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Mixture of species in Subareas 5 and 6[1,2]

by

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I. Introduction

The high degree of mixture of species in Subarea 5 and Statistical Area 6 has been well documented in the commercial fisheries as well as research vessel surveys in the area. For example, the U.S.A. industrial bottom trawl fishery has traditionally taken a wide variety of groundfish in 5Z west and 6A. In 1958, this fishery took significant quantities of 20 species, including the three principal hake species, three species of skates, four species of flounder, alewife, sea herring, scup, butterfish, ocean pout, sculpins, sea robins, sea raven and spring dogfish (Figure 1, Table 1). In the same general area a wide mixture of species has also been observed in research vessel surveys on an individual catch basis. For example, in the 1971 joint U.S.A.-U.S.S.R. groundfish survey, the U.S.S.R. vessel made 37 random 30-minute hauls in sampling strata, 1, 2, 5, 6, 9, and 10, and with few exceptions there were 10 or more species per haul, with a mean of 13 species per haul (Table 2). Sampling strata used in the surveys are shown in Figure 2 and a typical station pattern is shown in Figure 3. Comparable numbers of species were caught by the U.S.A. vessel at an independent set of random stations in the same strata (Table 2). The only species represented by the industrial trawl statistics which were not taken in the 1971 survey are indicated by asterisks in Table 1.

Commercial fishermen do not, of course, fish at random and the degree of mixing is normally much less in commercial catches as, for example, has been documented for U.S.A. research and commercial catches in Subarea 5 (Redbook, Part I, 1968, pp. 61-63). Nevertheless, the problem of by-catch is a serious one in Subareas 5 and 6 as indicated in Comm. Doc. 73/3 and illustrated in the 1973 report of the Assessment Subcommittee (Summ. Doc 73/1). It is simply not possible to conduct a bottom trawl fishery in this region without harvesting a substantial mixture of species.

The purpose of this document is to provide a more accurate and comprehensive description of the distribution patterns of major species in Subareas 5 and 6, which in turn should provide a better basis for formulating and evaluating management measures designed to alleviate the by-catch problem. The distribution patterns shown here are based on individual trawl catches from U.S.A. and U.S.S.R. groundfish surveys conducted since 1968. Sample plots for 16 species are shown in the appendices for both spring and fall surveys. Virtually all of the species sought by the major trawl fisheries are included in the series of plots. Also included are species taken more or less incidentally in the trawl fisheries such as scup, fluke, sea bass, alewives, and lobsters, which are vulnerable to offshore bottom trawl fisheries, particularly in winter and spring.

Although only spring and fall distributions are shown here, distribution patterns at other times of year generally are intermediate between these two seasons since the spring and fall represent approximately the minimum

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1 Statistical Area 6

2 Revision of Sp.Mtg.Res.Doc. 73/9 presented to Special Commission Meeting, FAO, Rome, January 1973.

and maximum bottom water temperatures found in shoal waters. This document presents a first approach to a classification scheme for the nature and location of mixed fisheries in SA's 5 and 6, based chiefly on the groundfish surveys. A complete picture of the species mixture problem will require pooling data from both surveys and the fisheries for all areas and seasons; and this will require breakdown of commercial catches by species and individual hauls.

II. Species Distribution Overlap in Subareas 5-6

A. Spring (March-April)

During winter and spring months many groundfish species aggregate offshore in depths greater than 100 m along the edge of the shelf in SA 6 and Div 5Z. For example, among species sought by the major fishing fleets, aggregations of red and silver hake are found mixed together particularly in 5Z west and 6A (Figure 4); and mackerel and sea herring aggregations are mixed at times in 6B and 6C (Figure 5).

Many other species also aggregate along the shelf including squid, butterfish, alewife, sea bass, scup, fluke and lobster (see sample plots, Appendix I). In shoaler depths (generally less than 80 m) aggregations of sea herring are often found over yellowtail grounds in the vicinity of Hudson Canyon (Figure 5).

When distributions of all 16 selected species based on three or four surveys are all plotted on a single chart, the picture becomes too complicated to portray with different shadings. However, it is possible to identify at least seven different regions from Cape Hatteras to western Nova Scotia within which the species mixture can be classified as more or less severe according to the number, density and priority of the species found there, and in relation to the intensity of bottom trawling effort (Figure 6). For example, in the shoal areas in Div's 5Z west and 6A, a large amount of bottom trawling directed at sea herring will result in significant by-catches of yellowtail, cod and winter flounder, and hence this area is shaded as a "heavy mixture" area (Figure 6). The immediately adjacent offshore region is also labeled as a "heavy mixture" area since the presence of red and silver hake aggregations as well as mackerel attracts considerable bottom trawling effort, resulting in potentially significant by-catches of alewives, squid, butterfish and lobster (Figure 6). In general, it has been shown that in the spring months, the by-catch problem is much more severe in Div 5Z west and SA6 than in the remainder of SA5 and the western part of Div 4X, because of the heavy fishing directed at mackerel, sea herring, and the hakes, and the mixture of other species associated with these species.

