

ANNUAL MEETING - JUNE 1968Fish Stocks in ICNAF Subarea 4

by A.C. Kohler
Fisheries Research Board of Canada
Biological Station, St. Andrews, N. B.

Introduction

At the meeting of the ICNAF Standing Committee on Regulatory Measures in February 1968, a number of questions were posed concerning the distribution and status of fish stocks in the ICNAF area. This document attempts to answer some of those questions for Subarea 4, by presenting distributions of the commercially important marine species. The species dealt with here include cod, haddock, redfish, halibut, silver hake, plaice, witch, yellowtail, winter flounder, wolffish, pollock, white hake, cusk, herring, and mackerel. In addition to these, there are five species in Subarea 4 that are abundant at present but only lightly exploited commercially. These are sand lance, argentines, sculpins, anglers, and skates. Comprehensive distribution charts for these latter species are not yet available for Subarea 4, but research is going on at present into the biology of some of them.

Figures 2 to 16 on distribution were made by stippling areas in which the species considered are found in significant quantities. Fishing distribution is shown by larger dots in either 500- or 100-metric ton average landings for 1962 to 1966. A chart of Subarea 4 outlining ICNAF Divisions is shown in Fig. 1.

Stock Distribution and FishingCod

Cod are to be found, sometimes seasonally, in all of ICNAF Subarea 4. Figure 2 shows the general distribution of this species and also the pattern of fishing. There

appear to be four major divisions of the cod stock in Subarea 4. The most northerly stock is north of the Laurentian Channel in Div. 4R and 4S, and may be composed of two groups. The southern Gulf of St. Lawrence stock is resident south of the Channel in Div. 4T and migrates annually into Div. 4Vn during the winter. Divisions 4W and 4Vs cod may be separated during the year, although there is some movement of fish to spawning areas in the Western Bank-Emerald region (4W) in the spring. The most southerly stock of cod in Subarea 4 is resident in Div. 4X, with the concentration in the Browns Bank area.

Figure 2 shows fishing of the cod stocks to be concentrated in a number of areas. These are along the west coast of Newfoundland, off the Gaspé in the southern Gulf of St. Lawrence, off northern Cape Breton, in the Western Bank-Emerald Bank area, and in the Browns Bank area. The variety of fishing gears used to catch cod include otter trawl, pair trawl, longline, Danish seine, gillnet, handline, and traps. Handlines, traps, and gillnets are mainly restricted to inshore waters. Otter trawling, pair trawling, longlining, and Danish seining are carried out on the offshore banks.

Pure cod trips by Canadian trawlers are rare. In general, the proportion of cod to other species in a trip is high in the Gulf of St. Lawrence, moderate on the Nova Scotia banks, and low in the Bay of Fundy. Many of the commercial species are caught in varying amounts along with cod. It would be difficult to fish cod on the Nova Scotia banks and in the Bay of Fundy area without catching considerable quantities of haddock as well.

Haddock

The distribution and fishing of haddock in Subarea 4 are shown in Fig. 3. Haddock are found in the area from northern Cape Breton, southward on the fishing banks and west to the Bay of Fundy. However, there are

only light seasonal concentrations of haddock in Div. 4Vn and 4Vs. Only spring and occasional summer concentrations are found regularly in Div. 4W. In Div. 4X the main stocks of haddock are to be found in the Browns Bank area and also in the mouth of the Bay of Fundy. In the area as a whole, we would separate the stocks into two, divided by the deep-water Scotian Gulf which lies near the border of Div. 4V and 4W.

About 95% of the haddock landings **now taken** from Subarea 4 are fished by otter trawl. Longlines and Danish seines pick up some catches as do traps and gillnets inshore, but these landings are relatively small.

Practically all of the Canadian haddock landings are from mixed species landings, cod being the principal species taken in conjunction with haddock.

Redfish

The distribution of redfish in Subarea 4 is shown in Fig. 4. In general, this species is found in relatively deep water on fishing grounds 100 fathoms deep and over. In the Gulf of St. Lawrence, the redfish is commonly found in Div. 4R and 4S, north of the Laurentian Channel, and along the southerly edge of the Laurentian Channel in Div. 4T. The distribution follows the deep water both inshore and on the offshore edge of the Nova Scotia banks, and the species can be found around into the mouth of the Bay of Fundy (4X). On the basis of limited knowledge, we would separate the stocks of Div. 4R and 4S from those in 4T, and we would probably divide again somewhere in the shallow-water area of Western Bank, Middle Ground, and Scatarri Bank (4Vs, 4W) where there appears to be a natural shallow-water division. Although redfish appear to be fairly common from surveys along the outer edges of the Nova Scotia banks, there is little fishing in these areas.

Practically 100% of the redfish landed in Subarea 4 are caught by otter trawl. In these catches, considerable

quantities of silver hake and argentines could be caught by a vessel fishing for redfish, but no Canadian figures are available on this since the latter species are not retained by our vessels. Minor quantities of witch are also caught and landed along with redfish.

Halibut

Halibut are distributed throughout the fishing grounds in Subarea 4. Figure 5 shows their distribution in Div. 4R and 4S, where they are found around Anticosti Island, along the south coast of Quebec-Labrador, and along the west coast of Newfoundland. South of the Laurentian Channel they are found occasionally along the Channel edge in Div. 4T. On the Nova Scotia banks they may be found all the way from the east to the west along the 100-fathom edge. Main concentrations appear to be seasonal and occur in the Sable Island gully, and along the deep-water areas in Div. 4V, 4W, and 4X.

Stock divisions are difficult to make for halibut because of the migratory habits of the species. A major tagging effort in the Sable Island-Banquereau gully showed that many fish move to the Grand Banks area. Earlier taggings in Div. 4X and 4W showed other extensive movements.

The main Canadian fishery for halibut is carried out by longline although handline landings are made each year. Occasionally, concentrations of halibut are fished by otter trawlers when the opportunity affords itself. Hake, cusk, and cod are taken incidentally and sometimes in fair quantities by halibut longliners.

Practically all of the halibut landings from Subarea 4 are by Canadians and about two thirds of this catch is taken on longlines.

Silver Hake

Our present knowledge of the distribution of silver hake in Subarea 4 is shown in Fig. 6. Areas of

distribution are limited mainly to the outer edge of the Nova Scotia banks in Div. 4Vs, 4W, and 4X, and the area of Sable Island Bank and Middle Ground in Div. 4W. They are also found in the deep-water area between Div. 4W and 4X. Silver hake are normally found in deep water but apparently, when the water warms up during mid summer over the banks, they move into shoaler water occasionally, particularly in the area around Sable Island.

All of the catches landed are made by otter trawl at present. Any incidental catches made by Canadian otter trawlers are discarded at sea. The landings shown for the ICNAF area are made by the USSR and the USA, with the majority by the former. It is not known if any other species are caught in abundance incidentally to silver hake catches; however, from the areas of fishing concentration shown in Fig. 6, it is likely that haddock would be caught along with silver hake.

Plaice

Plaice have a wide distribution in Subarea 4 and are found in all Divisions as shown in Fig. 7. Concentrations are indicated in Div. 4T and 4Vn, as shown by the plot of landings. However, most of these landings are taken incidentally to other species. The exception to this is the Danish seiner and small otter trawler fishery where the main species sought may be plaice.

Witch

The distribution of witch in Subarea 4 is shown in Fig. 8. In general, this species is found in depths of 80 fathoms or more. The Figure shows that, in the northern Gulf of St. Lawrence, the main area of concentration is along the deep water off the west coast of Newfoundland in Div. 4R. South of the Laurentian Channel, witch is found along the edge of the Channel in Div. 4T and 4Vn, and in the deep-water areas of 4Vs and the Scotian Gulf (4W-X). They also occur along the outer edge of the Nova Scotia banks.

Landings indicate that areas of fishing concentration are mainly along the southern edge of the Laurentian Channel and in the deep-water areas of Div. 4V. Otter trawlers capture fair amounts of witch while fishing for redfish or for cod in the deep water. At certain times of the year, Canadian Danish seiners fish specifically for witch in the eastern Nova Scotia region (eastern 4W, 4V). Other landings of this species are taken by otter trawl.

Yellowtail

The distribution of yellowtail in Subarea 4 is shown in Fig. 9. Although this flounder may be found occasionally in almost all the shoal-water areas in Subarea 4, the main concentrations are in Div. 4Vs on Banquereau and in Div. 4W on Western Bank and around Sable Island. Although some yellowtail are landed incidentally in landings of other species, the main landings shown in the statistics are for the effort directed specifically towards catching yellowtail. Divisions of populations are not clear at present.

Winter Flounder

Winter flounder distribution and fishing in Subarea 4 are shown in Fig. 10. The species has an inshore distribution and, as shown in the Figure, is found from Chaleur Bay in Div. 4T around to the eastern end of Prince Edward Island. The distribution inshore in the Nova Scotia banks area extends from the tip of Cape Breton in 4Vn through 4W and 4X around to the Bay of Fundy in the inshore areas. Landings are mainly from the inshore ground by small otter trawlers and, in the last 6 years, have been concentrated in the western part of Div. 4T. An area between Cape Breton and P.E.I. also supports some landings in Div. 4T. There is also a fishery for winter flounder in the St. Mary Bay region, ^(Div. 4X) Small sizes generally predominate in areas along the outer Nova Scotia coast.

Tagging in the St. Mary Bay area indicates that stocks are mainly local along the coast.

Wolffish

Wolffish distribution and fishing are shown in Fig. 11. This species is found scattered over the fishing banks in Div. 4V, 4W, and 4X. Most of the landings in recent years have been incidental to other species and mainly by otter trawl and longline. Occasionally wolffish have been found to concentrate and move inshore during the months of May and June, particularly in the southwestern Nova Scotia area (Div. 4X). This concentration resulted in small draggers and longliners fishing seasonally for the species in inshore areas.

Pollock

Pollock distribution in Subarea 4 is shown in Fig. 12. The main areas of distribution are the Nova Scotia banks and the Bay of Fundy, from Div. 4V to Div. 4X. Areas of concentration are found to be from Western Bank in Div. 4W, westward.

Canadian fishermen account for about 90% of the total pollock landings from Subarea 4. The fish are taken inshore in summer by handline, trap, purse-seine, and longline, and are taken offshore in all seasons by otter trawl. When pollock are taken incidentally to other species, they are usually taken with either cod or haddock by otter trawl. However, when they are the species sought, they are quite often segregated and fished independently of other species. This occurs particularly in Div. 4W and 4X.

Studies of pollock distribution indicated that there are three groups of pollock in the Gulf of Maine and adjoining regions. These stocks are the Bay of Fundy, southwestern Nova Scotia, and southern Gulf of Maine stocks. Tagging studies have shown little mixing of the Bay of Fundy fish with those of southwestern Nova Scotia.

