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Distribution of Herring in the Northern Gulf of St. Lawrence in Winter

by

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Abstract

As a result of the discovery of concentrations of herring in the area of Great Mecatina Island concurrent with the disappearance of herring from the traditional autumn fishing areas in western Newfoundland, studies were undertaken to examine the distributional pattern of herring in the northern Gulf of St. Lawrence. An examination of the distribution of incidental herring catches recorded in bottom trawl surveys indicated that the winter distribution of herring in the Gulf of St. Lawrence was more diffuse than previously thought. This diffuse distribution and the similarity in age compositions between herring from Great Mecatina Island and those from northern Div. 4R indicate that herring in northern Div. 4R and eastern Div. 4S may belong to one stock.

A la suite de la découverte de concentrations de hareng dans la région de l'île Grand Mécatina, en même temps que la disparition de cette espèce des lieux de pêche d'automne traditionnels à l'ouest de Terre-Neuve, on a entrepris une étude de la répartition du hareng dans le nord du golfe du Saint-Laurent. Un examen de la distribution des prises accessoires dans les relevés au chalut de fond indique que la distribution du hareng dans le golfe du Saint-Laurent était plus diffuse qu'on ne l'avait cru. Cette distribution diffuse et la similitude des compositions par âge entre le hareng de l'île Grand Mécatina et celui du nord de la div. 4R donnent à penser que le hareng de cette dernière région et celui de l'est de la div. 4S appartiennent au même stock.

Introduction

Although herring fisheries have been conducted along the west coast of Newfoundland and Quebec North Shore for generations (Templeman 1966) investigations into the migration patterns and distribution of these herring are relatively recent. Tagging studies were conducted along the southwest coast of Newfoundland and southern Gulf of St. Lawrence in the late 1960's and early 1970's (Winters 1975) and in Hawke's Bay in 1971 (Winters and Parsons 1972). These studies suggested that there was a relationship between northern Gulf and southern Gulf of St. Lawrence herring.

With changes in the pattern of the Gulf herring fisheries in the mid 1970's a series of tagging experiments using external tags was conducted along the west coast of Newfoundland (Moores 1979). These studies indicated that the west coast represented a fairly discrete stock area with only minimal interchange with adjacent stocks. These studies formed the main basis for the formation of the Newfoundland west coast stock area which essentially corresponds to NAFO Div. 4R. The migration hypothesis devised on the basis of the tagging studies and data from the commercial fishery suggested a north-south migration pattern for spring-spawners and an east-west route for autumn-spawners. Spring-spawners were thought to overwinter in the southern portion of 4R, moving inshore to spawn in May and then dispersing to feed in the northern Gulf during the summer. Large schools reform in the area of St. John Bay (Fig. 1) in the late fall, and presumably move south during the winter. The autumn-spawners were thought to overwinter along the edge of the Esquiman Channel, moving inshore to spawn in the late summer and then moving offshore again during the winter.

The relationship of the west coast stock to 4S herring has been raised on several occasions, but the minimal fishery in the area has not provided insights into the situation. There are, however, similarities between the summer fisheries in St. John Bay and the Quebec shore, both being dominated by autumn-spawning fish.

In December, 1981 concentrations of herring were reported in the area of Great Mecatina Island (Fig. 2). The presence of large bodies of herring in this area raised questions about the distribution of herring during this time of year and efforts were made to resolve the problem by examining distributional information available from groundfish surveys. The results of these studies and their implications regarding the current thoughts on herring distribution in the northern Gulf form the basis of this paper.

Methods and Materials

The distribution of herring during winter and spring in Div. 3Pn4RS was determined from incidental catches recorded during bottom trawl surveys (Table 1) designed to catch mainly cod and redfish. Five line-transect surveys (4 winter, 1 spring) using the A.T. Cameron were conducted from 1968 to 1976. Fishing stations were generally at predetermined depth intervals on transects perpendicular to the slope. The shallowest sets were sometimes at 37 m. Stratified-random surveys using the Gadus Atlantica were conducted in depths >91 m in winter 1978-81. Both ships trawled for 30 min at 3½ knots. Catches are reported on the basis of catch per 30 min tow.

Herring samples were obtained during a tagging operation conducted aboard the commercial purse-seining vessel MV Silver Dolphin in the area of Great Mecatina Island on December 15, 1982. These were compared with samples obtained from the autumn commercial fishery in NAFO Div. 4R.

Results

1. Mecatina Island Herring:

As in previous years the fall purse-seine fishery in the area north of Cape St. Gregory commenced in early October. Initially herring appeared abundant and catches were good, however, in late October and November fish became scarce. In efforts to find concentrations the vessels searched outside areas normally fished. In the course of searching, herring were found in the area of the Mecatina Islands, but no fishery could be conducted as the Mecatina Islands are outside the west coast stock area. To obtain more information concerning these fish, a tagging experiment was conducted at Great Mecatina Island on December 15 on board the MV Silver Dolphin. Concentrations of herring were found around the Island, particularly in the northern and southern harbours (Fig. 2). A total of 6,000 tags were applied. No recoveries have been reported to date.

A comparison of the age frequency in the sample collected at Great Mecatina Island with that of the purse-seine catch along the west coast of Newfoundland (Table 2) showed marked similarities, particularly for

autumn-spawners. The only major difference was the relative abundance of the 11+ age-group of spring-spawners, which was dominant (56%) in the Newfoundland purse-seine fishery but was weak (2%) in the Mecatina area.

2. Herring Distribution in Groundfish Surveys:

During line-transect surveys in January-February of 1968, 1971, and 1972 (Fig. 3-5) herring were distributed throughout Div. 4R and on the one transect in Div. 3Pn. Catches south of Cape St. George were smaller in 1972 than in 1971. The survey in May-June 1973 (Fig. 6) revealed herring well distributed throughout Div. 4RS with the exception of the transect off St. George's Bay. The winter survey in 1976 (Fig. 7), which was reduced in coverage compared with earlier surveys, yielded no herring south of Cape St. George.

The four stratified-random surveys in January-February 1978-81 (Fig. 8-11) revealed similar herring distributions. In Div. 4R herring were broadly distributed over all depths surveyed north of Cape St. Gregory, but south of this area very few herring were taken. Good catches of herring were also taken in eastern Div. 4S. Indeed, the herring appeared to be distributed continuously from the northwest coast of Newfoundland to north of Anticosti Island. Significant herring catches were taken southeast of Anticosti Island in 1980 and northwest of the Island in 1981.

Discussion

The groundfish survey catches suggest a much more diffuse pattern of distribution during the overwintering period than is suggested by the current theory of herring migrations. This pattern of distribution is supported by catches from the January 1981 survey of the Martin and Philip (Moores et al. 1981). The question remains as to whether this pattern represents a stable winter dispersion or a gradual migration of herring from the northern area into the southern area.

