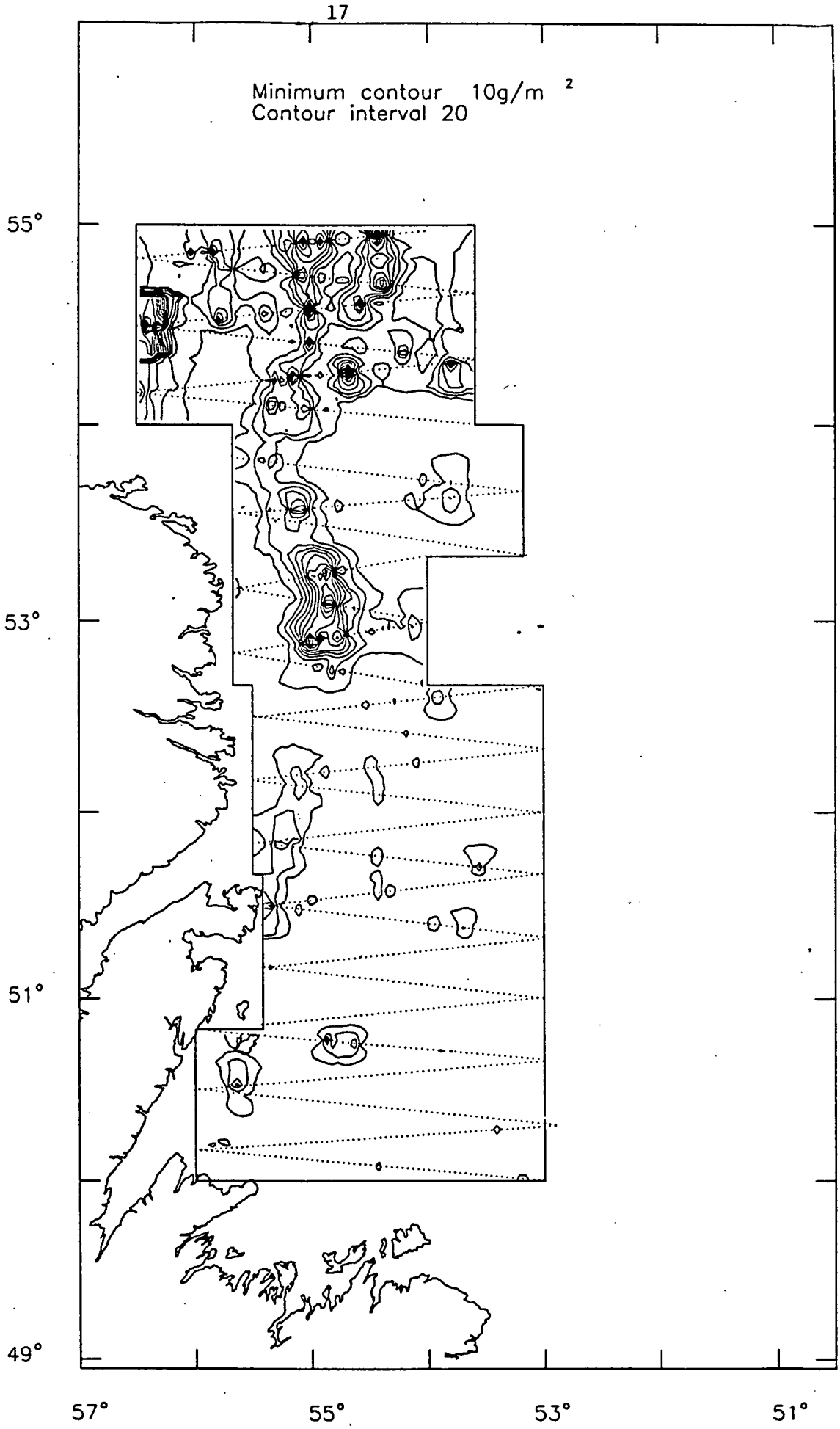


Figure 2. Acoustic capelin distribution in 1981

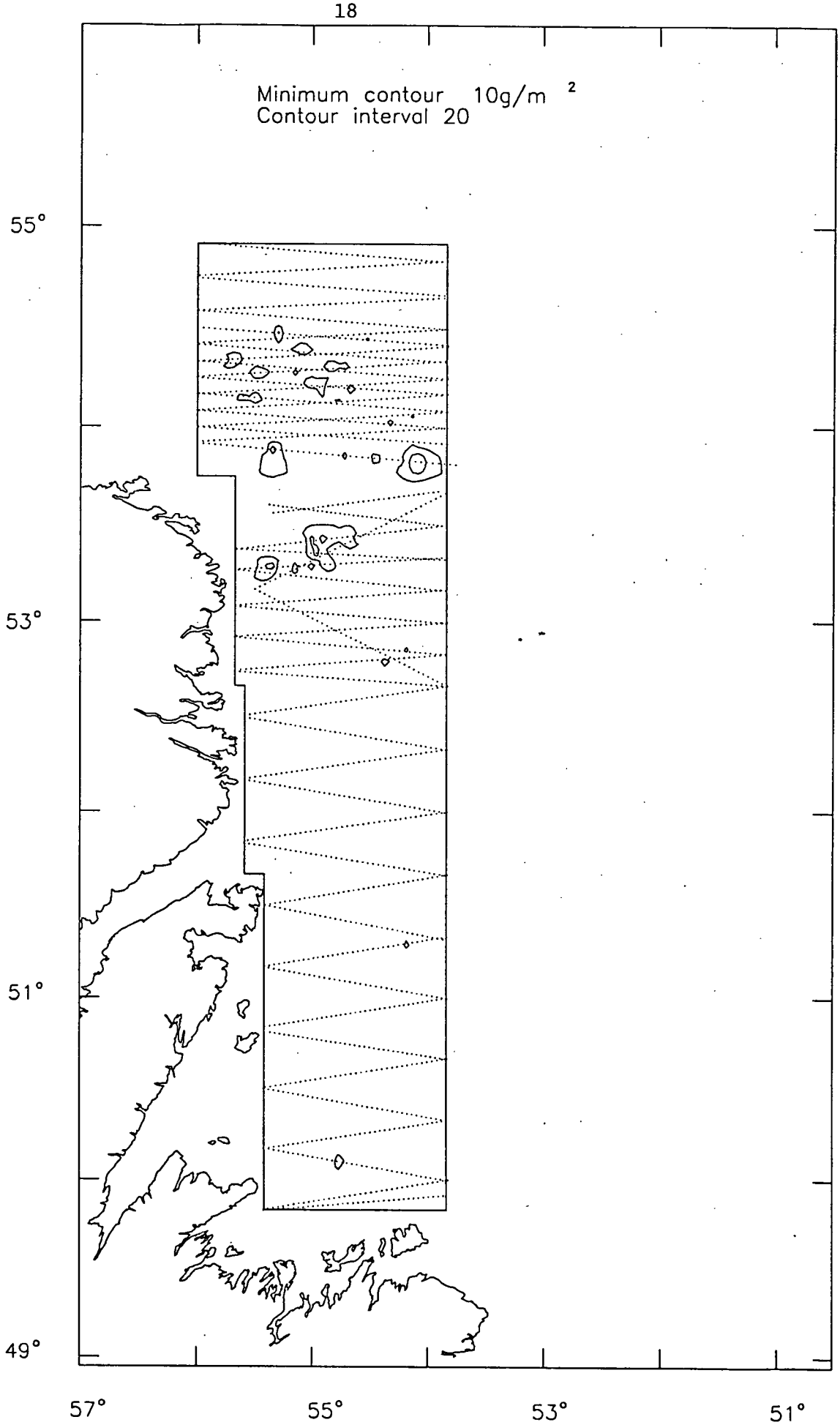


Figure 3. Acoustic capelin distribution in 1983