White Hake

The distribution and fishing of white hake are shown in Fig. 13. This species is found south of the Laurentian Channel in Subarea 4 (Div. 4T, 4V, 4W, and 4X). No particular areas of depth distribution are evident for this species as it may be found at the edge of the banks or on top of the banks in the south. Studies have not yet progressed far enough to show separation of stocks. However, tagging carried out in the Gulf of St. Lawrence in 1967 may help to solve this problem. The main fisheries for white hake are by gillnet, line, and otter trawl in the southern Gulf of St. Lawrence; a line fishery off Digby Neck; and incidental line and otter trawl catches off southwestern Nova Scotia. Many of the Div. 4X-4W landings are incidental, whereas the fishery in the southeastern part of Div. 4T is specifically for hake.

Cusk

Cusk distribution in Subarea 4 is shown in Fig. 14. The main area of known distribution is in Div. 4X and in the western part of Div. 4W. Over 95% of the cusk landings from Subarea 4 are from longline catches, and over 80% of these are from Div. 4X. Landings by otter trawl are incidental to other species. Cusk is the main species in some longline catches, but a considerable quantity is taken by halibut longliners also.

Nothing is known of stock divisions of cusk at present.

Herring

Distribution of herring stocks and landings is shown in Fig. 15. The Figure shows eight stock divisions known at present. These are in the north of Div. 4S, on the west coast of Newfoundland in Div. 4R, in the Gaspé area in Div. 4T, in the mouth of the St. Lawrence River in

Div. 4T, in the Magdalens area in Div. 4T, in the Cape Breton area in Div. 4Vn, in the coastal Nova Scotia region in Div. 4W and 4Xq, and in the Bay of Fundy area, Div. 4X. Herring are fished inshore by traps or weirs, seines, and purse-seines. Recently, the purse-seine fishery in Subarea 4 has increased, and during the last year, mid-water trawling for herring has become important.

Mackerel

Mackerel distribution and fishing areas are shown in Fig. 16. It is assumed that there is a single population of mackerel that migrates to the Canadian coastal region (Subarea 4) in the late spring and retreats southward in the autumn. The fishery usually starts in southwest Nova Scotia (Div. 4X) in late May and extends along the Nova Scotia coast (Div. 4W and 4V) and into the Gulf of St. Lawrence (Div. 4T, 4S, and 4R) in June. Very few mackerel are caught after the middle of October. The area of distribution extends throughout the Gulf of St. Lawrence, but fishing is restricted chiefly to the southern part (Div. 4T). Mackerel are fished inshore chiefly with gillnets and traps, although some purse-seining is carried on in Div. 4T. The fishery has shown steady growth since 1959, and landings during that period have increased from 4000 to 11,000 tons annually.

Total Annual Yields from Subarea 4

Table I shows the total marine fish landings from Subarea 4, in metric tons, for species that are currently commercially exploited in the Subarea. Total landings by species, by division, for the years 1962 to 1966 are given. Averages for this period have also been calculated. On the average, over the 5 years summarized, relative importance of marine fish in terms of weight landed is as follows: cod, herring, redfish, haddock, silver hake, pollock, plaice, white hake, witch, mackerel, yellowtail, winter flounder,

cusks, and halibut. Areas of importance for particular species by division can be seen both in Table I and in the Figures.

Total sustainable yields for most of these stocks and species are not known.

Sampling for Year-Class Strengths in Subarea 4

Sampling for ages of fish in the commercial catch is carried out by Canada and by other countries fishing in Subarea 4. Examples of what has been taken in samples of Canadian commercial landings from Subarea 4 are shown in Table II. The Table contains a summary of commercial sampling for 1965 to 1967 by division and by species.

It will be noted that sampling for ages is significant only for cod, haddock, and herring, and for these three species only in certain divisions. For cod, the best sampling is in Div. 4T, followed by Div. 4X, 4Vn, and 4W. For haddock, by far the best sampling for these 5 years has been in Div. 4X, while significant numbers of samples have also been taken from Div. 4W. Herring have been well sampled in Div. 4T and 4X.

Other species shown in the Table are sampled irregularly. These include hake, plaice, yellowtail, witch, winter flounder, and mackerel, which are sampled for age and length. Commercial samples of pollock and redfish are also taken for lengths.

Research-vessel samples for age and length in Subarea 4 are available for cod, haddock, some of the flounder species, and recently, for silver hake and argentines. Main areas of concentration of research-vessel sampling have been Div. 4T for cod and plaice in September, and Div. 4W and 4X for haddock, silver hake, and argentines in the spring, summer, and fall months. Yearly continuity in these samplings is broken in most cases.

Table III shows Subarea 4 samples from countries other than Canada (Maritimes) for the years 1964 to 1965. These were summarized from the Sampling Yearbook.

For 1964, there was significant sampling for cod in 4Vn by Spain and Newfoundland, for haddock in 4X by the USA, and for silver hake in 4W by the USSR. In 1965, there was significant sampling for cod in 4V by Poland, for cod in 4W by Poland, for haddock in 4W by Poland, for haddock in 4X by USA, and for silver hake in 4W by USSR. All these samples were from otter-trawl catches except for five trap samples which are indicated in the Table.

Tables II and III indicate that, for many of the species resident in Subarea 4, information on year-class strengths is either poor or non-existent. In addition, ageing techniques for many of these species have yet to be verified. Consequently, growth, recruitment, and mortality estimates for the majority of stocks are not available for Subarea 4 at present.

Acknowledgments

Assistance in assembling the data presented in this document was provided by S.N. Tibbo and D.N. Fitzgerald.

Table I. Marine fish landings from Subarea 4 (in metric tons, round fresh).

	Cod	Had.	Redf.	Hal.	Sil. Hake	Plaice	Witch	YT	W.Fl.	Fl. N.S.	Wolf- fish	Pol.	White Hake	Cusk	Herr.	Mack.
4R	1962	48102	128	1609	243	270	1555		20	49	10	2	7		1985	16
	1963	42366	316	6908	233	348	2090		4	87	8	17	4		2274	-
	1964	58960	680	9967	389	428	1621	13		132	29	6	8		5148	11
	1965	43839	706	20115	340	523	1564	2		79	16	2	7		4868	10
	1966	44208	203	33057	405	554	1171	-	13	166	53	168	50		6490	44
	Avg.	47495	407	14331	322	424	1600	3	7	102	25	39	15		4155	16
4S	1962	13171	12	3444	272	182	61			632	22	2	18		85	126
	1963	12176	27	9674	160	68	46	9	2	625	25	1	26		47	438
	1964	10142	43	16845	152	45	39	1	1	914	74	62	159	1	51	231
	1965	8355	9	23517	130	52	102		2	392	-	3	67		47	9
	1966	7253	16	24133	84	97	74	9	18	474	-	-	20		78	29
	Avg.	10219	21	15522	159	88	64	4	5	607	24	14	58		58	177
4T	1962	53218	1142	1532	106	4590	1775	3	2311	1308	19	18	7244		34430	1635
	1963	50715	1065	3212	144	6358	1501	42	2594	2218	29	36	6550		39900	2326
	1964	41618	462	2890	74	6916	1034	34	2644	1419	66	8	6206	9	39333	5094
	1965	46471	438	5195	223	8778	1367	43	3710	2569	6	16	4706	1	44254	4622
	1966	38248	150	8025	123	9362	1744	99	2413	3531	4	18	7024		36905	5258
	Avg.	46054	651	4171	134	7200	1484	44	2734	2209	25	19	6346	2	38964	3787
4Vn	1962	23290	1105	3676	59	741	2007	17	37	36	230	554	201	4	9346	733
	1963	27124	1284	2746	47	1184	4492	10	11	209	204	400	229	1	526	907
	1964	29562	1069	2450	104	903	3858	114	12	225	187	337	192	6	411	1070
	1965	28555	539	2867	84	1646	3055	30	27	154	10	147	376	1	299	1088
	1966	26476	857	6888	66	2126	3575	16	50	236	58	226	348	1	143	1235
	Avg.	27001	971	3721	74	1320	3397	37	27	172	138	333	269	3	2145	1005

continued

Table I (continued). Marine fish landings from Subarea 4 (in metric tons, round fresh).

	Cod	Had.	Redf.	Hal.	Sil. Hake	Plaice	Witch	YT	W.Fl.	Fl. N.S.	Wolf- fish	Pol. Hake	White Hake	Cusk	Herr.	Mack.
4V's	1962	25768	2311	4372	235	111	342	1463			56	738	49	11		
	1965	27566	4085	6270	167	140	322	1730	6		38	274	31	8		
	1964	25496	2747	7629	228	1058	1923	3964		8	54	137	25	8		
	1965	36715	3054	3319	402	3036	1957	4295	5	22	12	1058	110	19		
	1966	27165	2443	3067	466	5969	1520	3499	3	20	12	562	22	43		
Avg.	28541	2928	4931	300	-	2063	1213	2990	3	10	34	554	47	18		
4W	1962	38804	21408	16173	623	8825*	3428	1998	74	726	437	12045	391	481	2074	827
	1965	40607	20138	20146*	479	116388*	2090	2013	65	572	288	9152	1462	257	5038	751
	1964	37761	19016	6535	358	62905*	2530	1147	19	56	222	12488	773	255	2280	1492
	1965	34275	51487*	7740	458	49461*	2631	966	103	7632*	26	13134	7929*	669	7284	1098
	1966	41007	20199	16105*	313	3860	1752	190	5	13094*	31	11040	2657	601	2976	2016
Avg.	38491	26450	13340	446	48288	602	2486	1263	53	4416	201	11572	2642	453	3930	1357
4X	1962	15829	17925	12812	785	29	61	24	466	107	668	19624	1930	3199	67696	2888
	1965	17785	24414	9592	840	6472*	72	53	558	103	484	20645	900	1634	63645	1678
	1964	25755	35979	6244	861	18210*	247	90	1211	157	689	19283	4702	4098	92319	2166
	1965	26914	29007	5652	665	379	105	103	1107	693	48	13390	1605	3945	123691	3976
	1966	30899	42224*	14776*	331	6423*	74	53	640	1198*	29	12648	1169	4352	188918	4146
Avg.	23436	29910	9815	696	6303	367	112	65	796	452	384	17118	2061	3446	107254	2971
All areas	1962	218182	44031	43618	2323	8854	9229	3505	2908	2858	1442	32983	9840	3695	115614	6215
	1965	218339	51329	58548	2070	123028	10613	3857	3240	3814	872	30525	9202	1900	111430	6100
	1964	229294	59996	52538	2166	81147	11252	5363	3887	2911	1321	32321	12065	4377	139522	10114
	1965	225122	85240	68405	2302	50020	10781	5439	4954	11541	118	27750	14800	4635	180443	11403
	1966	215254	66092	106051	1788	10323	9910	3866	3142	18719	187	24662	11290	4997	235510	12728
Total																
Avg.	221237	61338	65831	2131	54675	12064	10356	4406	3625	7968	829	29649	11438	3922	156504	9312

*Large USSR landings

Table II (continued)

