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The Winter Distribution of Cod in NAFO Divisions 2J, 3K, and 3L,
Based on Research Vessel Catches During 1978-83

by

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INTRODUCTION

During February 19-26, 1978, a random stratified survey was conducted around Hamilton Bank, mainly along its eastern and southern slopes. During February-March 1979 and March 1980-83, otter trawl sets were made in various areas from northern Hamilton Bank to the northern slopes of the Grand Bank to catch cod for tagging purposes. The results of these studies are presented to give an overall picture of the catches associated with the major cod distributions over the area (2J3KL) during winter and spring.

FISHING METHODS

During February 19-26, 1978, a total of 58 sets of 30 minute duration was conducted in Div. 2J. These sets were randomly chosen from 25 depth strata ranging from 100-200, 200-300, 300-400, 400-500, and 500-700 m. The survey was conducted on the research vessel GADUS ATLANTICA, using an Engels-High Rise otter trawl with a 29 mm liner.

The sets to obtain live cod for tagging were made using the same net but without the 29 mm liner during the tagging cruises of 1979-83. The sets were generally of shorter durations (10-30 minutes), depending upon the size of the cod concentration as deduced from the echo sounder. The tagging sets were not chosen randomly but were made in areas where cod appeared abundant on the echo sounder or were reported plentiful by the commercial trawlers. Since the concentrations of cod were in deep water (230-350 m) and generally in ice covered areas, the net had to be taken back very slowly (8-10 m/minutes) to allow the cod to acclimate to the changing pressure and to prevent suffocation from crowding of cod in the codend.

This procedure allowed the net to be hauled along the bottom somewhat longer after the end of the set than for a regular survey set where the net was hauled back quickly. The slow hauling of the net and warps along the bottom possibly served to corral cod into the net similar to Danish seining. The cod concentrations where fishing occurred ranged from the northern Hamilton Bank to the northeastern Grand Bank (Fig. 1).

RESULTS

Survey, February 1978

During the February 1978 random stratified survey, the cod were most abundant along the outer slopes of Hamilton Bank (Fig. 2) and the shelf area slope east of Belle Isle Bank. In Hawke Channel and on the top of Hamilton Bank no cod were caught in most sets or if there were, the catches were small (<50 kg). The two largest catches, 1872 and 1352 kg, occurred to the southeast of Hamilton Bank in 400 and 314 m and temperatures of 3.7 and 3.6 C, respectively. There was a catch of 784 kg in 318 m and 2.9 C. Five other catches, ranging from 234 to 356 kg were in depths of 367-547 m and temperatures ranging from 3.2 to 5.4 C. The results of this survey confirm that cod are scarce in depths less than 300 m around Hamilton Bank and that they are concentrated mainly along the outer slopes in depths from 300 to 500 m and temperatures about 3 to 5 C.

TAGGING CRUISES

Northern Hamilton Bank

The catches (kg/30 minute tow) on the northern Hamilton Bank during March 1981 ranged from 0-499 to 3000-3499 kg (Table 1) but averaged about 604 kg. The 6 best catches (>1000 kg) were from depths of 250-296 m and bottom temperatures of 2.6-3.1 C (Table 6). In March 1982 only 2 sets were made on northern Hamilton Bank as fishing was hampered by heavy ice in the area. Average catch was 362 kg in 324-354 m (2.3-2.5 C). Ice prevented our fishing in the shallower area where good cod catches were obtained in 1981.

Southeast Hamilton Bank

In March 1981, 10 sets were made on the southeastern slopes of Hamilton Bank. Catches were small (<500 kg) and averaged 115 kg (Table 1). In March 1982 cod were plentiful on southeast Hamilton Bank. Our tagging was conducted in the vicinity of commercial vessels which were obtaining excellent catches. Our catches ranged from 0-499 to 5500-5999 kg. The highest catches (>1000 kg) were in depths of 323-424 m and bottom temperatures of 1.5-5.5 C. This concentration was found by the commercial vessels who generally search over a wide area until they find cod and report to one another. The area of these concentrations is apparently small and the chances of one boat finding the school on its own in a short period of a day is remote. It is quite possible that catch rates similar to those of 1982 were available in 1981 but the lack of time to continue searching decreased our chance of finding the school. The schools appear to be very dense and catch rates up to 50 MT are occasionally obtained by the commercial boats. Just outside the perimeter of the school the catch rate may be as low as 1000 kg/hr or lower.