The groundfish survey data also show a marked change in the presence of herring in Div. 3Pn and southern Div. 4R. During the surveys in 1968-72 herring were frequently caught in these areas but they have been absent in subsequent surveys. This disappearance corresponds to the time period during which the herring fishery collapsed along the southwest coast of Newfoundland due to the failure of southern Gulf of St. Lawrence herring to migrate into the area.

The discovery of concentrations of herring in the area of Great Mecatina Island coincidental with the disappearance of herring in the traditional west coast fishing area may indicate that both areas contribute to the one stock. If these herring are indeed part of the west coast herring stock, then the migration pattern is more complex than currently hypothesized. The Great Mecatina Island area could represent a major overwintering area. If this more complex migration hypothesis is found to be valid, then bias may be introduced into the interpretation of the abundance indices used in assessment of the Div. 4R stock. However, the hypothesis that Div. 4R and Div. 4S represent distinct stock areas cannot yet be disproved.

Further tagging in Div. 4S, particularly in the late autumn, is required to clarify the overwintering distribution of herring in the northern Gulf of St. Lawrence and to resolve possible relationships between herring in northern Div. 4R and eastern Div. 4S. The outcome of such work may indeed be a unification of the northern Gulf of St. Lawrence into one management zone with the stock complex being managed on a basis similar to that which has been used for the southern Gulf of St. Lawrence stock.

Acknowledgements

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References

Moores, J.A. 1979. Analysis of the status of the Newfoundland West Coast herring stock. CAFSAC Res. Doc. 79/5, 17 p.

Moores, J.A., G.H. Winters, and C.I. Barbour. 1981. An examination of the status of the Newfoundland west coast herring stock. CAFSAC Res. Doc. 81/9, 37 p.

Templeman, W. 1966. Marine Resources of Newfoundland. Bull. Fish. Res. Board Can. 154: 170 p.

Winters, G.H. 1975. Population dynamics of the southern Gulf of St. Lawrence herring stock complex and implications concerning its future management. Ph.D. Thesis, Dalhousie University, 142 p.

Winters, G.H. and L.S. Parsons. 1972. Inter-relationships among Hawke's Bay, southwest Newfoundland and southern Gulf of St. Lawrence herring stocks. ICNAF Res. Doc. 72/100.

Table 1. Groundfish surveys utilized for examining the distribution of herring in the Gulf of St. Lawrence.

Date	Cruise	Survey design	Fishing[1] gear
1968 Jan. 26-Feb. 6	A.T. Cameron 141	line transect	Yankee 41-5
1971 Jan. 24-Feb. 6	A.T. Cameron 181	line transect	Yankee 41-5
1972 Jan. 22-Feb. 3	A.T. Cameron 194	line transect	Yankee 41-5
1973 May 19-June 4	A.T. Cameron 210	line transect	Yankee 41-5
1976 Jan. 31-Feb. 8	A.T. Cameron 242	line transect	Yankee 41-5
1978 Jan. 6-22	Gadus Atlantica 4	stratified random	Engels high rise
1979 Jan. 6-15	Gadus Atlantica 16	stratified random	Engels high rise
1980 Jan. 27-Feb. 11	Gadus Atlantica 31	stratified random	Engels high rise
1981 Jan. 29-Feb. 17	Gadus Atlantica 46	stratified random	Engels high rise

[1] trawls were fitted with a 29 mm liner in the codend.

Table 2. A comparison of the age frequency in the samples obtained from Mecatina Island and in the fall purse-seine fishery along the west coast of Newfoundland.

Age	Mecatina			M+N		
	AS	%	SS	AS	%	SS
1	-		4	-		0.1
2	-		6	-		-
3	-		2	3		2
4	19		31	11		6
5	-		1	5		1
6	-		4	4		2
7	-		45	5		29
8	13		1	17		1
9	-		2	7		2
10	-		1	3		1
11+	69		2	45		56