Subdivision	1965			1966			1967			
	No. of Samples	No. of fish Measured	No. of Otoliths	No. of Samples	No. of fish Measured	No. of Otoliths	No. of Samples	No. of fish Measured	No. of Otoliths	
471	2	381	0	12	1,785	0	4	581	92	
	0	0	0	0	0	0	2	282	0	
	3	561	0	0	0	0	2	202	0	
472	6	961	69	<u>American Plaice</u>						
	0	0	0	8	855	139	1	200	0	
	0	0	0	1	107	0	0	0	0	
	0	0	0	1	100	20	2	333	91	
473	0	0	0	0	0	0	1	148	30	
	<u>Winter Flounder</u>									
474	3	570	0	8	809	160	4	435	40	
	1	162	100	0	0	0	0	0	0	
475	<u>Yellowtail Flounder</u>									
	0	0	0	1	100	20	0	0	0	
	0	0	0	3	500	100	3	600	120	
476	0	0	0	1	100	26	0	0	0	
	<u>Witch</u>									
	1	200	42	0	0	0	0	0	0	
	4	510	139	5	431	107	0	0	0	
477	3	644	140	4	700	140	1	200	50	
	0	0	0	0	0	0	6	1,146	255	
478	4	603	171	2	234	46	0	0		

TABLE II (continued)

Subdivision	1965			1966			1967		
	No. of Samples	No. of fish Measured	No. of Otoliths	No. of Samples	No. of fish Measured	No. of Otoliths	No. of Samples	No. of fish Measured	No. of Otoliths
	<u>Herring</u>								
4X	147	26,763	4,539	140	18,655	3,429	178	26,351	6,093
4T	5	875	200	17	4,197	2,297	24	3,266	2,239
4Vn	-	-	-	1	500	500	-	-	-
	<u>Mackerel</u>								
4X	35	3,747	1,218	17	2,178	167	19	2,026	1,086
4W	1	100	-	6	383	216	-	-	-
4Vn	3	300	100	-	-	-	-	-	-
4T	11	1,118	300	14	1,265	293	-	-	-

Table III. Subarea 4 samples from countries other than Canada (Maritimes and Quebec)

<u>1964</u>						
Species	Area	No. of Samples	No. of fish Measured	Ages	Country	
Cod	4R	1 (trap)	130	?	Nfld.	
	4Vn	11	3,028	?	Spain and Nfld.	
	4Vs	3	654	?	Spain	
Haddock	4X	42	4,144	Yes	U.S.A.	
Redfish	4RST	25	2,423	?	U.S.A.	
	4V	14	1,500	?	U.S.A.	
	4W	10	995	?	U.S.A.	
	4W	1 (research)	2,072	?	Poland	
	4X	10	1,200	?	U.S.A.	
Silver hake	4W	55	20,615	?	U.S.S.R.	
	4W	*14	791	Yes	U.S.S.R.	
Am. plaice	4W	2	506	No	Poland	
<u>1965</u>						
Cod	4R	4 (trap)	495	?	Nfld.	
	4R	1	328	?	Nfld.	
	4Vn	5	1,695	?	Nfld.	
	4Vs	1	287	?	Nfld.	
	4V	2	245	?	U.K.	
	4R	2	100	Yes	Portugal	
	4V	? (research)	7,729	Yes	Poland	
	4W	? (research)	616	Yes	Poland	
	Haddock	4R	2	414	?	Nfld.
4Vs		? (research)	458	Yes	Poland	
4W		? (research)	12,447	Yes	Poland	
4X		63	3,345	Yes	U.S.A.	
Redfish	4R	3	856	?	Nfld.	
	4RST	22	2,200	?	U.S.A.	
	4Vn	1	403	?	Nfld.	
	4Vs	3	479	?	U.S.A. and Nfld.	
	4V	6 (research)	3,930	?	Poland	
	4W	12	1,200	?	U.S.A.	
	4W	1 (research)	385	?	Poland	
	4X	27	2,700	?	U.S.A.	
Silver hake	4W	58	20,498	?	U.S.S.R.	
	4W	*6	610	Yes	U.S.S.R.	

All samples from otter trawl catches except those marked (trap)

* Age frequency tables -- age length keys available

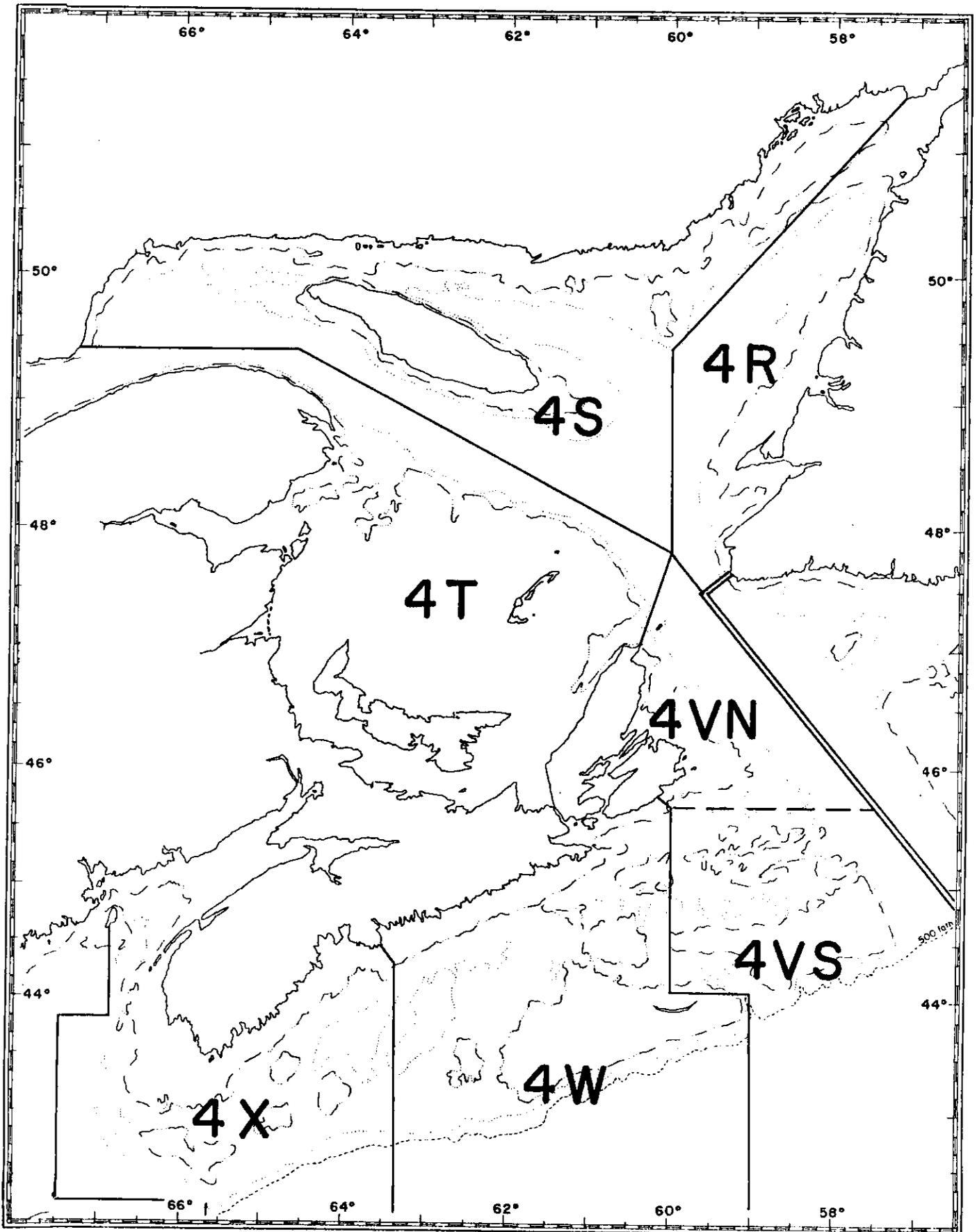


Fig. 1. Divisions of ICNAF Subarea 4.

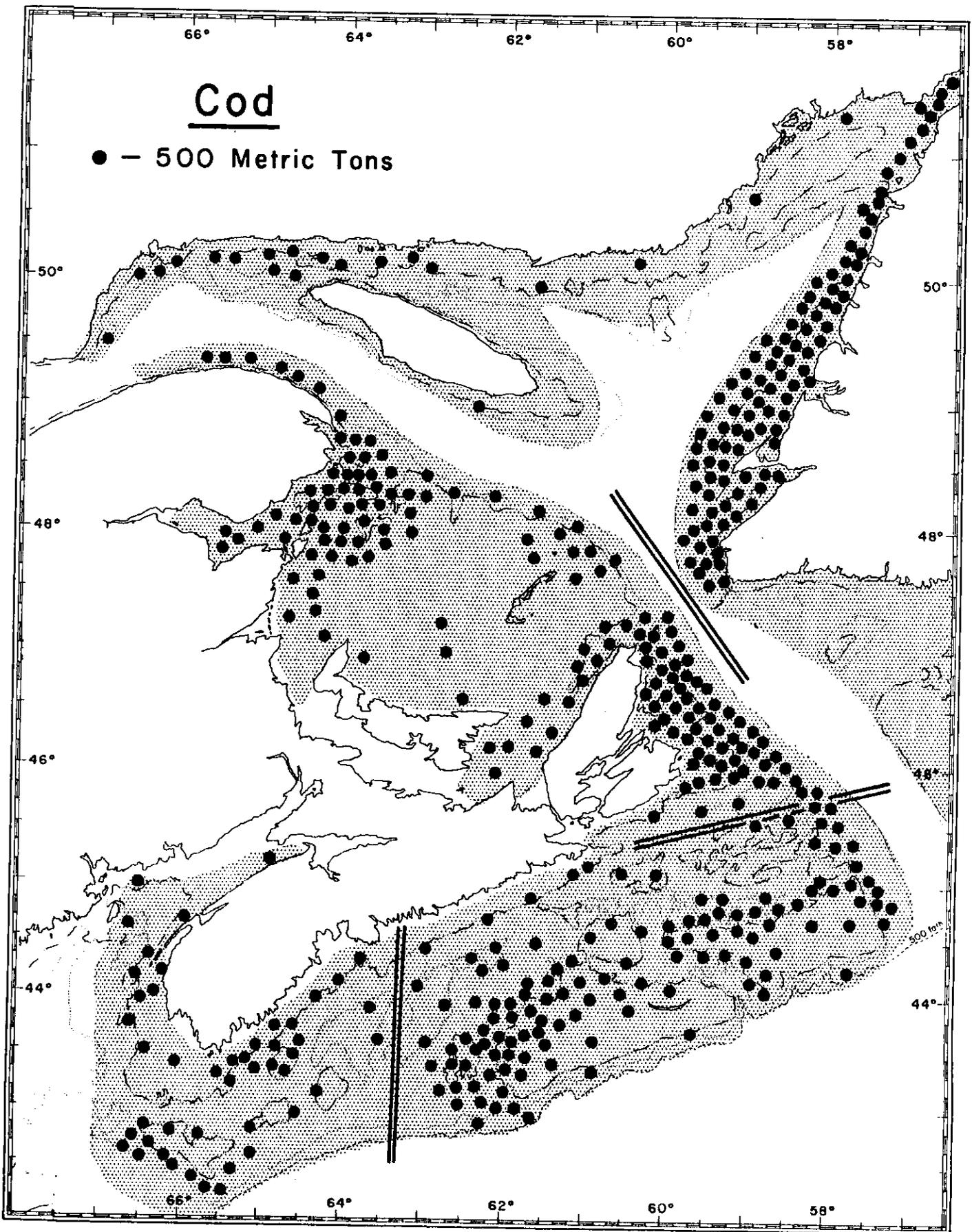


Fig. 2. Cod distribution in ICNAF Subarea 4. Stippled zones show areas of significant distribution. Straight lines show approximate divisions of stocks.