Belle Isle Bank

The catches on Belle Isle Bank during 1979 and 1981 were very small for the few sets that were conducted. Since we didn't find cod after about a day's searching, we left the area. In 1983 good catches were obtained on Belle Isle Bank and averaged 1283 kg. The larger catches occurred in depths of 278-319 m and temperatures of 2.7-3.2 C (Table 6).

Northern Funk Island Bank

Catches in this area were typically good during 1979 and 1981 (>2000 kg) and averaged about 1190 and 772 kg in 1982 and 1983, respectively (Table 2). In 1980 the catches of cod on the northern part of Funk Island Bank were low, averaging about 121 kg. The area where good catches were obtained in 1979 was searched but the cod had apparently disappeared from the area. It may be that our coverage of the area was inadequate to locate the concentrations. The large catches (1000-4900 kg) were in depths of 229-408 m and 1.9-4.2 C. The catches of 5000-8300 kg were in 283-346 m and 2.6-3.4 C. Those of 10,500-10,900 kg were in 294-320 m and temperatures of 2.5-3.2 C, while the largest catch of 18,000 kg was in 326 m and a bottom temperature of 3.9 C (Table 6). Generally, the best cod catches are along the outer slopes in depths of 230-400 m and bottom temperatures ranging from 1.9 to 4.2 C but generally averaging about 3 C.

This area of Funk Island Bank generally is consistent in providing good catch rates. The low rates in 1980 illustrate the possibility of missing the schools when searching with one boat. Echo sounding also has its drawbacks in daylight hours since cod sometimes rest close to the bottom and are not easily detected. Generally, the periods around dawn and twilight were the most productive when searching for cod with the echo sounder. There have been occasions when good catches of cod were obtained when they were not detected on the sounder.

Southeastern Funk Island Bank

There were only three catches in excess of 1000 kg taken on the southeastern slopes of Funk Island Bank (Table 3) in the 5 years from 1979 to 1983. Generally, the catches averaged less than 100 kg per year except during 1980 when the average catch was 326 kg. Generally, in this area there are no large concentrations similar to those found on the northern and northeastern slopes of Funk Island Bank. The catches in excess of 1000 kg were taken in depths of 332-336 m and temperatures of 3.0-3.7 C (Table 6).

Southwest Funk Island Bank

During March 1980, good catches of cod were obtained on the southwestern slopes of Funk Island Bank, where the average catch was 1070 kg (Table 4). The catches in excess of 1500 kg

were taken in depths of 256-328 m and temperatures, ranging from 2.2 to 3.7 C. The largest catch of 9300 kg was from 284 m and 3.1 C (Table 6). In the other 3 years, catches were generally smaller, averaging from 82 to 215 kg.

Notre Dame Channel

During March 4-9, 1979, fishing was conducted in the deep water (400-442 m) of Notre Dame Channel, where temperatures ranged from 3.0 to 4.5 C (Table 4). Cod catches in the deep water on the western side of Funk Island Bank were very low (average of 79 kg in 39 sets). These sets were intended primarily to obtain Greenland halibut for tagging. The catches of Greenland halibut generally ranged from about 50 to 300 individuals. The significant by-catches consisted mainly of mentella redfish. Very few cod were overwintering in the deep water on the inside part of the bank although farther to the south, cod were concentrating in shallower water (237-376 m) during March 1980.

North cape of the Grand Bank

Generally, the overall catch rates from the north cape of the Grand Bank during March 1979 and 1980 were good with averages of 524 and 735 kg, respectively (Table 5). During March 1982 catch rates were lower at 188 kg. Typically, the catch rates of this area are generally lower than those of the northern Funk Island Bank. The catches on the north cape of the Grand Bank occurred over a wide range of depths (217-480 m), although bottom temperatures were relatively uniform (1.5-3.8 C) with the average around 3 C. The catches in excess of 1100 kg occurred in 252-290 m and temperatures of 2.1-3.3 C within a small area on the north cape (Table 6).

Northeast Grand Bank

On the northeast Grand Bank, during March 1983, catch rates were similar to those on the north cape during 1979 and 1980. The two catches in excess of 1100 kg were in depths of 351-369 m almost 100 m deeper than those on the north cape of the Grand Bank during March 1979-80 and 1982. Temperatures ranged from 1.8 to 3.4 C. The two sets during March 1980 failed to locate a concentration of cod (Table 5).