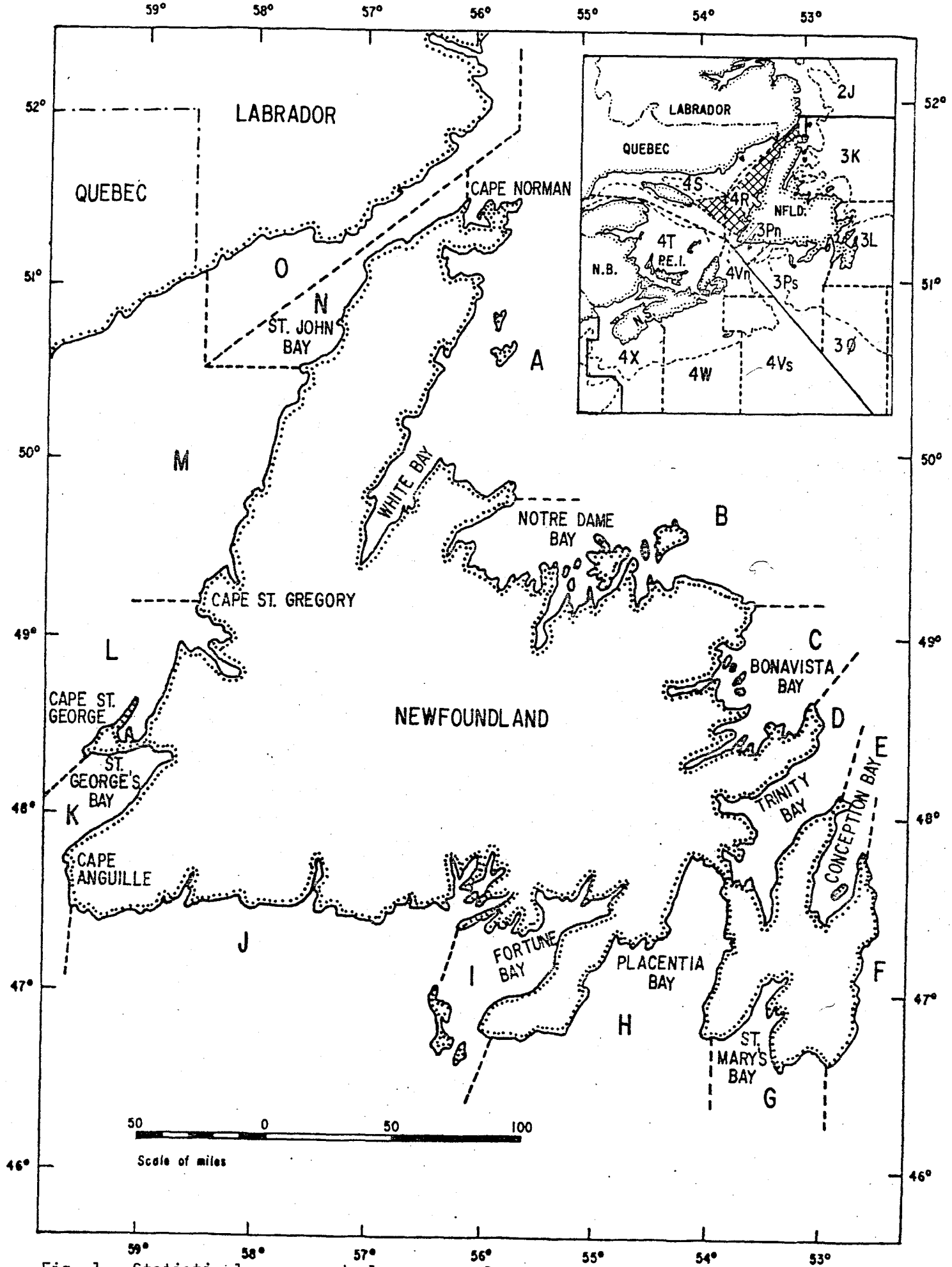

Fig. 1. Statistical areas and place names for Newfoundland Region.
Inset: NAFO areas and Newfoundland west coast stock area (hatched region).

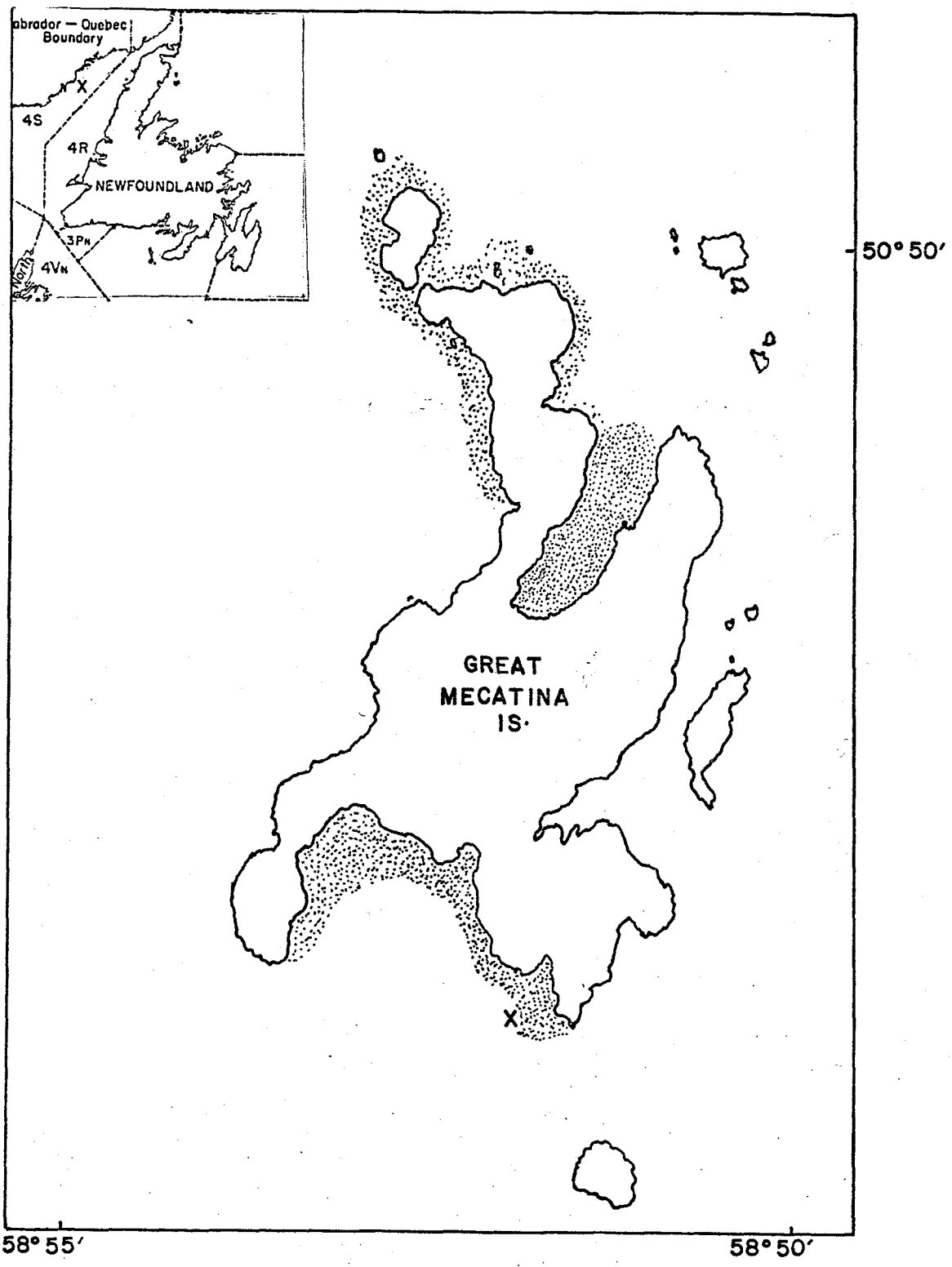

Fig. 2. Site of herring tagging December 15, 1982. Areas where herring schools seen are indicated by stipled areas.