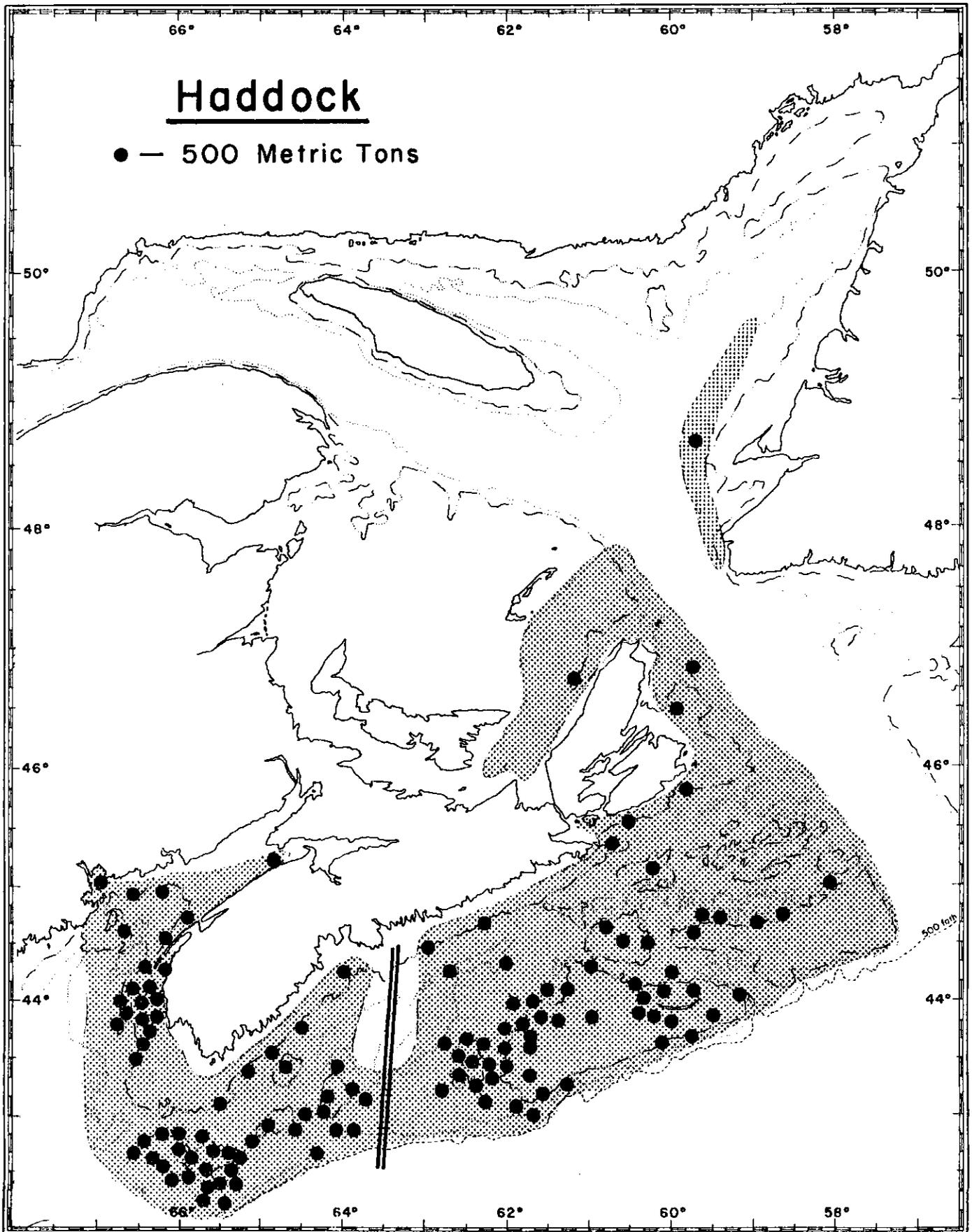


Fig. 3. Haddock distribution in ICNAF Subarea 4. Stippled
..... stocks.

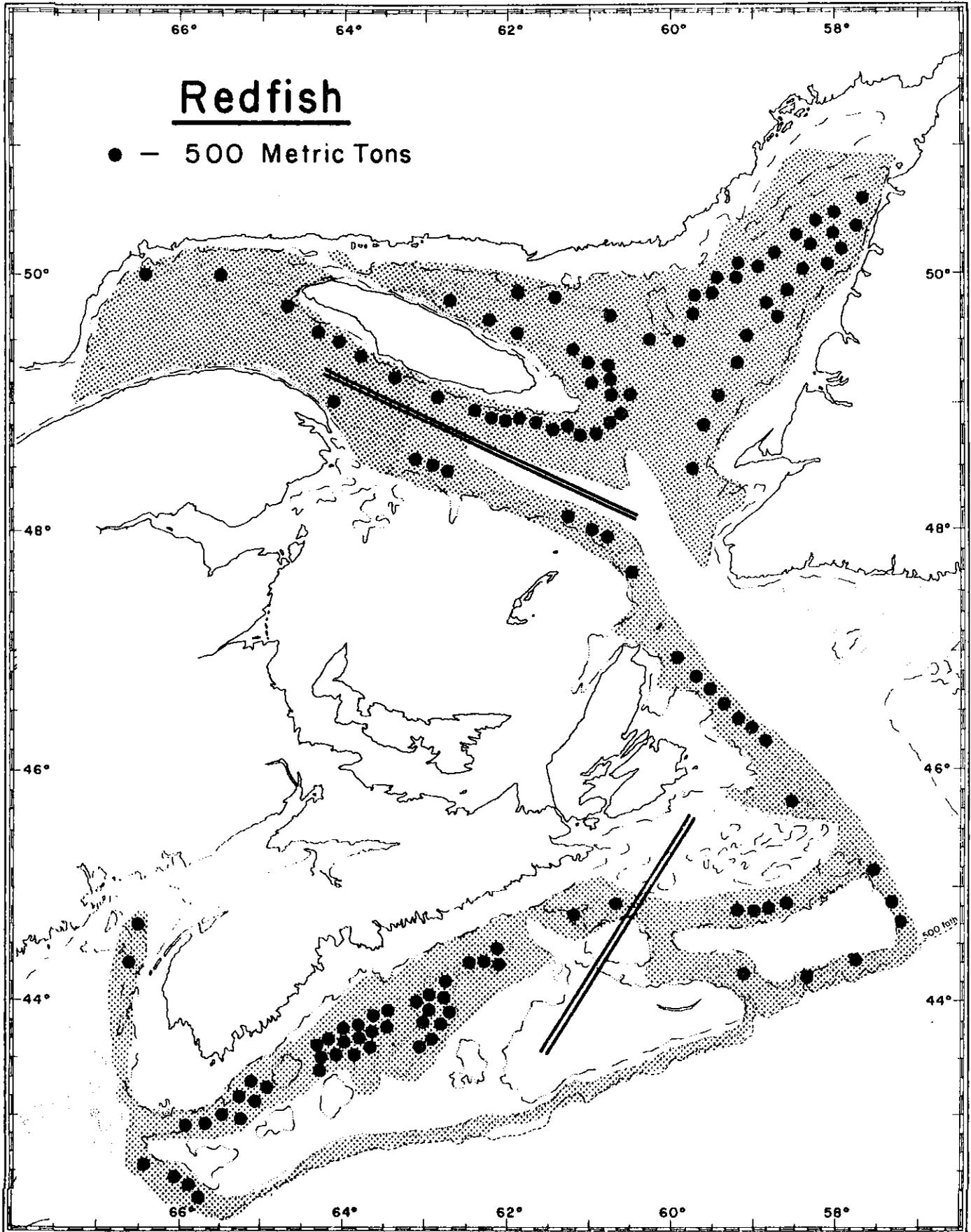


Fig. 4. Redfish distribution in ICNAF Subarea 4. Stippled
..... stocks.

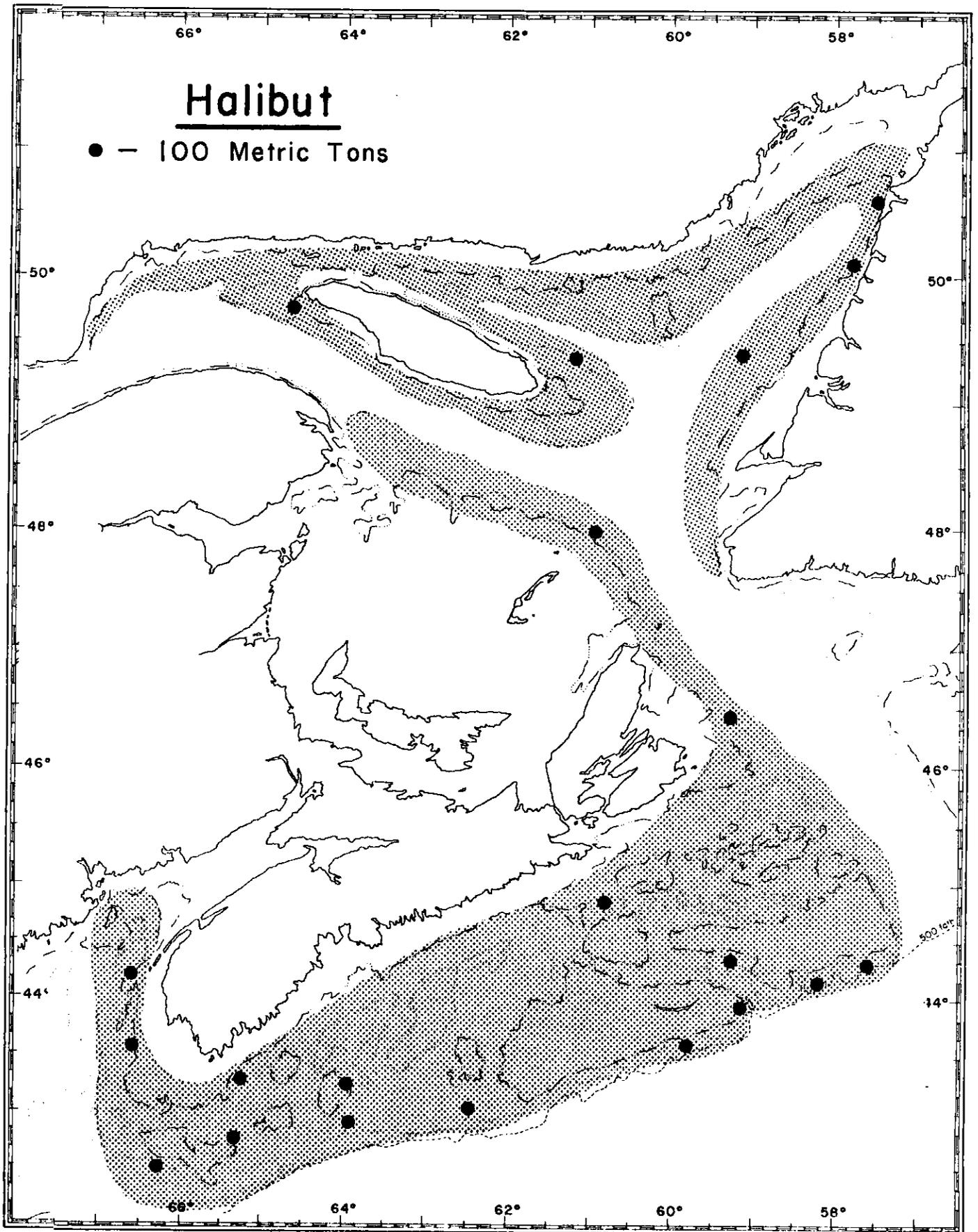


Fig. 5. Halibut distribution in ICNAF Subarea 4. Stippled zones show areas of significant distribution.