Northwest Grand Bank

During March 1982, 26 sets were made along the northwest slope of the Grand Bank, due east of Cape Bonavista (Table 5). The overall catch rate (326 kg/30 minute tow) was good and was comparable to catch rates from the north cape and the northeast Grand Bank. The cod were caught in depths of 207-266 and bottom temperatures of -0.7 to 2.4 C (average of 1.2), about 1-2 C lower on average than temperatures from the north cape and the northeast Grand Bank. There was only one catch of about 1000 kg which was taken in 240 m and 0.7 C (Table 6).

DISCUSSION

The survey during February 1978 in NAFO Div. 2J indicated that cod were most abundant on the eastern slopes of Hamilton Bank in depths of 300-500 m and bottom temperatures of about 3-5 C. These results are similar to those reported by Templeman and May (1965) who found that during surveys conducted in April and May of 1963, large concentrations of spawning and post-spawning cod were present in the extreme eastern slope of Hamilton Bank in depths of 225-330 m at temperatures mainly between 2.5 and 3.1 C. Also Pechenik and Noskov (1962) stated that in the early part of 1961 cod occurred in stable concentrations and were fished successfully on the southeastern slopes of Hamilton Bank at depths of 285-336 m and temperatures of 3-3.75 C.

On the basis of catches during tagging cruises, the highest catch rates occurred on the northern slopes of Funk Island Bank, followed by southeast Hamilton Bank, Belle Isle Bank, and southwest Funk Island Bank. Other areas where catch rates were about 400-700 kg were northern Hamilton Bank, north cape of Grand Bank, and the northeast and northwest Grand Bank. Catch rates on southeastern Funk Island Bank were about 300 kg. The catch rate in Notre Dame Channel was low (79 kg).

The greatest concentrations are on the outer slopes of the continental shelf, especially on the shelf area bounded by southeastern Hamilton Bank, Belle Isle Bank, and northern Funk Island Bank. Catches on the western slopes of Funk Island Bank were generally lower, especially in the deep Notre Dame Channel even though temperatures were favourable (3.0-4.5 C).

A random-stratified survey conducted on the outer slopes of the banks and shelves of NAFO Div. 2J, 3K, and 3L during February-March could possibly serve as an index of the biomass of cod which overwinter in each of the major components.

REFERENCES

- Pechenik, L. N., and A. S. Noskov. 1962. USSR research report, 1961. ICNAF Redbook, 1962, Par. II: 128-139.
- Templeman, W., and A. W. May. 1965. Research vessel catches of cod in the Hamilton Inlet Bank area in relation to depth and temperature. ICNAF Spec. Publ., 6: 149-165.

Table 1. Frequencies of cod catches (kg) per 30 minute tow from northern and southeastern Hamilton Bank during March 1981 and 1982 and from Belle Isle Bank during March 1979, 1981, and 1983.

Catches (kg)	Northern Hamilton Bank		Southeast Hamilton Bank		Belle Isle Bank		
	1981	1982	1981	1982	1979	1981	1983
0-499	22	1	10	9	9	6	12
500-999	6	1		3			1
1000-1499	2			4			4
1500-1999	2			2			
2000-2499	1			1			
2500-2999							
3000-3499	1			1			
3500-3999							
4000-4499				2			
4500-4999				1			
5000-5499							1
5500-5999				2			1
6000-6499							
6500-6999							1
Total	34	2	10	25	9	6	20
Average (kg)	604	362	115	1662	26	8	1283
Depth range (m)	252-361	324-354	251-553	305-434	278-479	241-294	236-343
Av. depth (m)	284	339	342	399	332	271	280
Temp. range (C)	2.3-4.7	2.3-2.5	1.8-3.5	1.5-5.5	3.0-3.6	1.0-2.9	1.7-3.2
Av. temp (C)	2.9	2.4	2.4	3.2	3.3	2.2	2.9

Table 2. Frequencies of cod catches (kg) per 30 minute tow from northern Funk Island Bank during February-March 1979 and March 1980, 1981, 1982, and 1983.