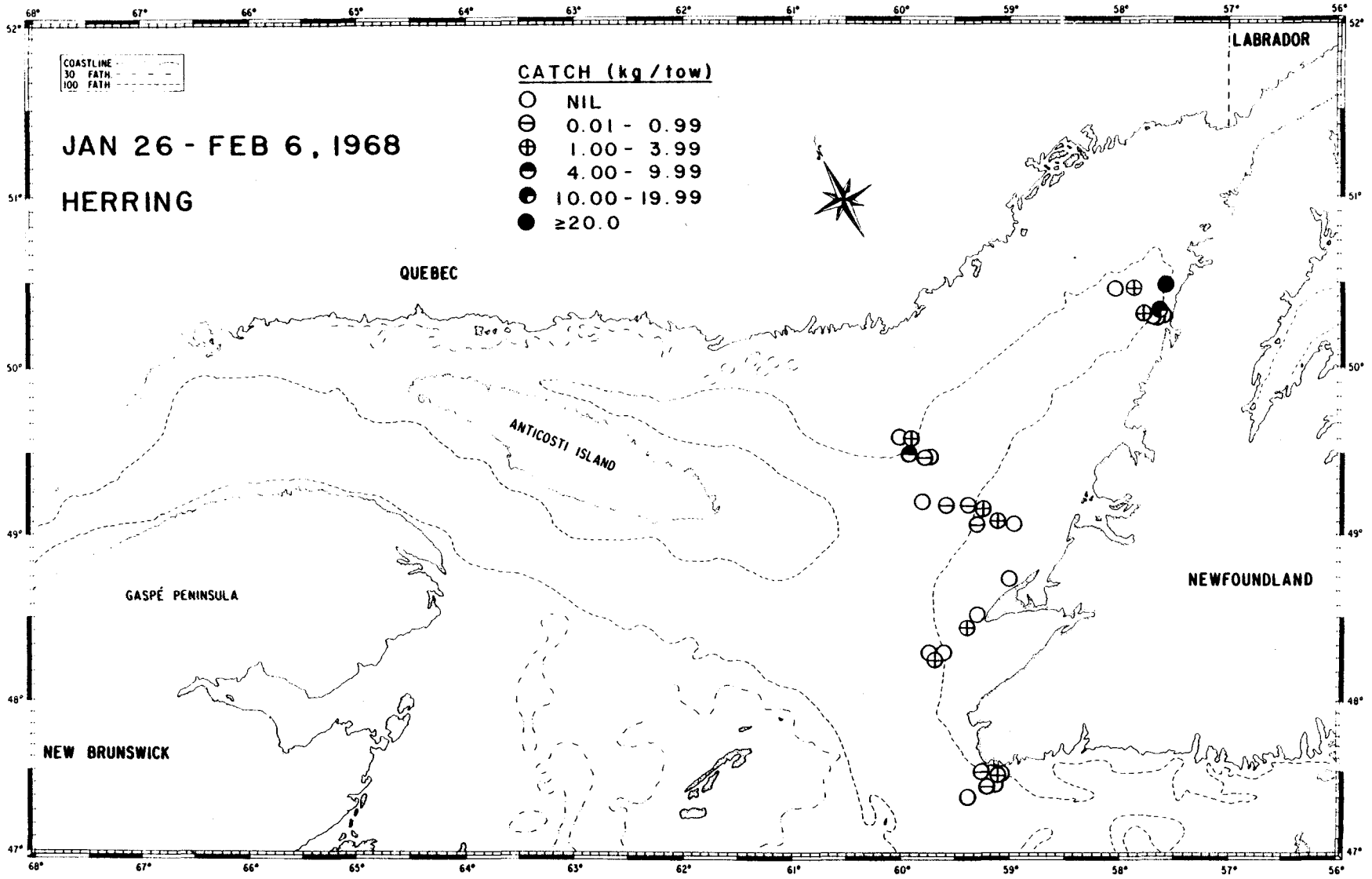

Fig. 3. Winter distribution of herring in 1968.

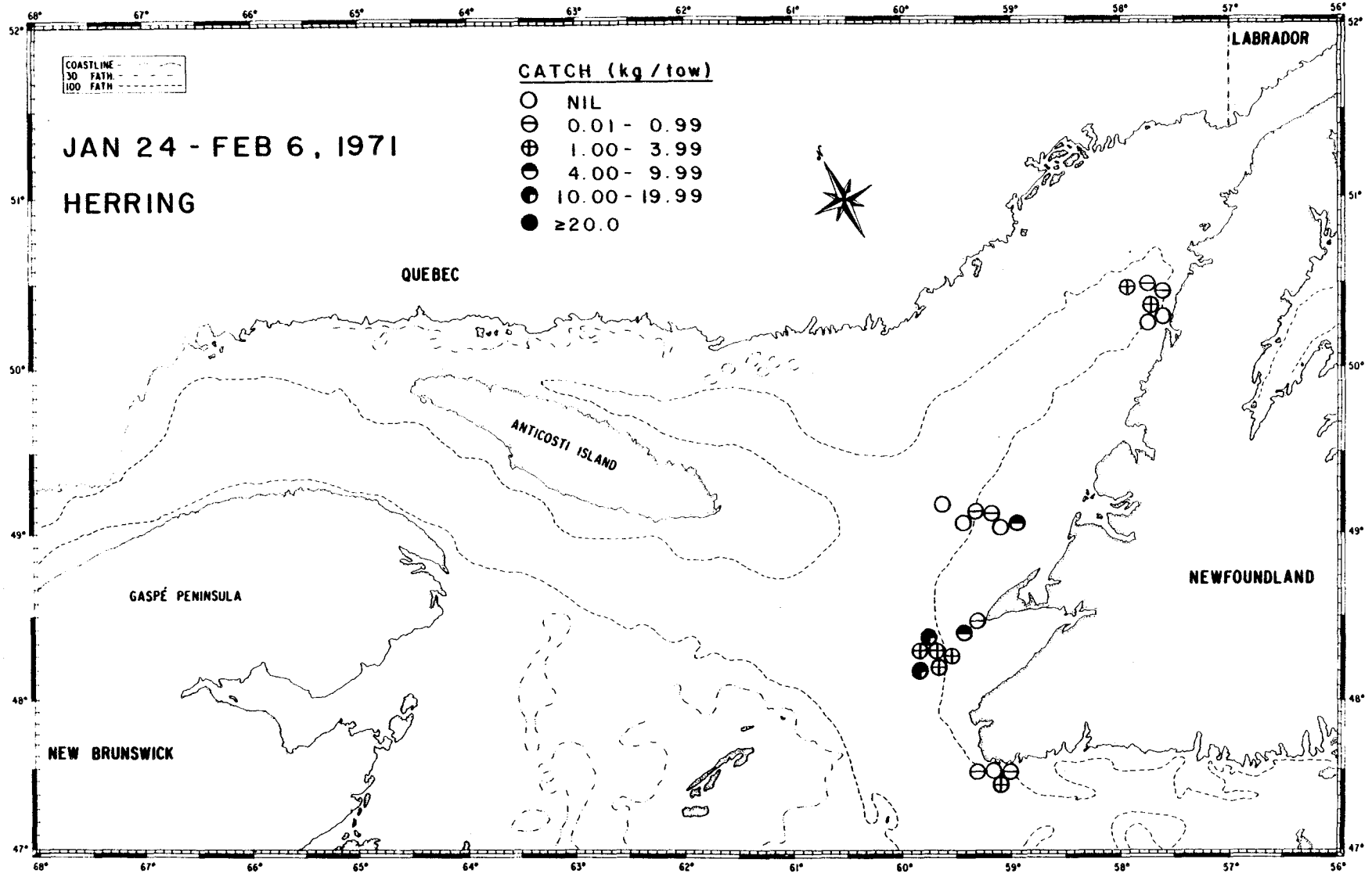

Fig. 4. Winter distribution of herring in 1971.