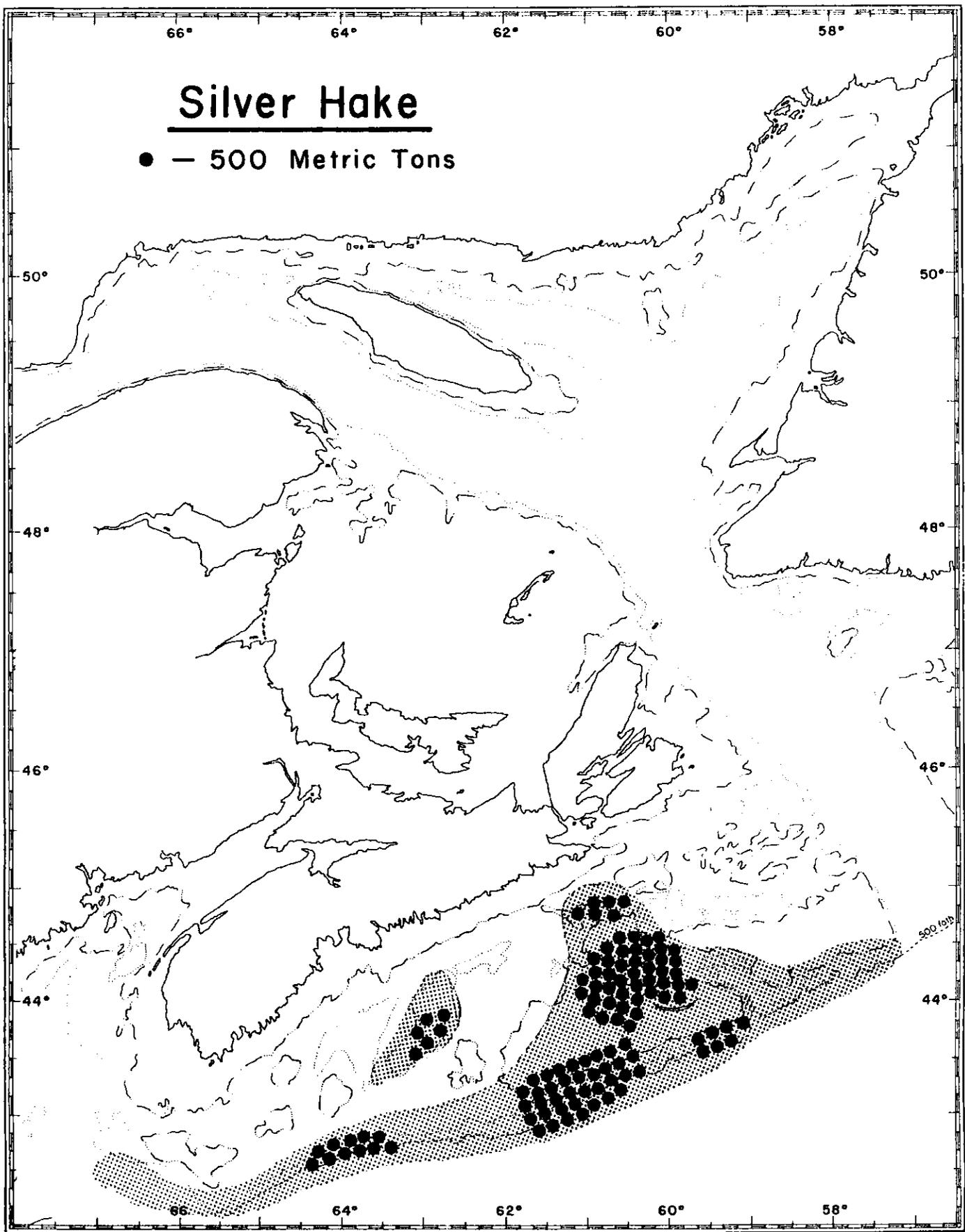


Fig. 6. Silver hake distribution in ICNAF Subarea 4.
Stippled distribution.

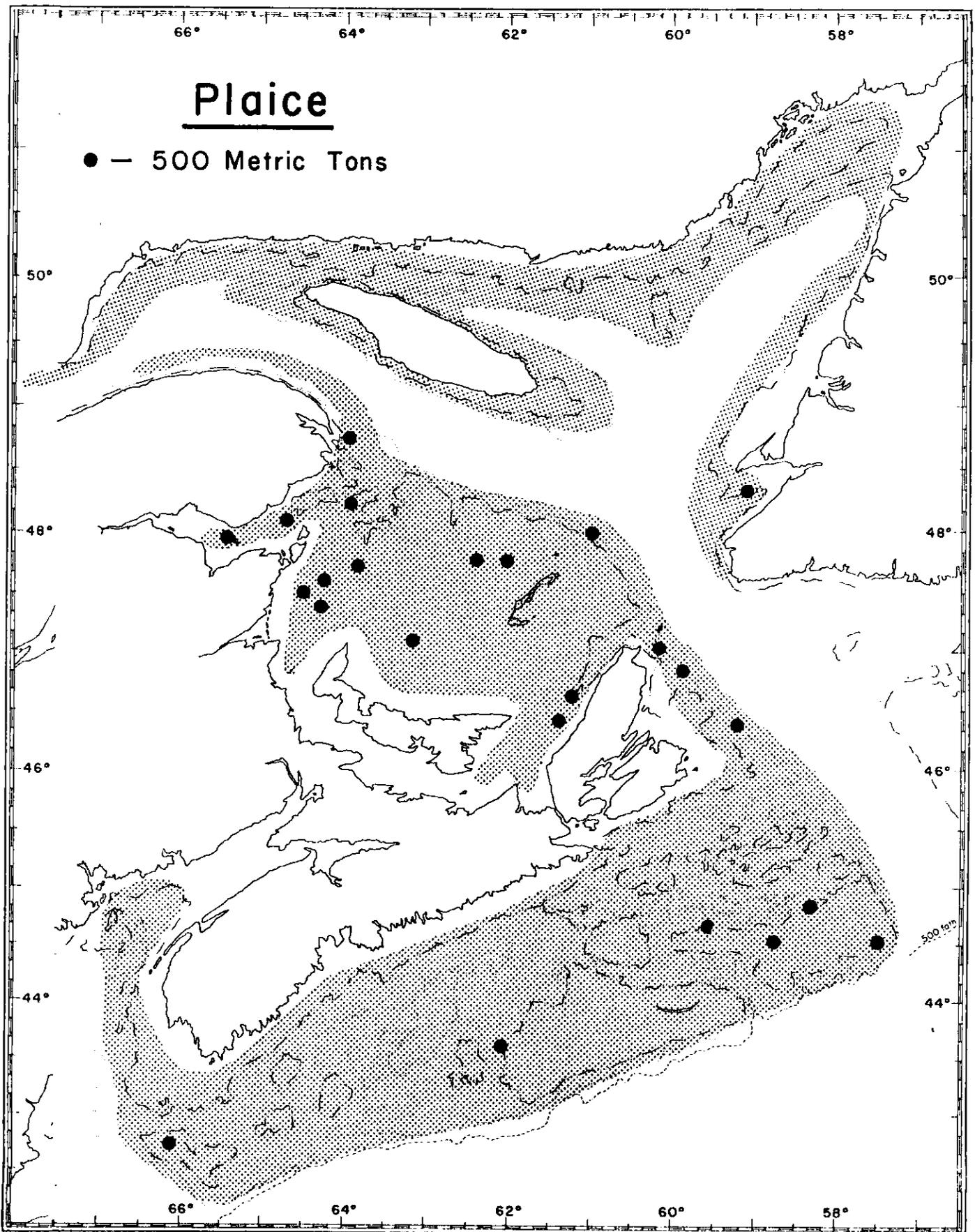


Fig. 7. Plaiice distribution in ICNAF Subarea 4.
Stippled distribution.