Catches (kg)	1979	1980	1981	1982	1983
0-499	14	19	7	13	7
500-999	5		1	3	5
1000-1499	3		1	2	1
1500-1999	3		1		1
2000-2499	1			1	1
2500-2999	1		2	1	1
3000-3499	3		1	1	
3500-3999	1				
4000-4499	1				
4500-4999	1				
5000-5499	1		2		
5500-5999	1		1		
6000-6499	1				
6500-6999			1		
7000-7499	1				
7500-7999	1				
8000-8499	1				
8500-8999					
9000-9499					
9500-9999					
10000-10499	1				
10500-10999				1	
18000-18499	1				
Total	41	19	17	22	16
Average (kg)	2714	121	2184	1190	772
Depth range (m)	229-408	238-369	283-378	251-424	252-315
Av. depth (m)	276	302	325	297	281
Temp. range (C)	2.5-4.2	2.1-3.3	2.6-3.5	2.2-3.8	1.7-3.4
Av. temp. (C)	3.2	2.9	3.0	2.6	2.3

Table 3. Frequencies of cod catches (kg) per 30 minute tow from southeastern Funk Island Bank during February-March 1979 and March 1980, 1981, 1982, and 1983.

Catches (kg)	1979	1980	1981	1982	1983
0-499	15	50	9	7	3
500-999	1	6			
1000-1499		2			
1500-1999					
2000-2499					
2500-2999					
3000-3499					
3500-3999		1			
Total	16	59	9	7	3
Average (kg)	71	326	54	88	40
Depth range (m)	247-308	237-487	242-315	256-323	290-343
Av. depth (m)	280	321	277	297	314
Temp. range (C)	2.2-4.6	1.9-3.7	2.0-2.7	2.6-3.5	2.0-3.7
Av. temp. (C)	2.9	3.0	2.3	2.9	3.0

Table 4. Frequencies of cod catches (kg) per 30 minute tow from southwestern Funk Island Bank during March 1979, 1980, 1981, and 1982, and from Notre Dame Channel during March 1979.

Catches (kg)	Southwest Funk Island Bank				Notre Dame Channel 1979
	1979	1980	1981	1982	
0-499	7	15	22	3	39
500-999		5	2		
1000-1499					
1500-1999		1			
2000-2499					
2500-2999		1			
3000-3499		1			
3500-3999					
4000-4499					
4500-4999		1			
9000-9499		1			
Total	7	25	24	3	39
Average (kg)	82	1070	215	142	79
Depth range (m)	224-320	237-376	282-340	284-302	400-442
Av. depth (m)	274	312	302	293	426
Temp. range (m)	2.4-4.1	2.2-3.7	1.6-2.7	2.4-3.0	3.0-4.5
Av. temp. (m)	2.9	2.8	2.1	2.6	3.2

Table 5. Frequencies of cod catches (kg) per 30 minute tow from the north cape of the Grand Bank during March 1979, 1980, and 1982, northeastern Grand Bank during March 1980 and 1983, and northwestern Grand Bank during March 1982.

Catches (kg)	North cape of Grand Bank			Northeast Grand Bank		Northwest Grand Bank
	1979	1980	1982	1980	1983	1982
0-499	8	20	20	2	17	20
500-999		2	1		7	5
1000-1499		3			1	1
1500-1999		1				
2000-2499	1		1			
2500-2999	1	1			1	
3000-3499						
3500-3999		1				
4000-4499		1				
Total	10	29	22	2	26	26
Average (kg)	524	735	188	10	537	326
Depth range (m)	272-480	217-460	272-410	240-468	250-371	207-266
Av. depth (m)	308	295	311	354	324	233
Temp. range (C)	2.8-3.6	1.9-3.8	1.5-3.7	2.5-3.3	0.3-4.8	-0.7-2.4
Av. temp. (C)	3.0	3.0	2.8	2.9	2.2	1.2

Table 6. Depths and temperatures of cod catches in excess of 1000 kg/30 minute tow from various areas during 1979-83.