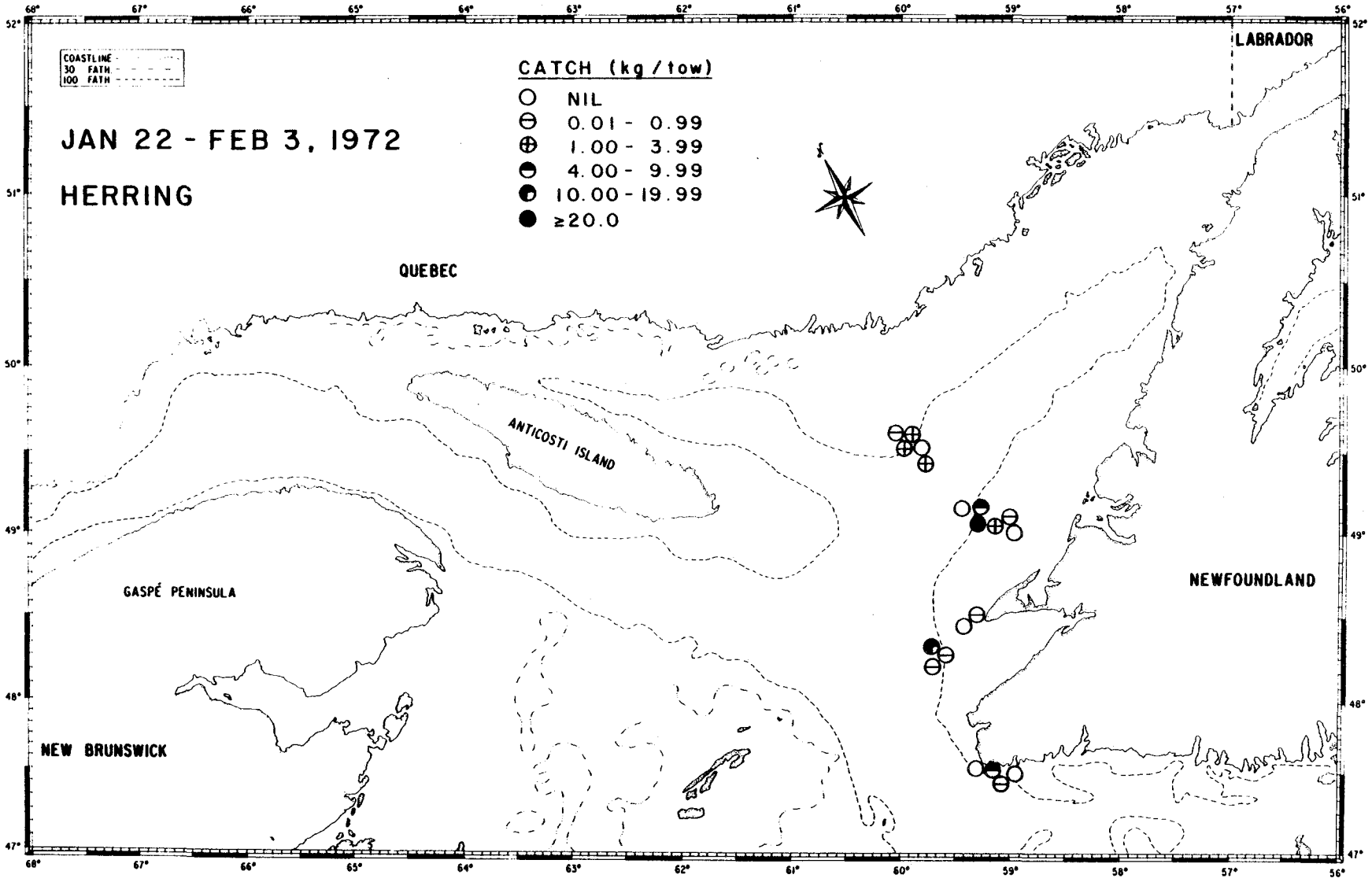

Fig. 5. Winter distribution of herring in 1972.

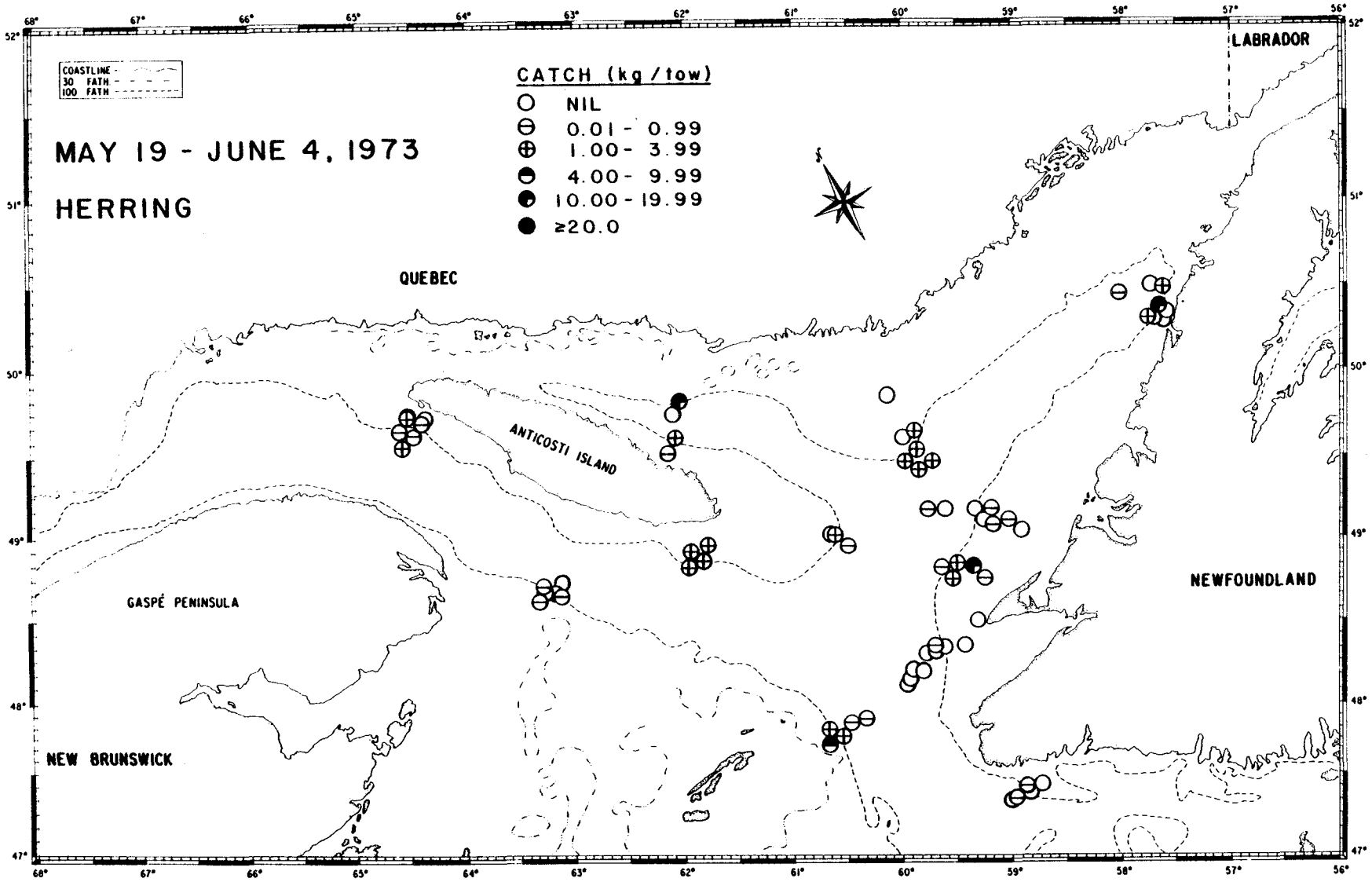

Fig. 6. Spring distribution of herring in 1973.