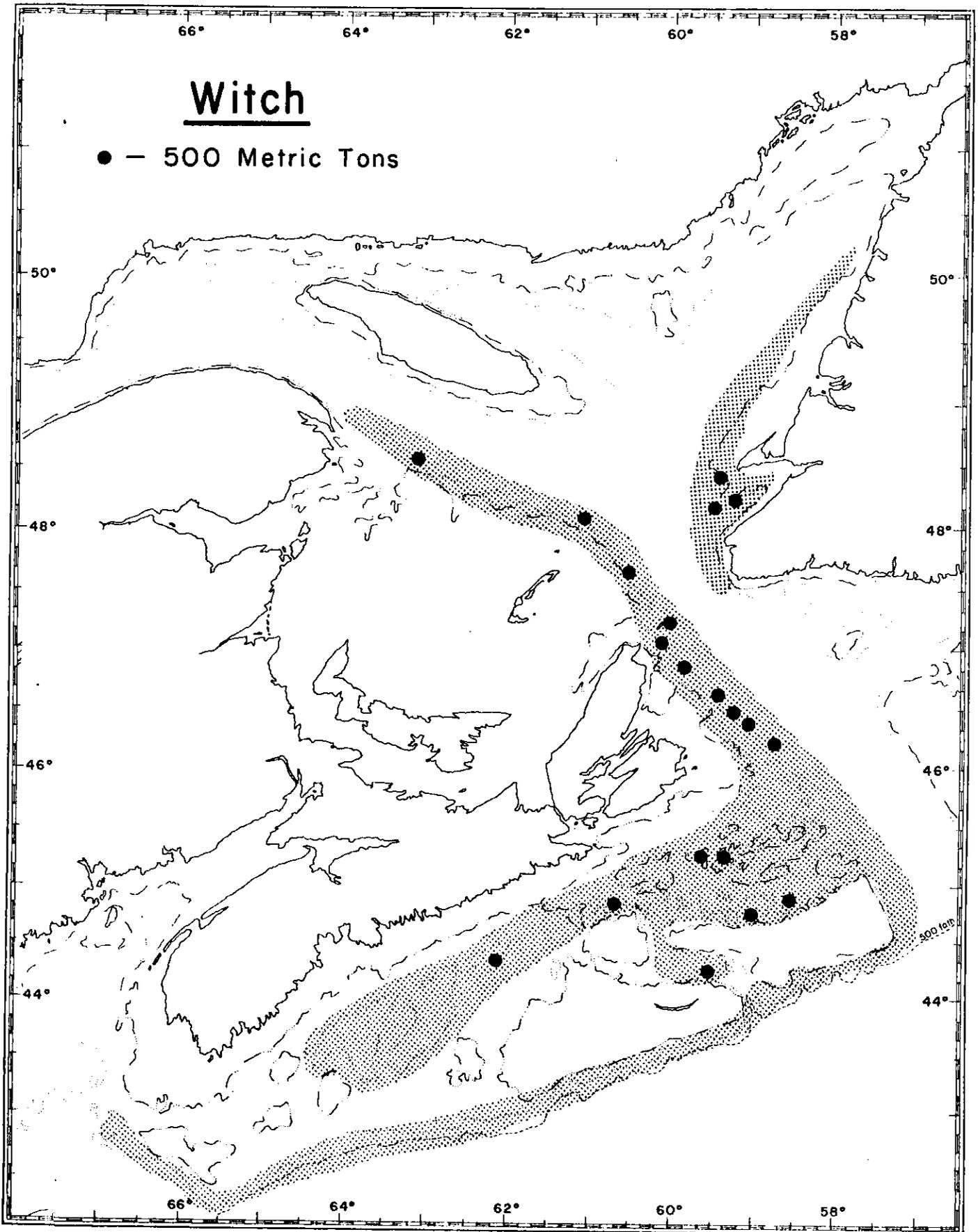


Fig. 8. Witch distribution in ICNAF Subarea 4.
Stippled distribution.

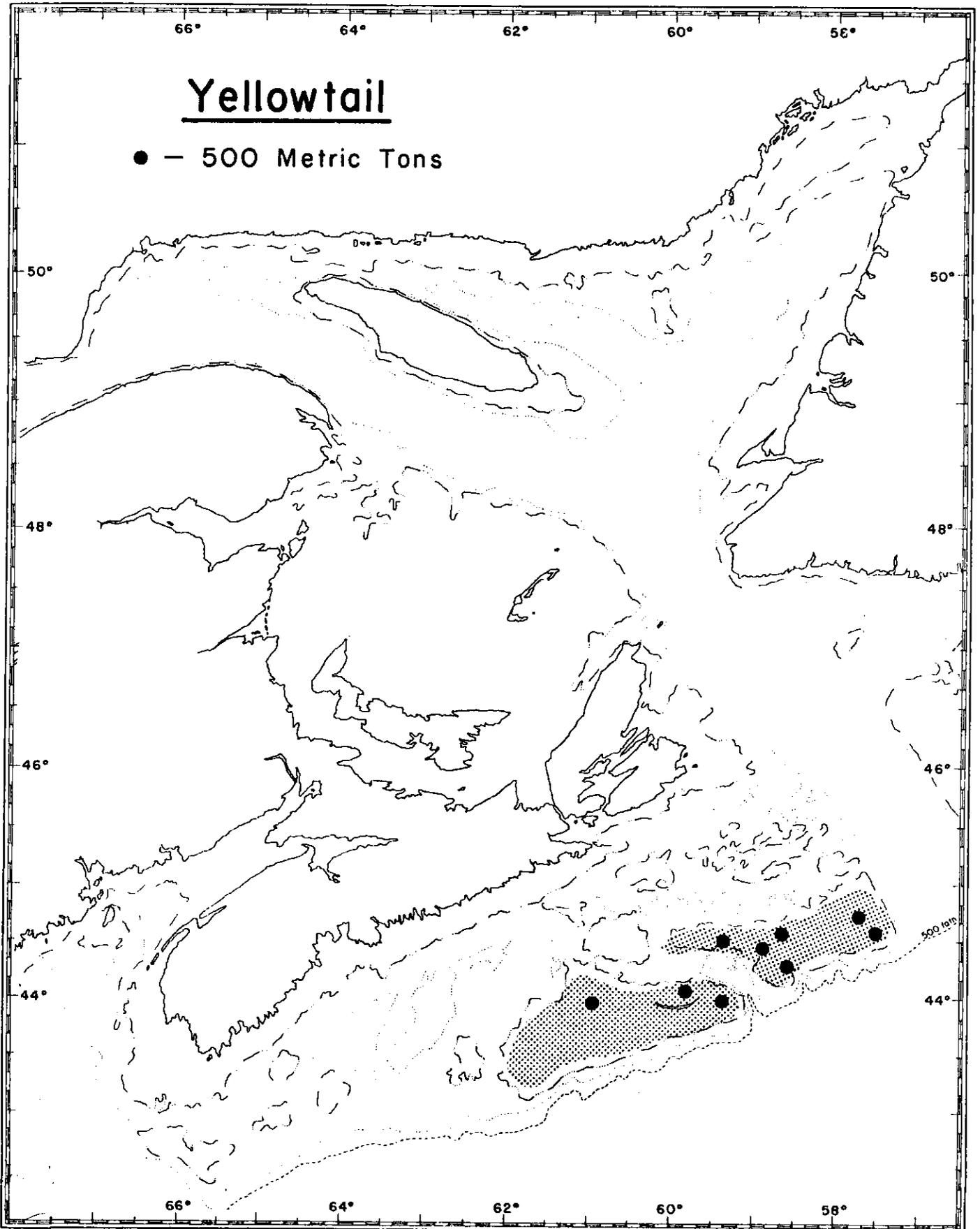


Fig. 9. Yellowtail distribution in ICNAF Subarea 4.
Stippled distribution.

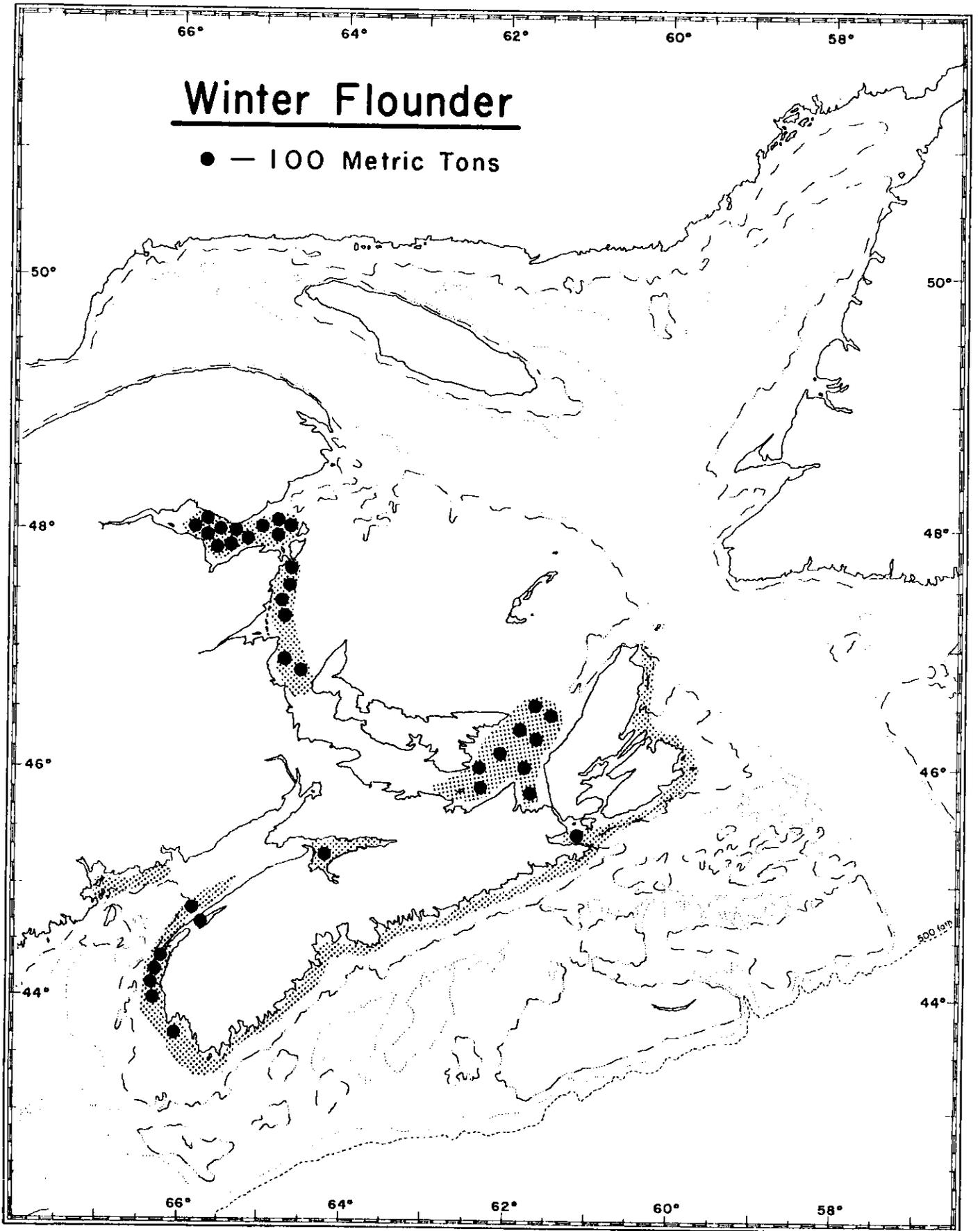


Fig.10. Winter flounder distribution in ICNAF Subarea 4.
Stippled distribution.