Area	Catch (kg)	N	Depth (m)		Temp. (C)	
			Range	Av.	Range	Av.
Northern Hamilton Bank	1,300-3,300	6	250-296	269	2.6-3.1	2.9
Southeast Hamilton Bank	1,100-5,700	13	323-424	406	1.5-5.5	3.3
Belle Isle Bank	1,100-6,800	7	278-319	292	2.7-3.2	3.0
Northern Funk Island Bank	1,000-4,900	28	229-408	291	1.9-4.2	2.9
	5,000-8,300	10	283-346	313	2.6-3.4	3.1
	10,500-10,900	2	294-320	307	2.5-3.2	2.9
	18,000	1	-	326	-	3.9
Southeast Funk Island Bank	1,500-3,600	3	332-336	335	3.0-3.7	3.4
Southwest Funk Island Bank	1,500-4,500	4	256-328	294	2.2-3.7	3.0
	9,300	1	-	284	-	3.1
North cape of Grand Bank	1,100-4,400	10	252-290	270	2.7-3.3	2.8
Northeast Grand Bank	1,100-2,700	2	351-369	360	1.8-3.4	2.6
Northwest Grand Bank	1,000	1	-	240	-	0.7

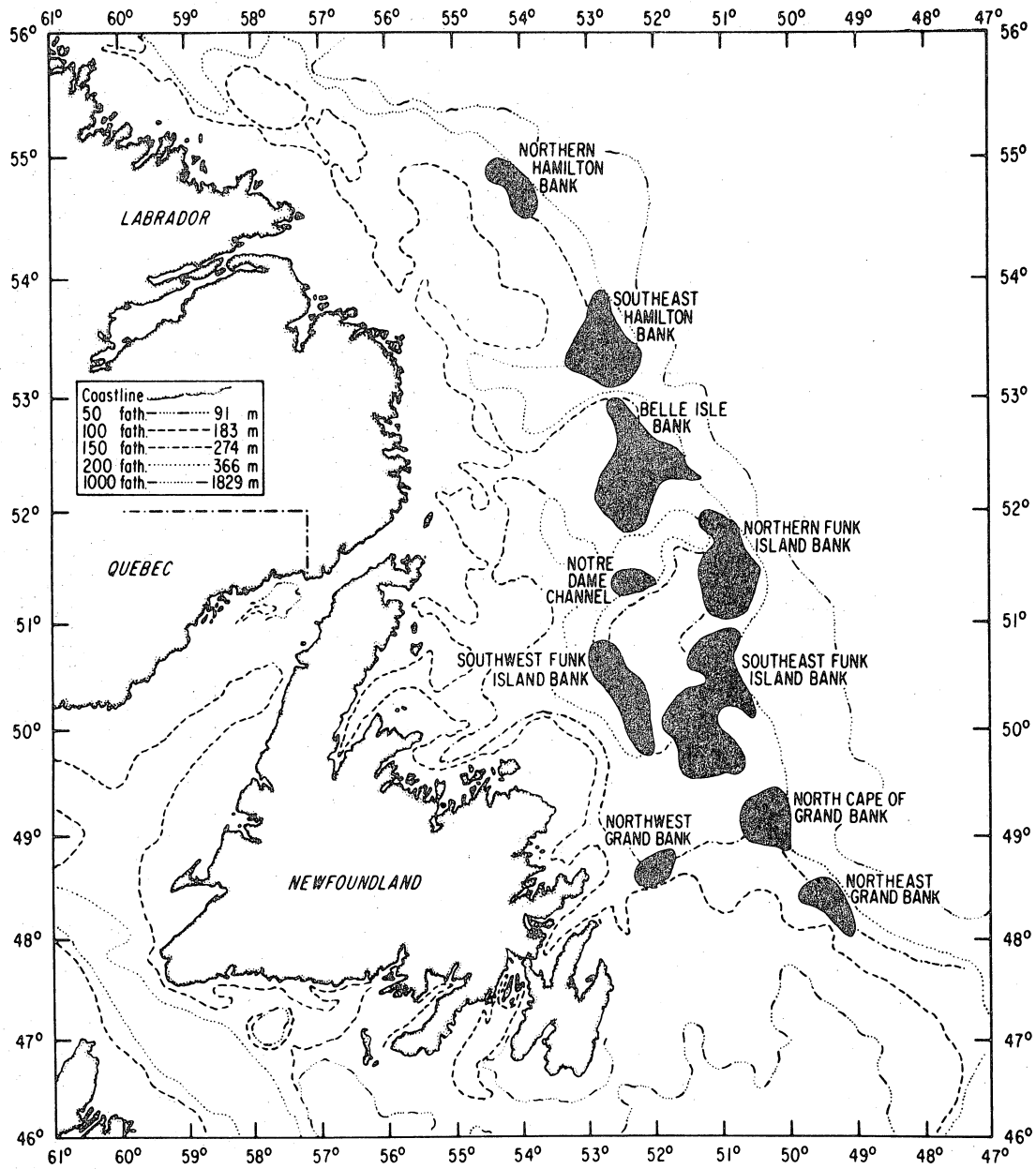


Fig. 1. Area map showing localities where tagging sets were made during February-March 1979 and March 1980-83.