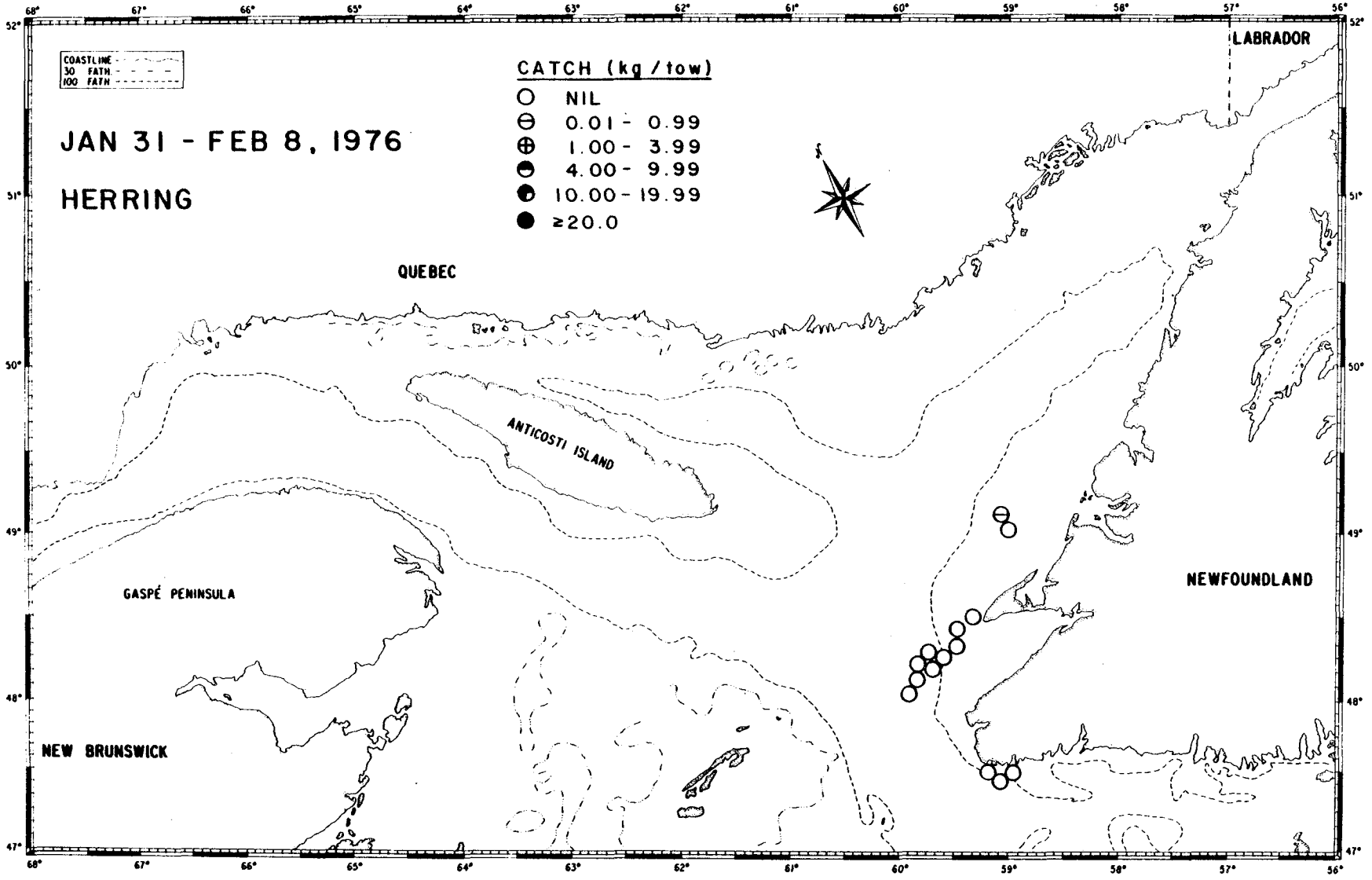

Fig. 7. Winter distribution of herring in 1976.