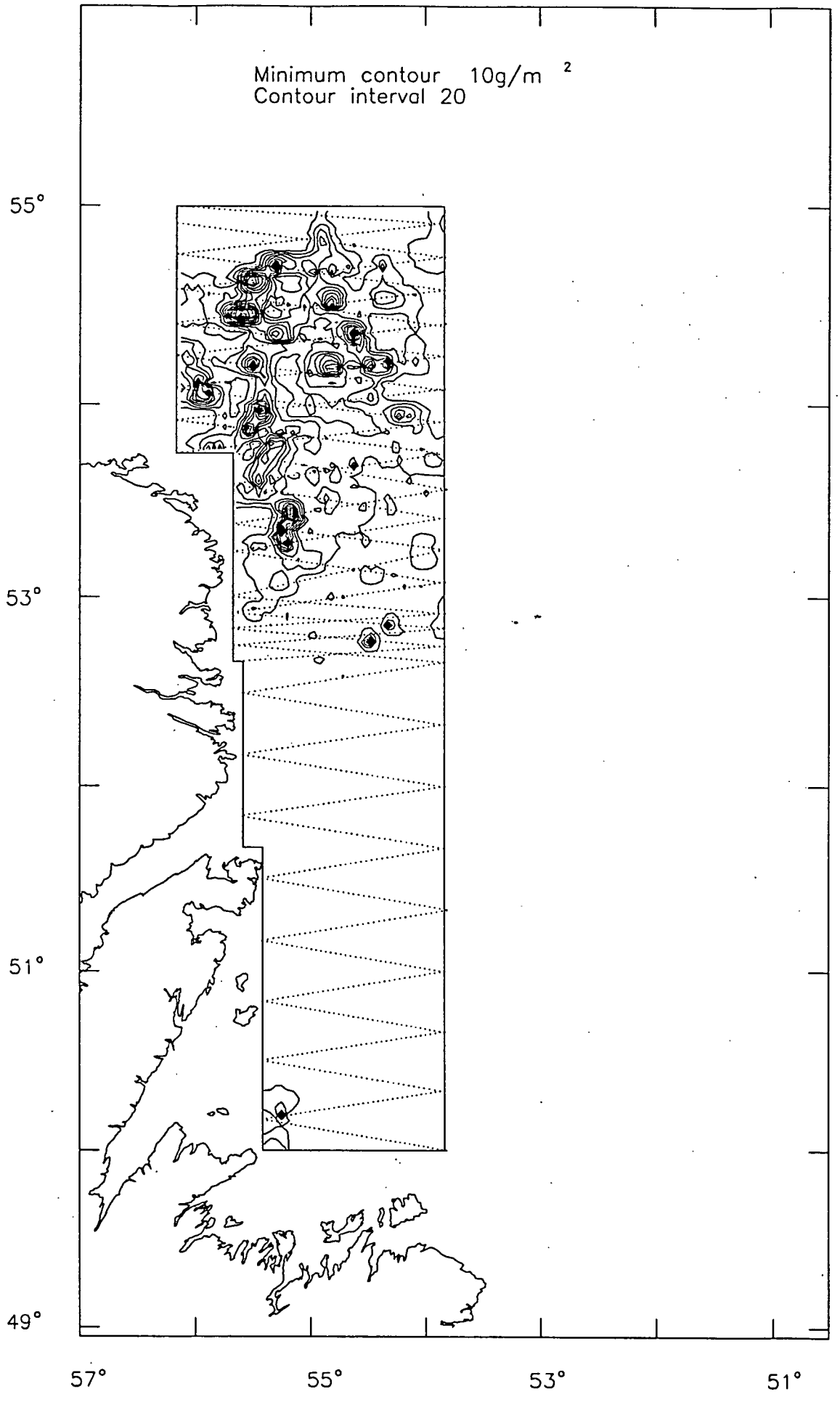


Figure 4. Acoustic capelin distribution in 1984

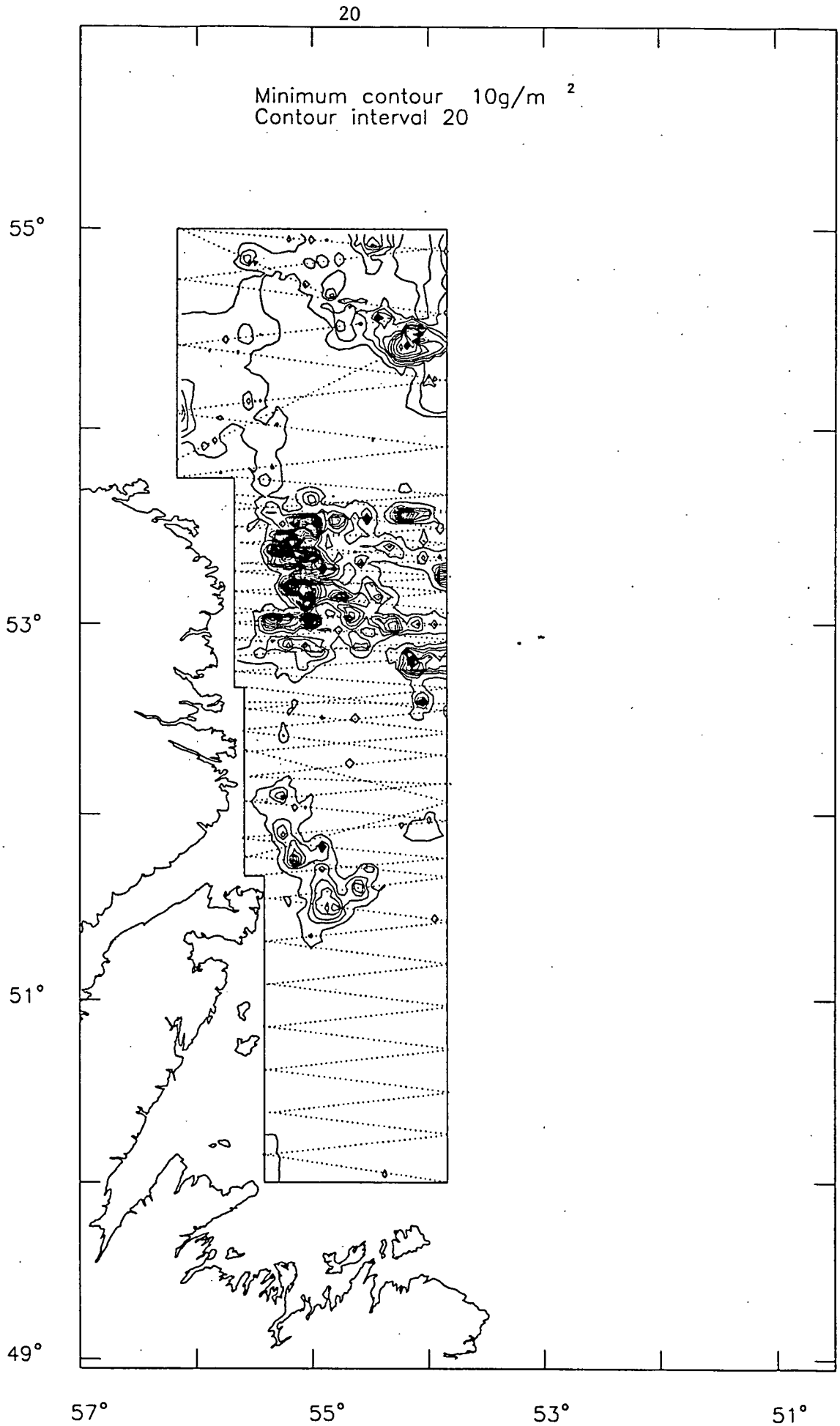