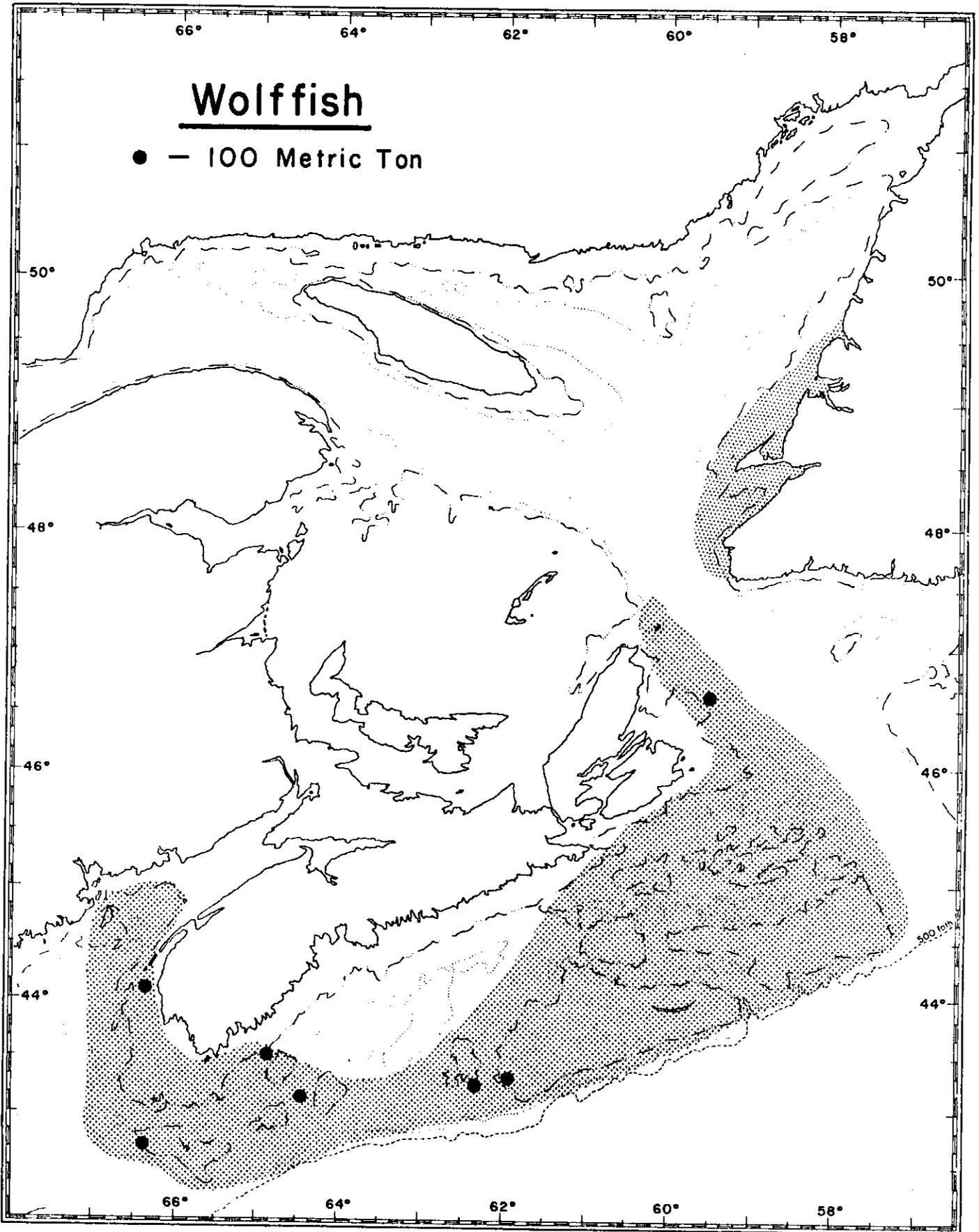


Fig.11. Wolffish distribution in ICNAF Subarea 4.
Stippled distribution.

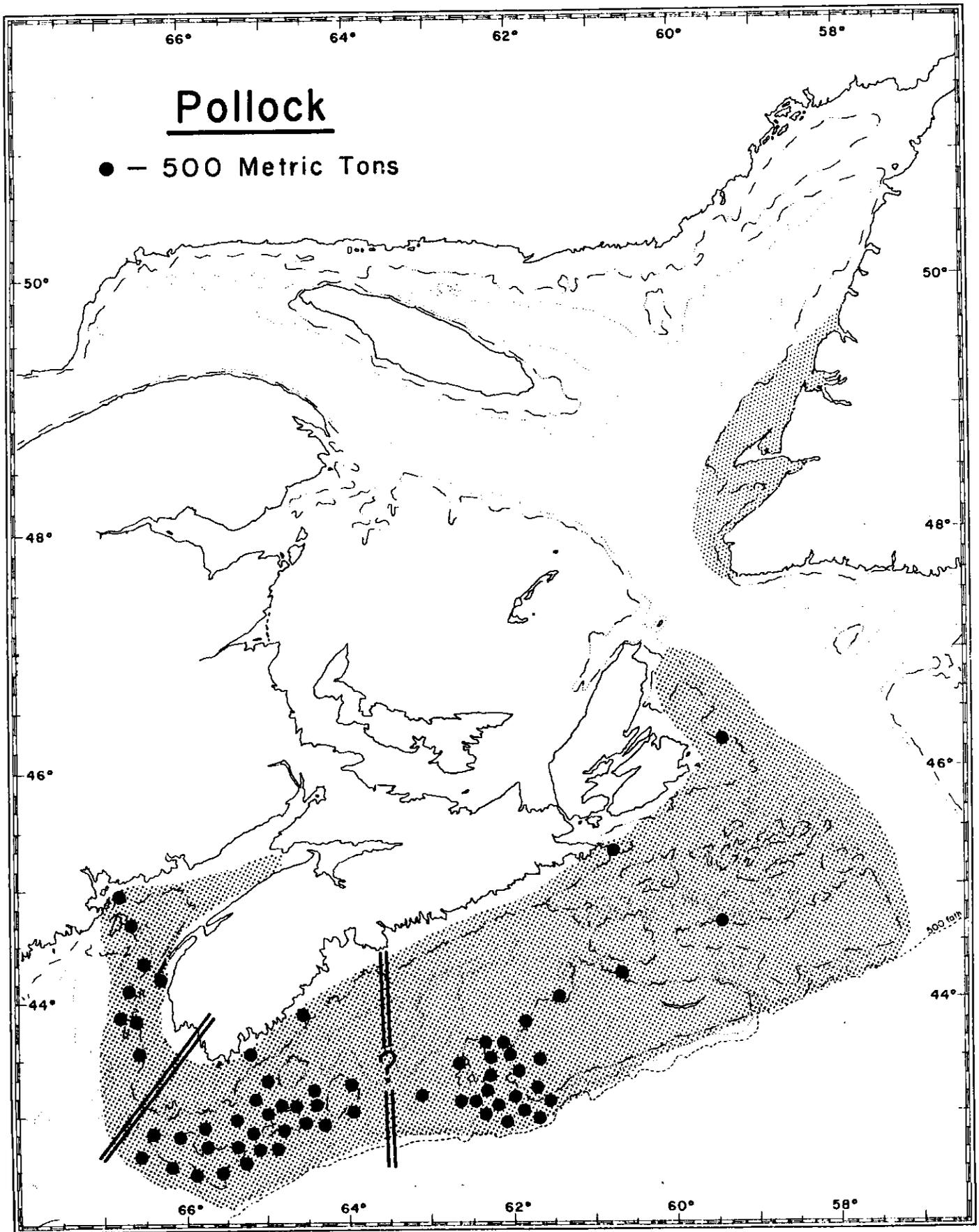


Fig.12. Pollock distribution in ICNAF Subarea 4. Stippled
..... stocks.

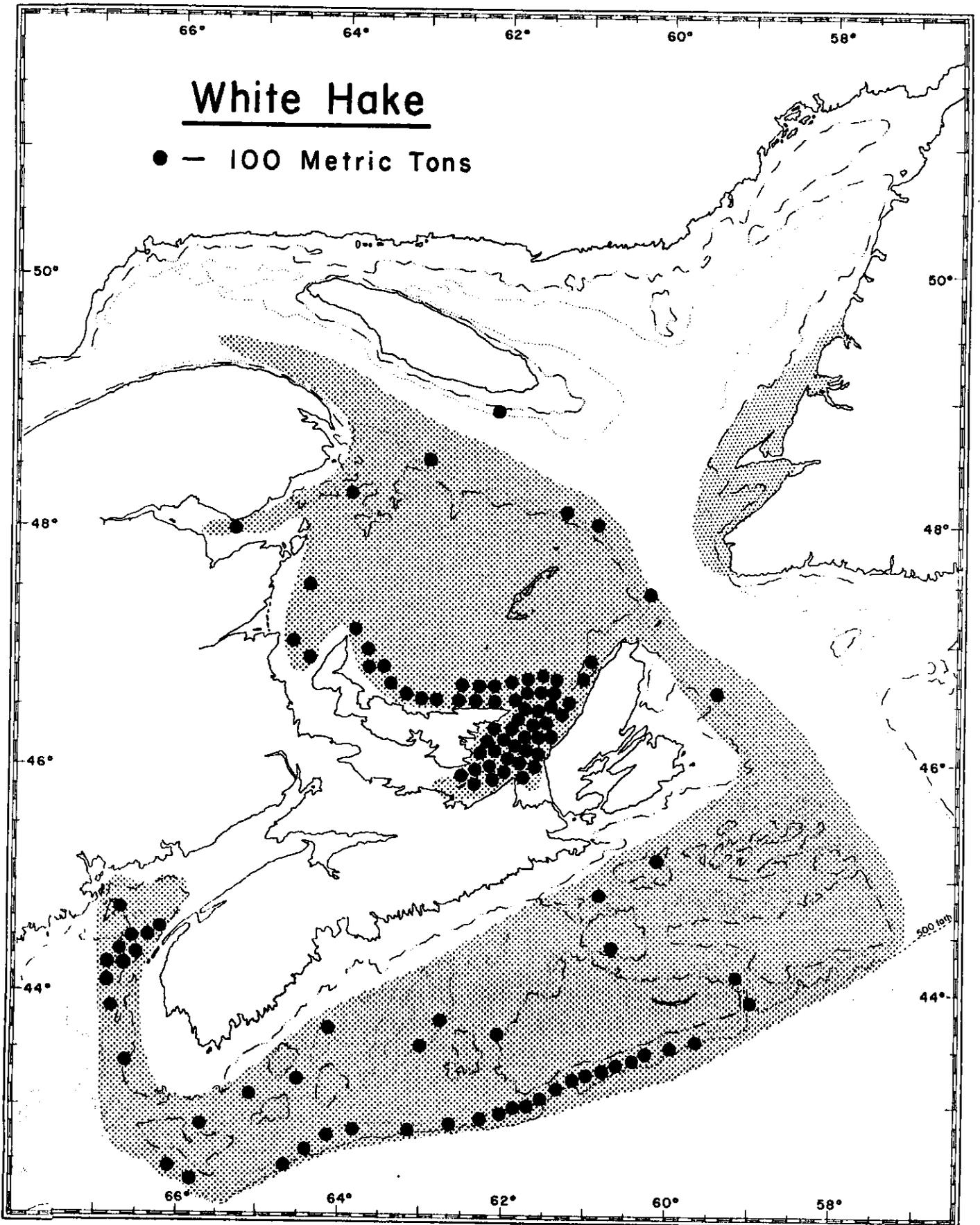


Fig.13. White hake distribution in ICNAF Subarea 4.
Stippled distribution.