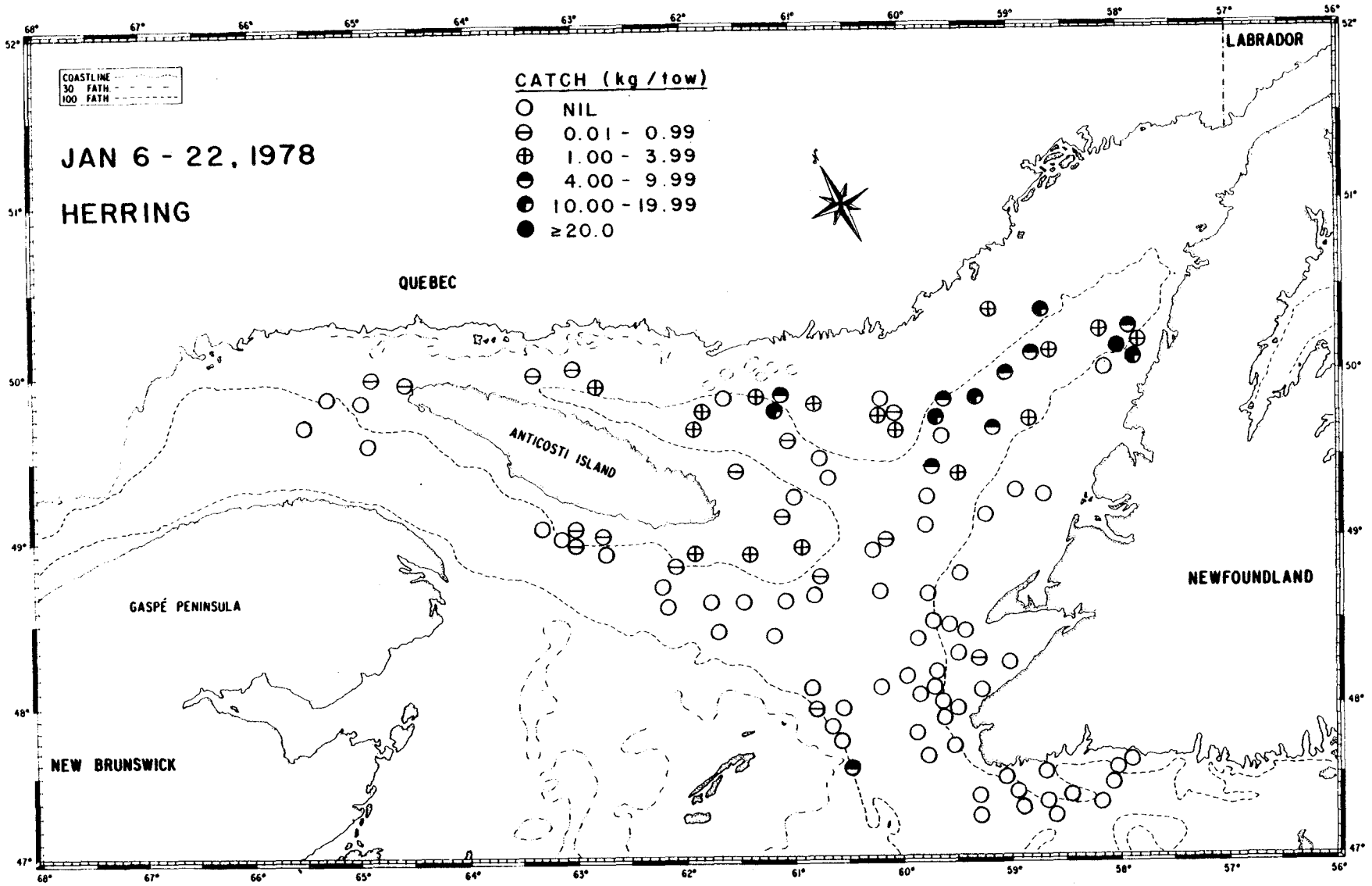

Fig. 8. Winter distribution of herring in 1978.

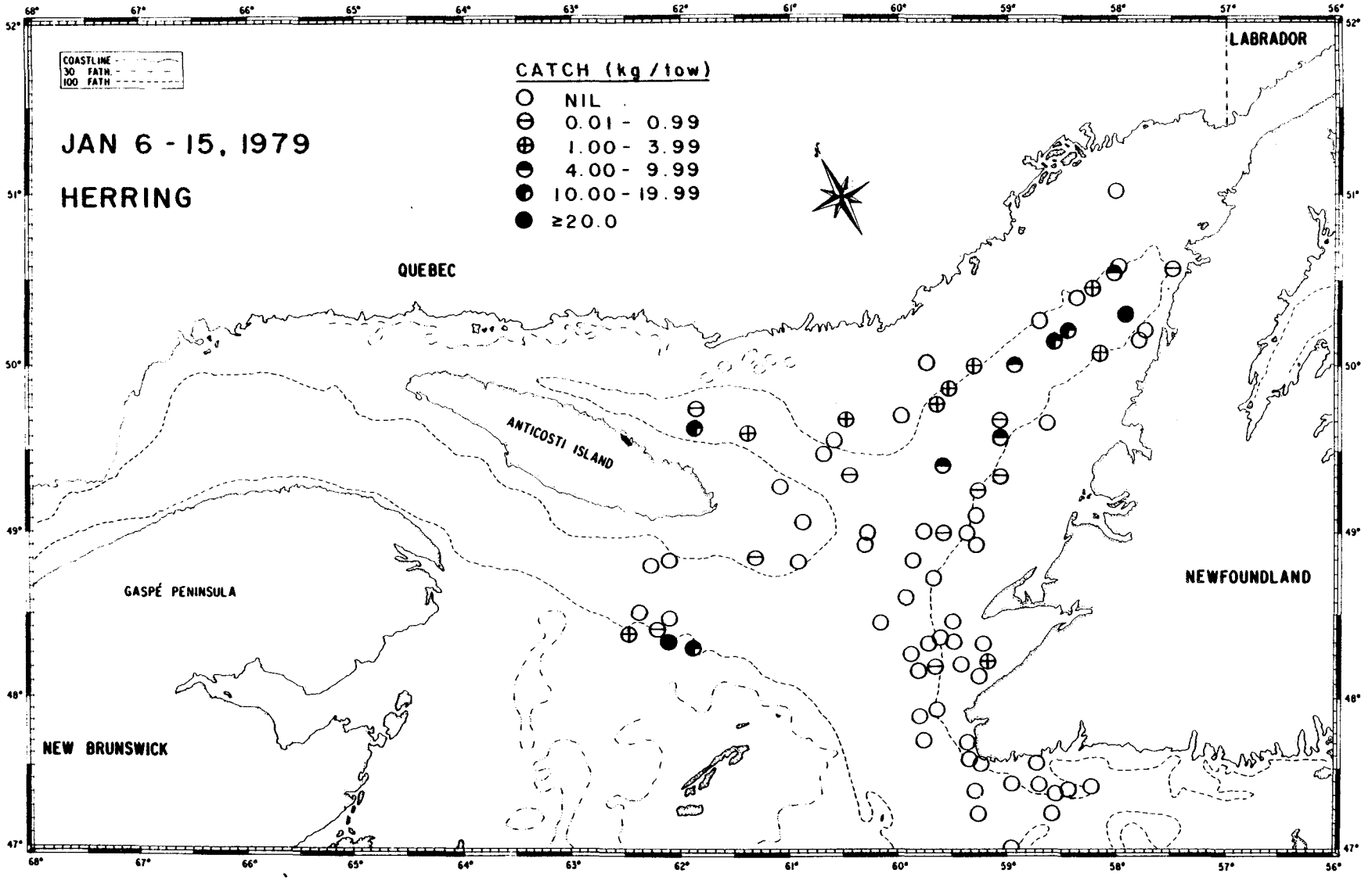

Fig. 9. Winter distribution of herring in 1979.