Figure 5. Acoustic capelin distribution in 1985

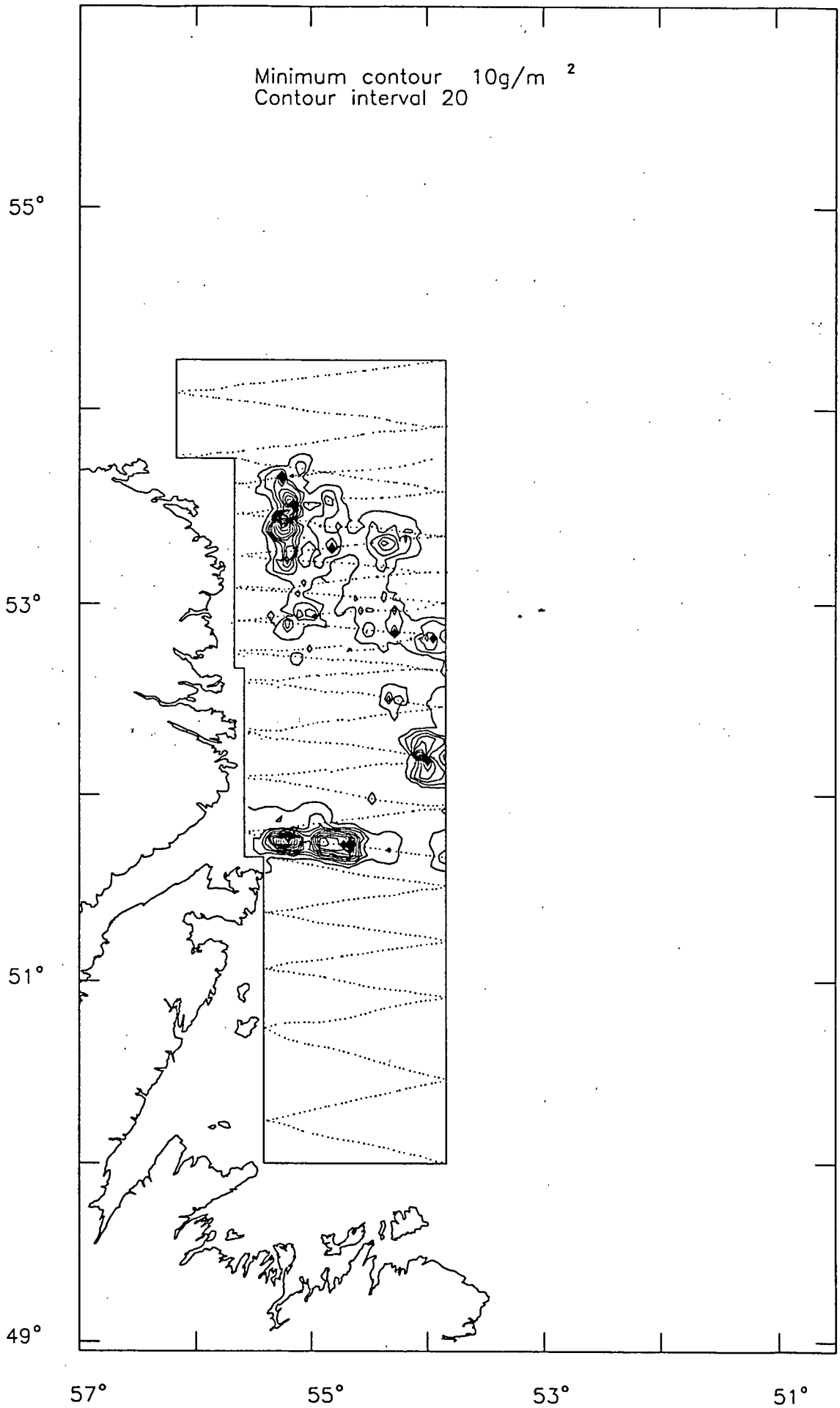


Figure 6. Acoustic capelin distribution in 1986

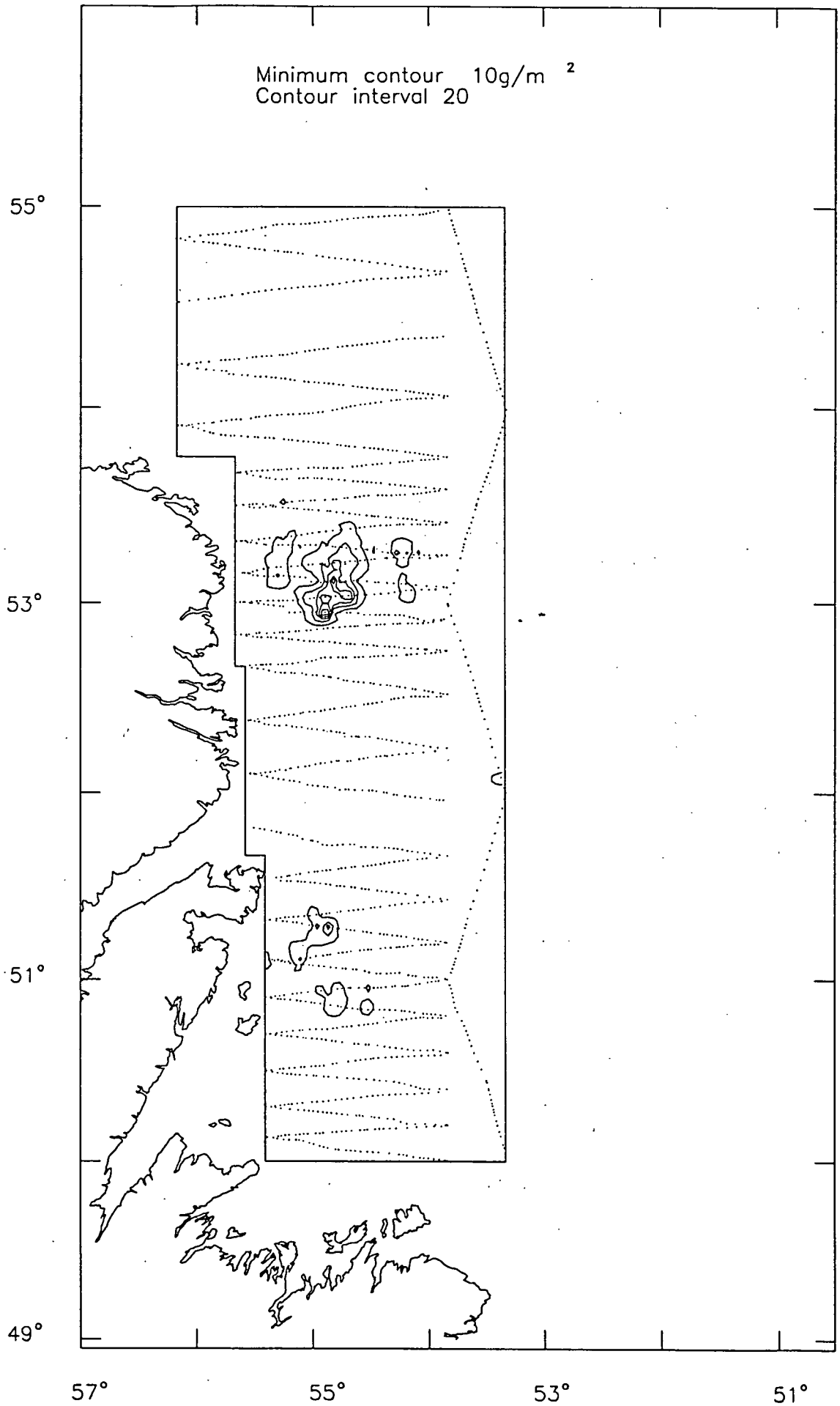