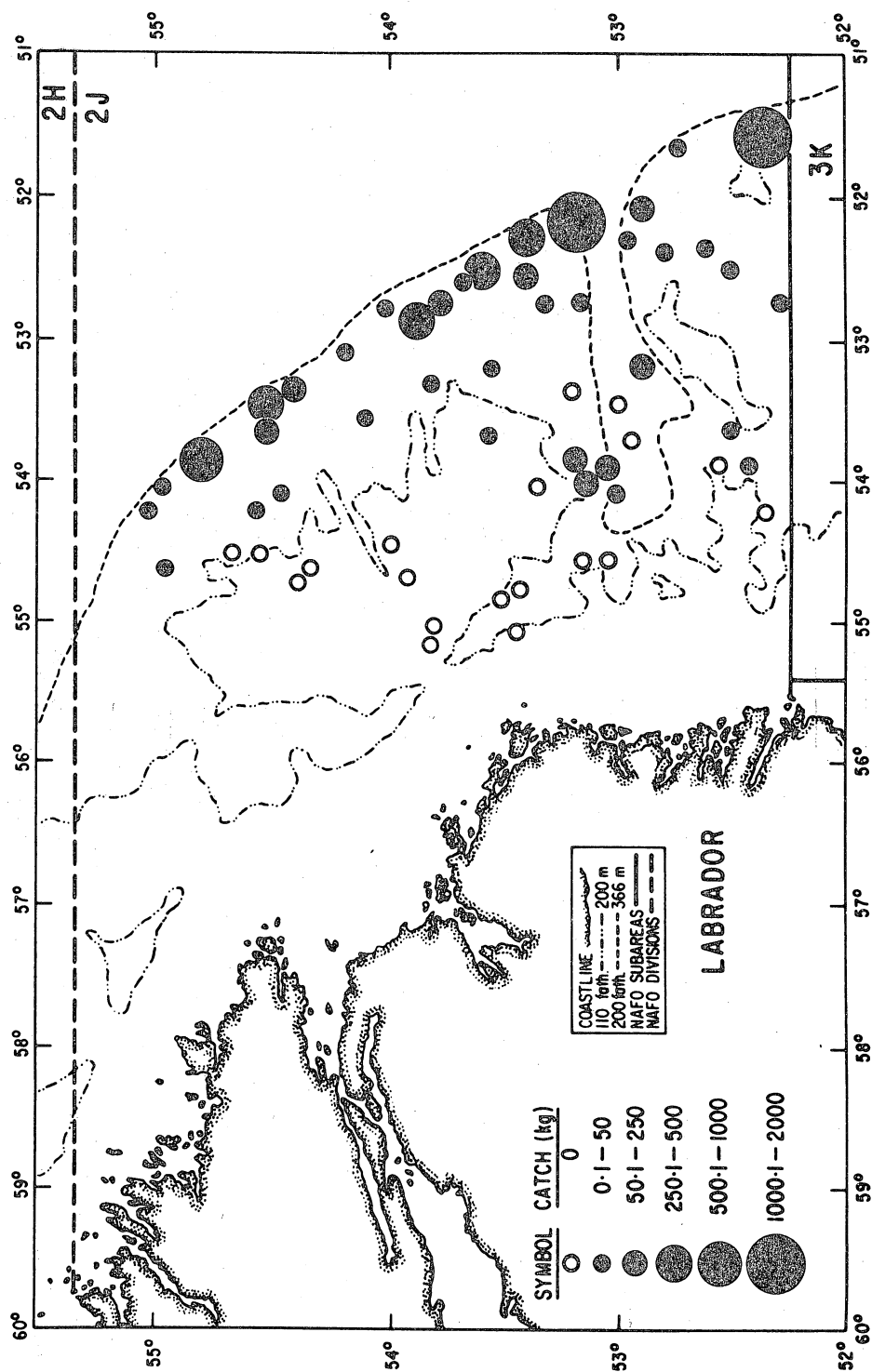


Fig. 2. Catches of cod (kg) per 30 minute tow, obtained during February 1978 by the GADUS ATLANTICA in NAFO Div. 2J.