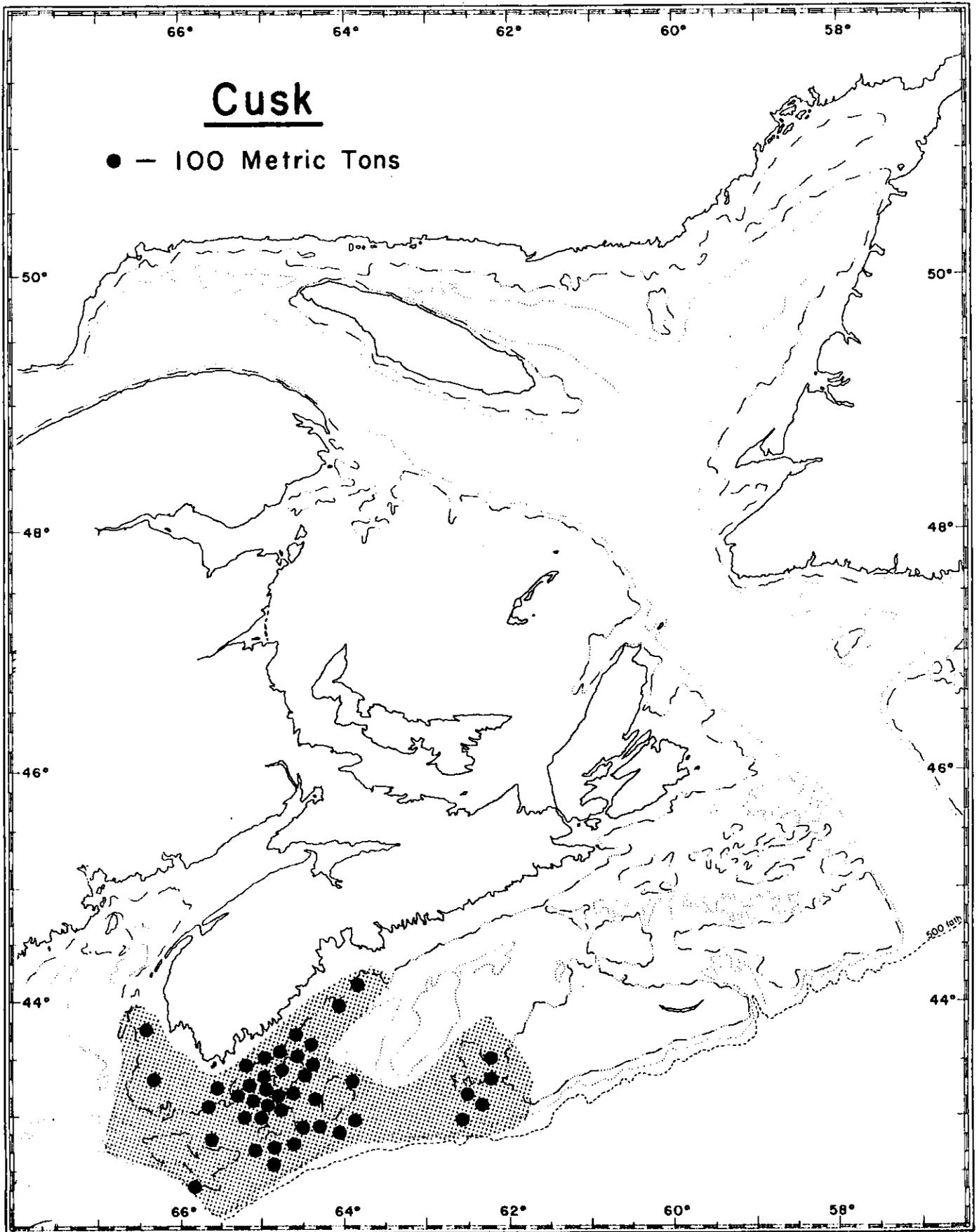


Fig.14. Cusk distribution in ICNAF Subarea 4.
Stippled distribution.

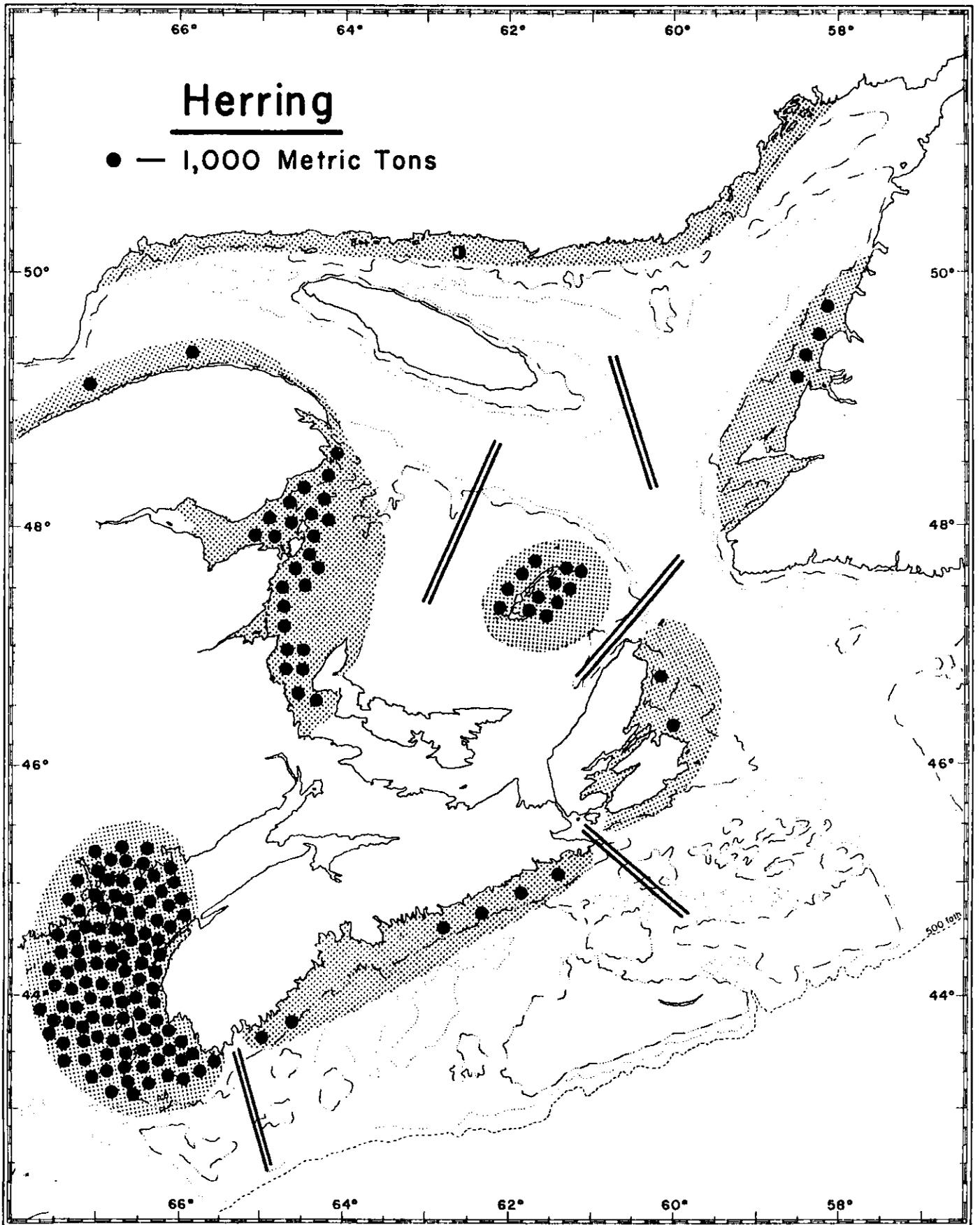


Fig.15. Herring distribution in ICNAF Subarea 4.
Stippled stocks.

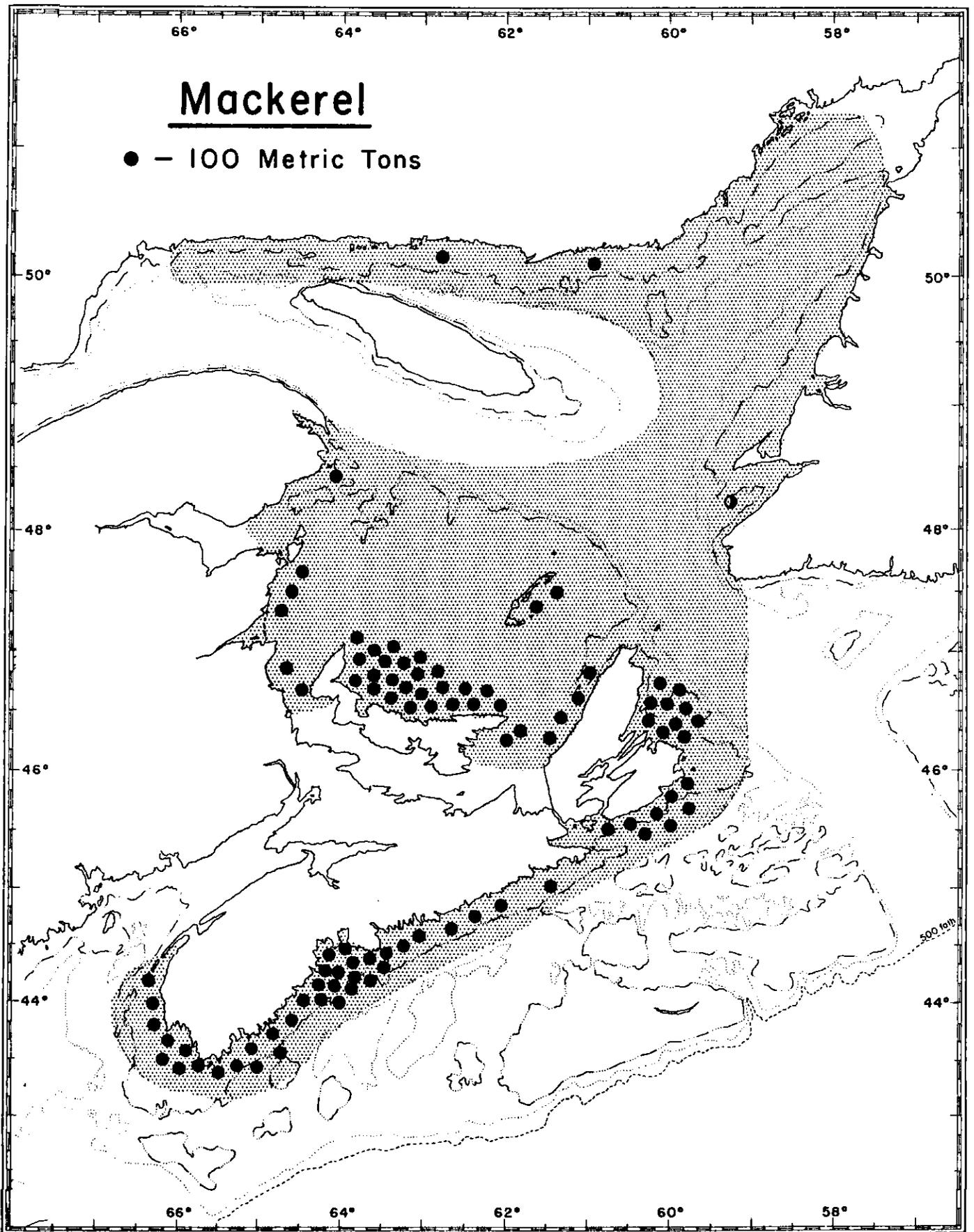


Fig.16. Mackerel distribution in ICNAF Subarea 4.
Stippled distribution.