Figure 7. Acoustic capelin distribution in 1987

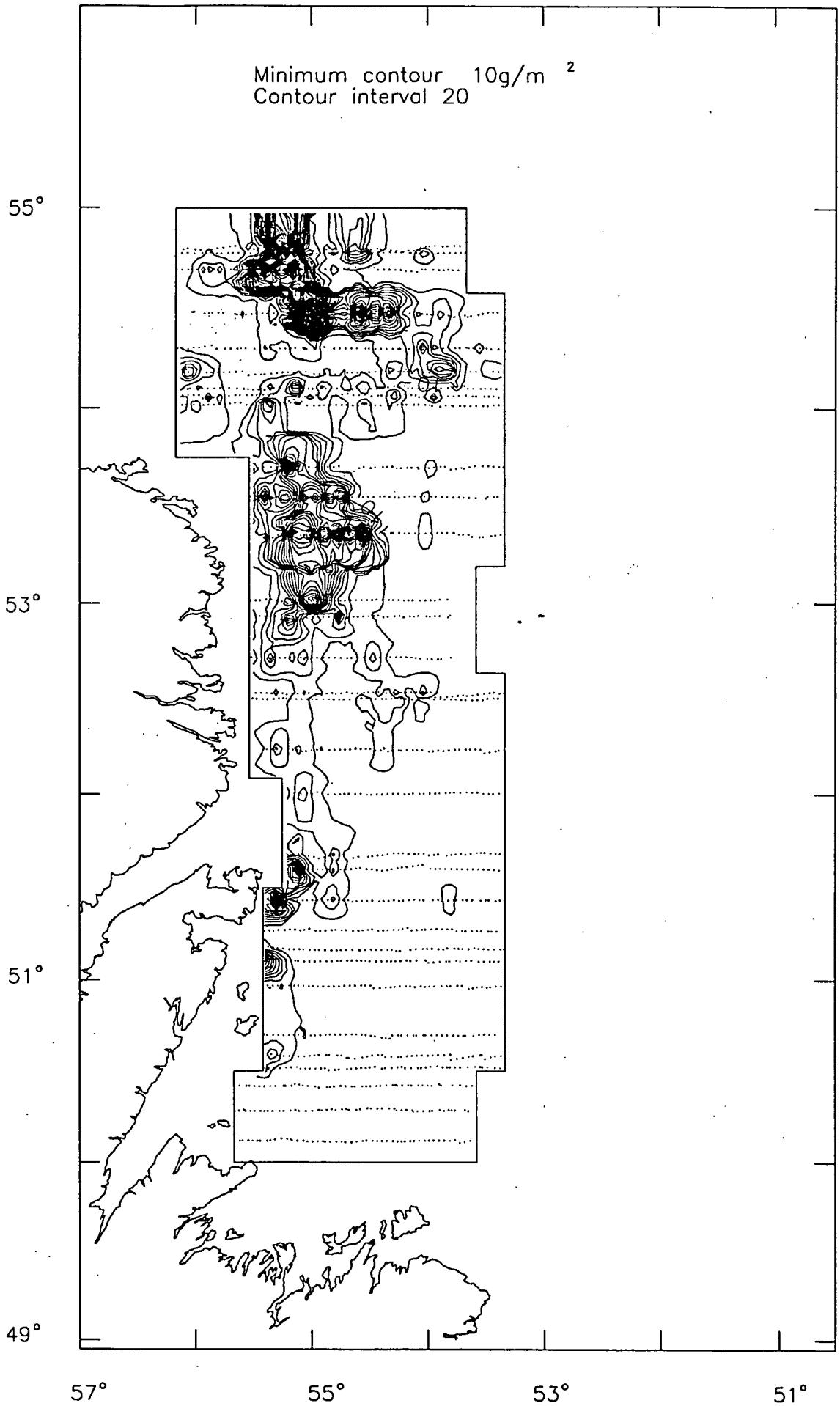


Figure 8. Acoustic capelin distribution in 1988