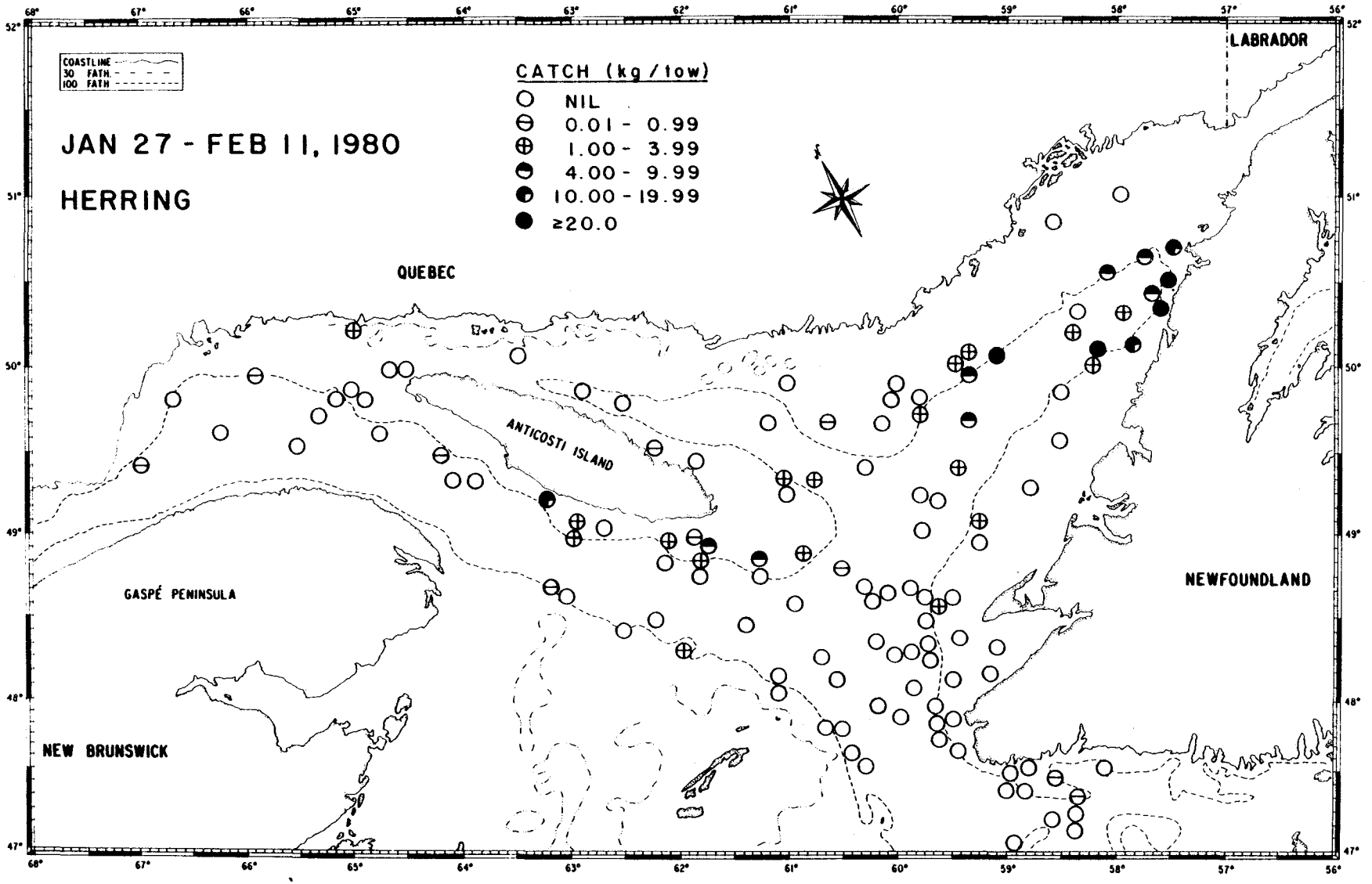

Fig. 10. Winter distribution of herring in 1980.

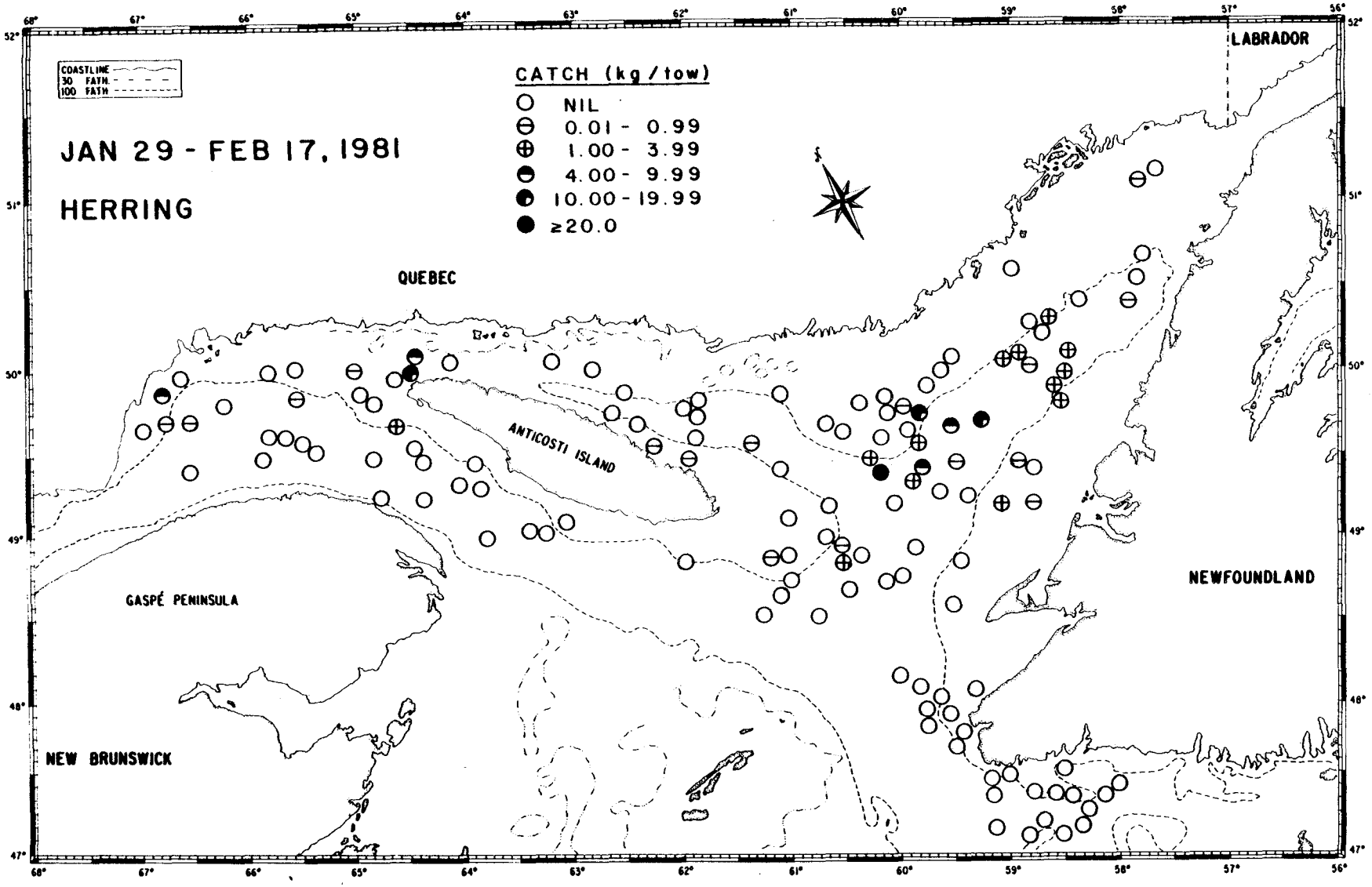

Fig. 11. Winter distribution of herring in 1981.