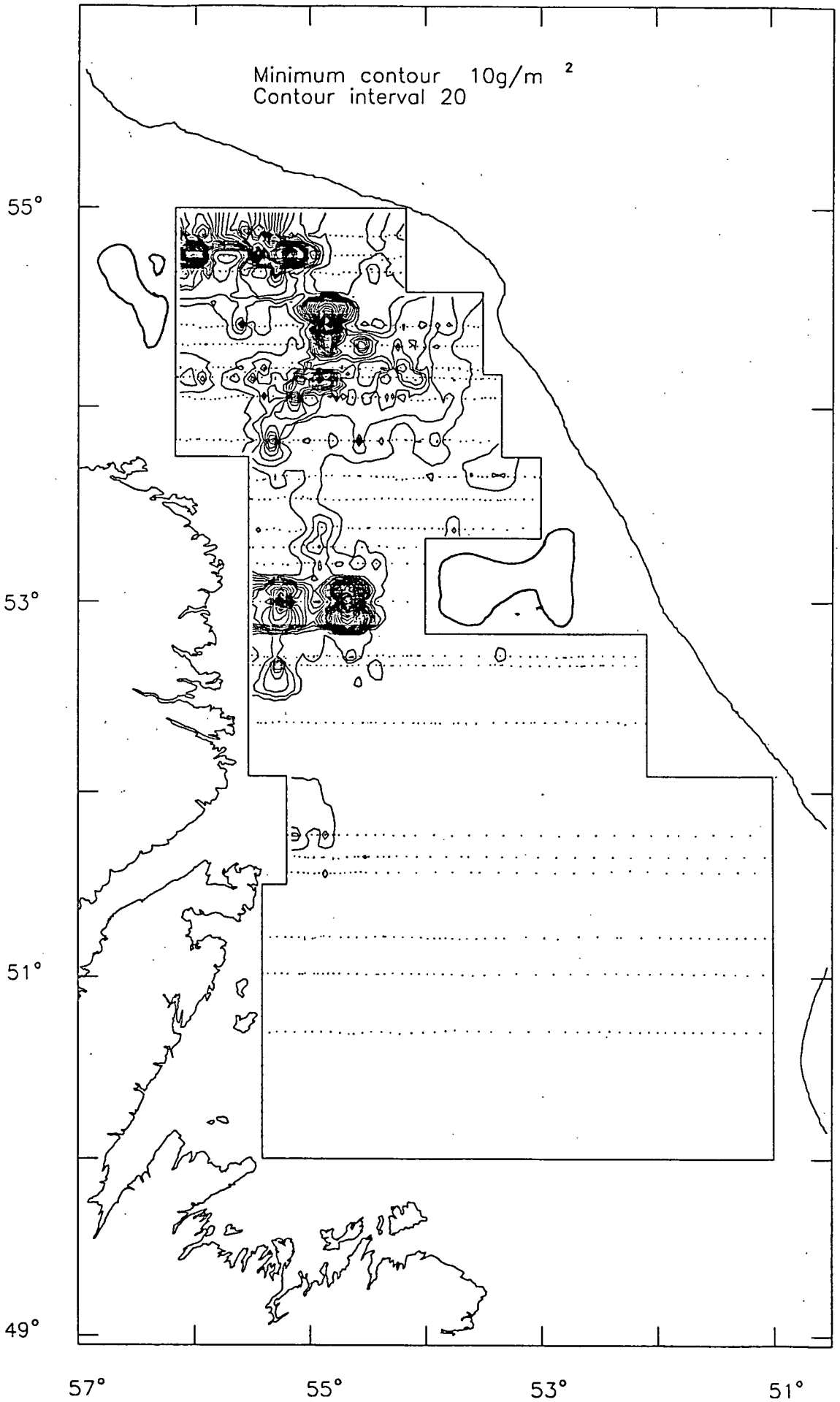


Figure 9. Acoustic capelin distribution in 1989

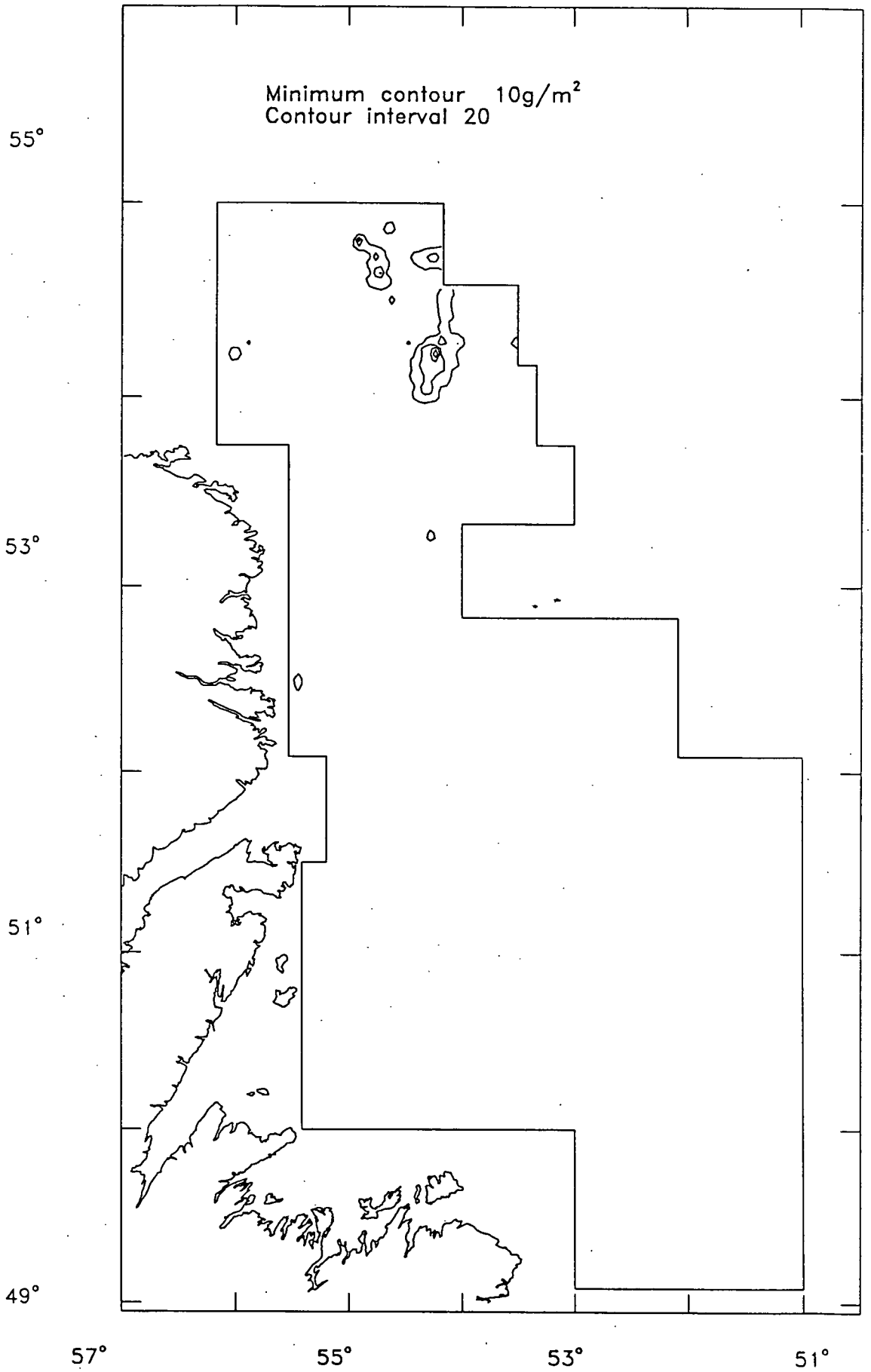


Figure 10. Acoustic capelin distribution in 1990

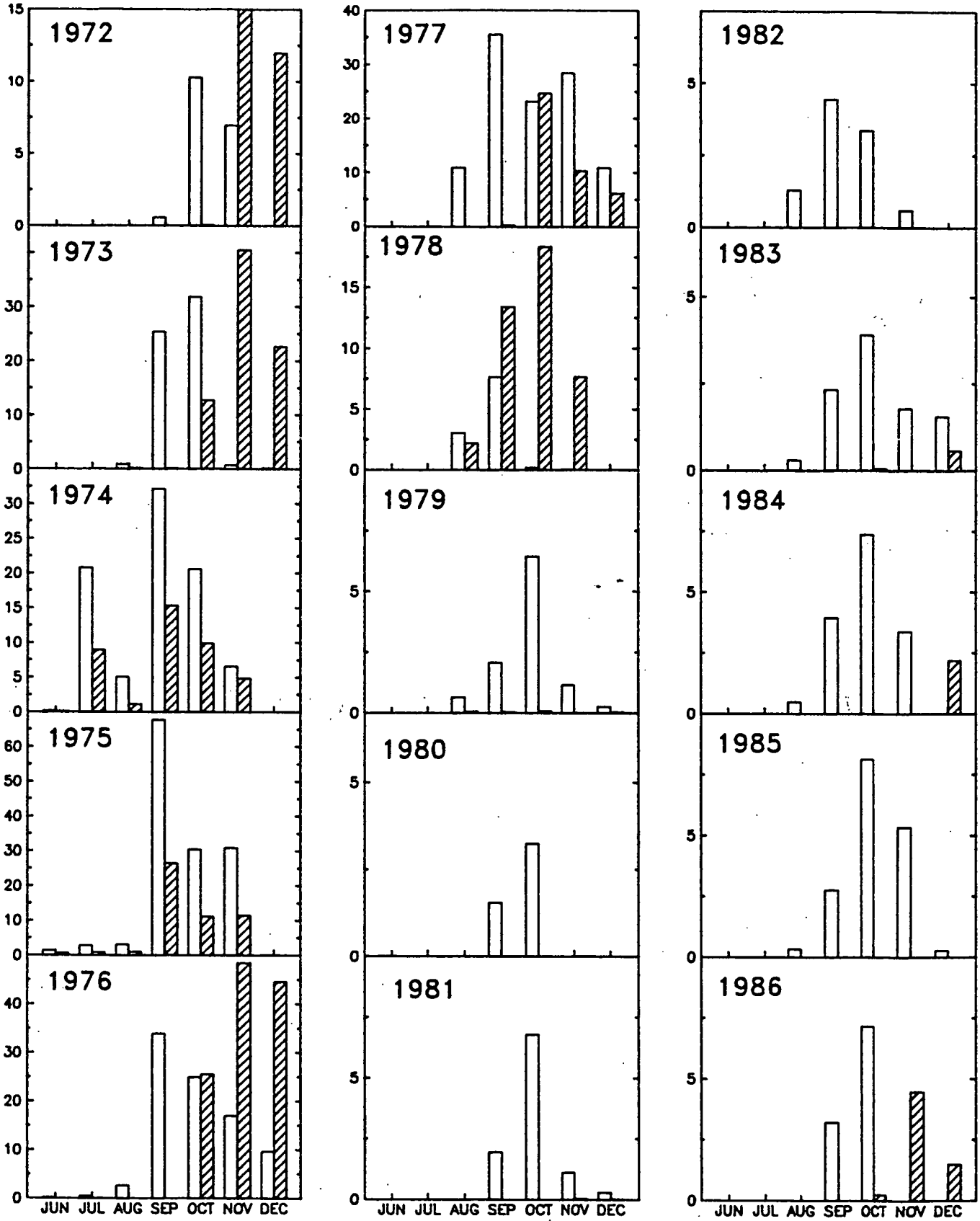


Figure 11a. Commercial fishery catches (1000's of tons)

(Open bars – Division 2J, Hatched bars – Division 3K)

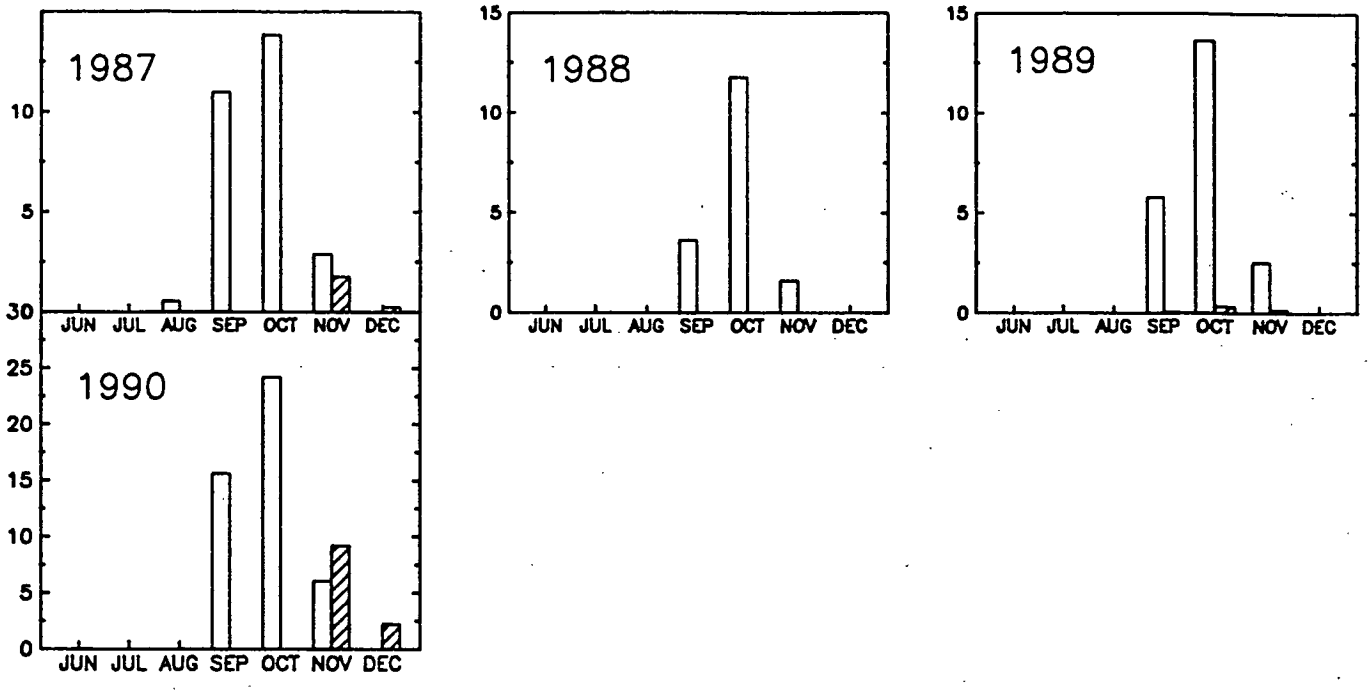


Figure 11b. Commercial fishery catches (1000's of tons)
(Open bars – Division 2J, closed bars – Division 3K)

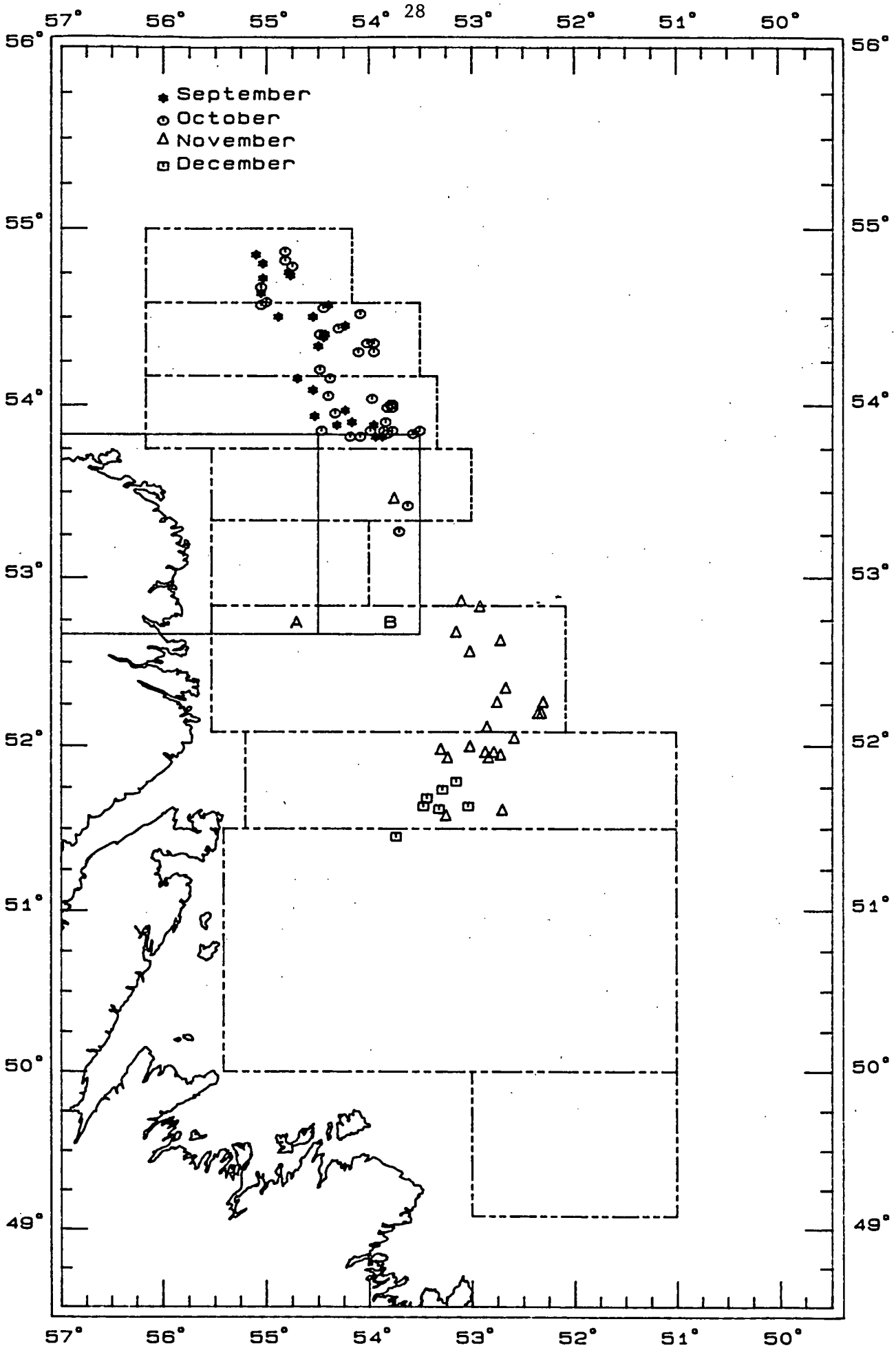
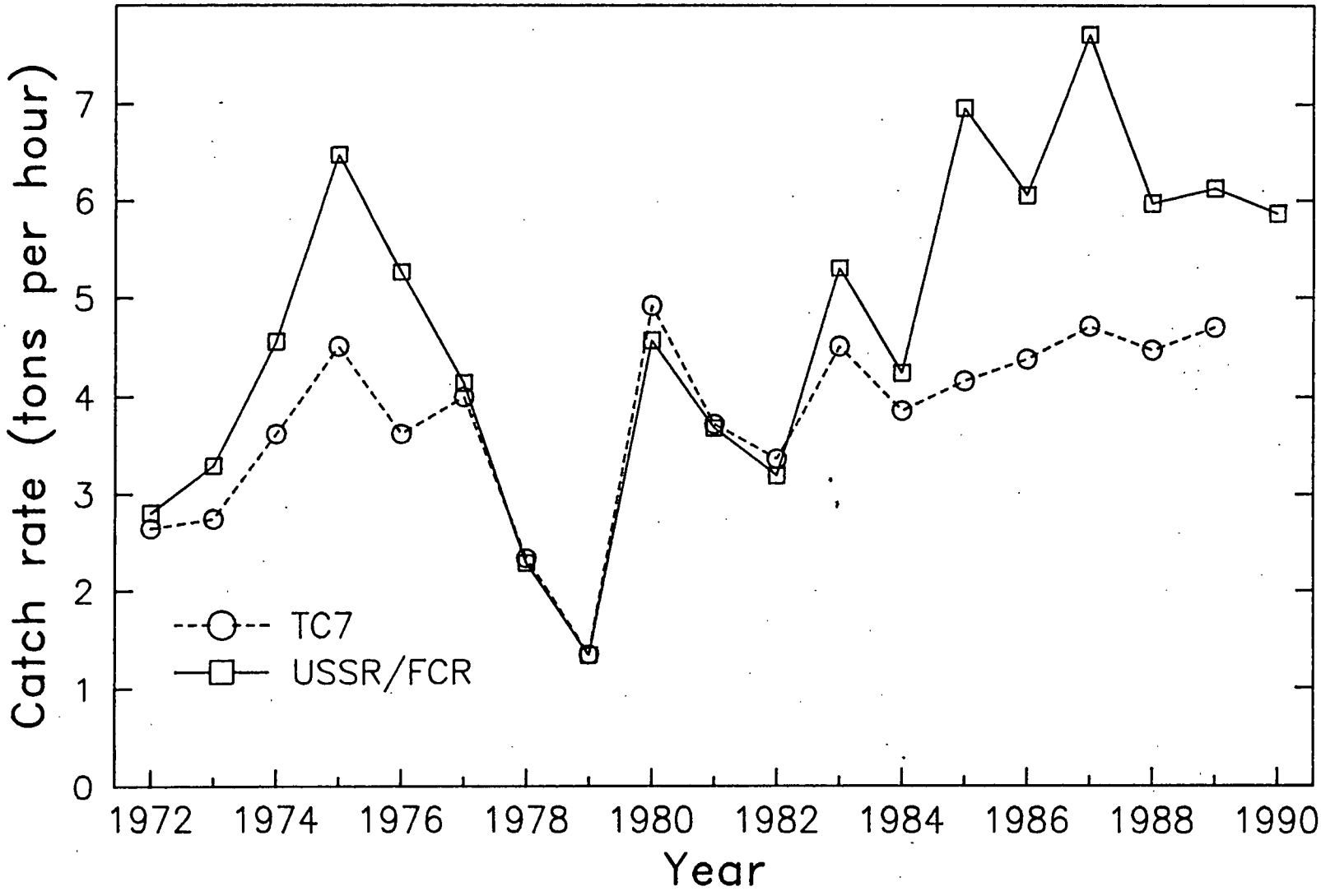


Figure 12. Distribution of monthly samples from the USSR capelin fishery.

Figure 13. Commercial catch rates for 2J3K capelin 1972–1990



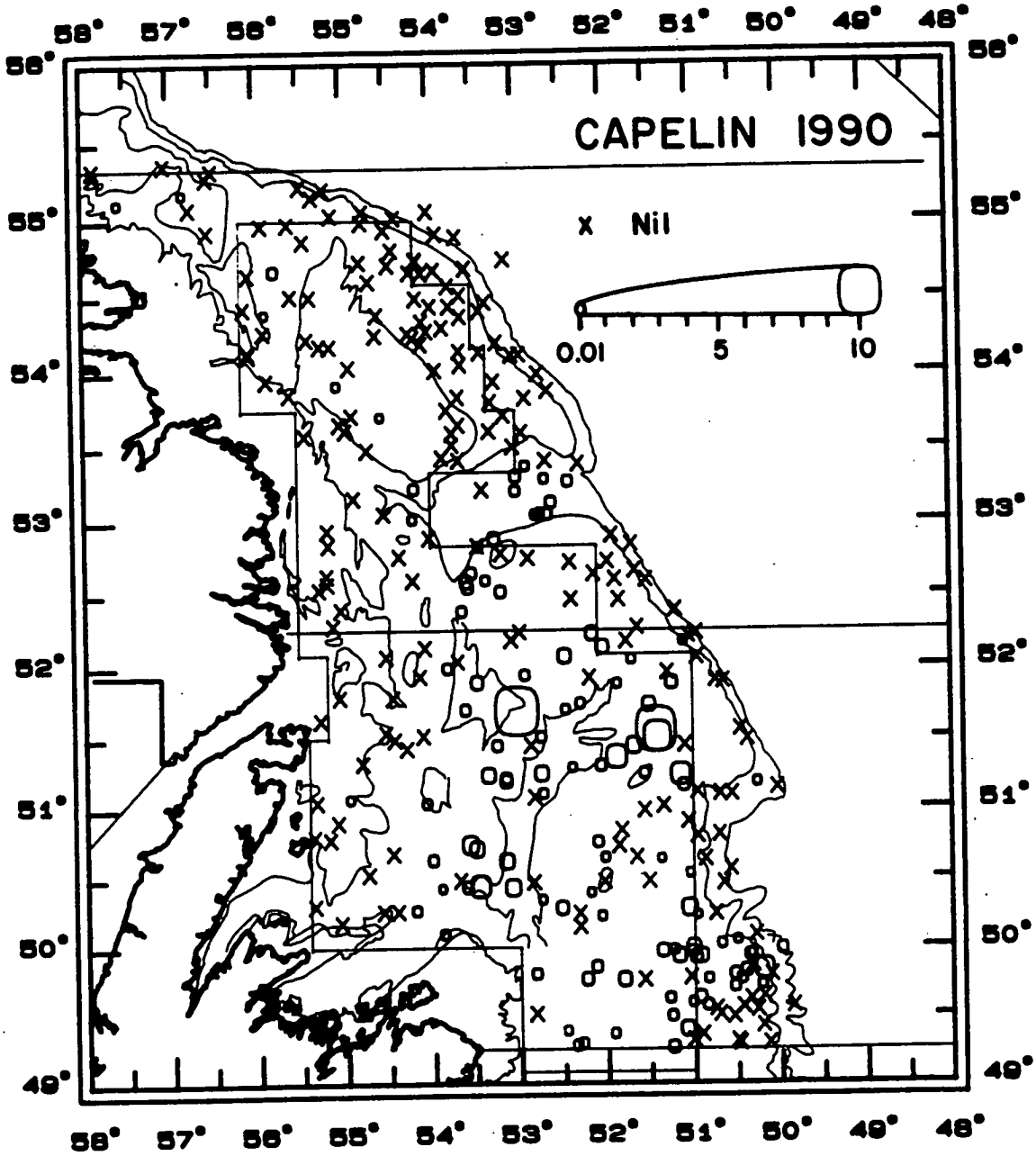


Fig. 14. Distribution of capelin catches (kg/30 min tow) during a random depth-stratified bottom-trawl survey in Div. 2J3K, Nov.3 to Dec. 19, 1990 (GADUS ATLANTICA trips 190-192). Catches from both phase 1 and phase 2 of the survey are shown. Symbol area is proportional to catch. Catches were set to a maximum of 10 kg before plotting. Also shown is the boundary of the Canadian acoustic survey (GADUS ATLANTICA trip 189).