B. Fall (October-November)

In the fall the mixed fishery problem shifts to the north and east and more into shoal waters largely in response to the corresponding movement of hake, mackerel and sea herring. Red and silver hake are now mixed with yellowtail largely inside 80 m in Divisions 5Z west and 6A (Figure 7). In the same region, mixed with the hakes and yellowtail, are found sea herring, mackerel, squid, scup, butterfish, lobsters and flounders inside 80 m in Divisions 5Z west and 6A (see plots for these species in Appendix II). An even greater mixture is found on Georges Bank (5Z east) where the above species are found as well as cod, haddock and alewives. The generalized picture of species mixture for fall is shown in Figure 6.

TABLE 1 --SPECIES COMPOSITION, IN POUNDS, OF POINT JUDITH INDUSTRIAL TRAWL-FISH LANDINGS FROM THE OFFSHORE AREA, BY MONTHS, 1958

[In thousands of pounds. + indicates less than 1,000 pounds]

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.[1]	Oct.	Nov.	Dec.
Red hake	4	20	5	1,300	2,751	821	348	959	242	1,639	651	13
White hake	5	1	--	--	--	--	--	+	1	98	12	--
Silver hake	23	19	6	32	180	878	431	595	460	1,932	168	60
Little skate	33	78	127	562	100	284	172	53	77	362	200	117
Big skate	83	159	130	516	54	--	--	72	--	79	156	50
Immature skate	4	--	--	65	--	--	--	--	--	--	--	--
Spotted hake	--	--	--	--	--	--	--	--	--	--	2	--
Eel pout	54	217	302	608	882	727	187	35	--	56	12	21
Longhorn sculpin	13	19	61	83	68	--	--	7	--	5	20	4
Sea robin	--	--	--	--	18	--	--	--	98	116	154	+
Striped sea robin	--	--	--	--	--	--	--	--	2	--	--	--
Angler	41	108	151	733	249	--	59	250	18	37	63	55
Four-spot flounder	4	+	5	18	23	34	10	26	6	--	7	7
Sand flounder	42	41	20	83	14	--	--	--	4	+	24	+
Gulf stream flounder	--	2	--	--	--	--	--	--	1	--	--	--
Yellowtail flounder	60	45	23	106	50	63	--	2	1	--	12	--
Blackback flounder	1	2	+	+	5	--	15	46	7	28	5	--
Sea raven	--	--	--	9	14	--	--	--	--	--	--	--
Spiny dogfish	145	29	37	346	77	--	--	--	--	--	927	257
Smooth dogfish	--	--	--	--	23	--	--	114	--	--	--	--
Barndoor skate	48	32	17	111	+	--	--	--	--	23	7	+
* Alewife	33	8	33	18	+	34	8	13	--	149	7	22
Herring	3	2	7	14	9	--	--	--	--	5	--	--
Scup	--	--	--	--	--	--	--	--	15	79	+	2
Butterfish	--	--	--	5	--	--	49	13	31	23	7	--
Cunner	--	--	--	--	--	--	--	--	--	+	--	--
# Three-bearded rockling	--	--	--	--	--	--	+	--	--	+	--	--
Total	596	782	924	4,609	4,517	2,841	1,279	2,185	963	4,631	2,434	608

[1] Based on 1955, 1956, and 1957 samples.

Table 2. Frequency Distributions of species per haul on 1971 joint USA-USSR trawl survey for selected strata in southern New England

Number of species per haul	Number of hauls in stratum												No. of hauls	
	1		2		5		6		9		10			
	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR
0														
1														
2									1					
3						1							1	1
4														
5			2										2	
6											3		3	
7			2		1			1					3	1
8			2				1		1		1	1	5	1
9		1	2	1	1		2						5	2
10		1		2			3						3	3
11	4	2		1			1	1			2	1	7	5
12**				1				2		1	2	1	2	5
13*	1	2											1	2
14	1			2	1		2	3	2			2	6	7
15					1	1	1	1	2	1	1	1	5	4
16	1	1			1	1							2	2
17					1	1			1		1		3	1
18					1		1					1	2	1
19	1								1	1	1		3	1
20														
21										1				1
22					1								1	
23														
24														
25														
Total No. hauls	8	7	8	7	8	4	11	8	8	4	11	7	54	37

* Mean of U.S.S.R. Haul

** Mean of U.S. Haul

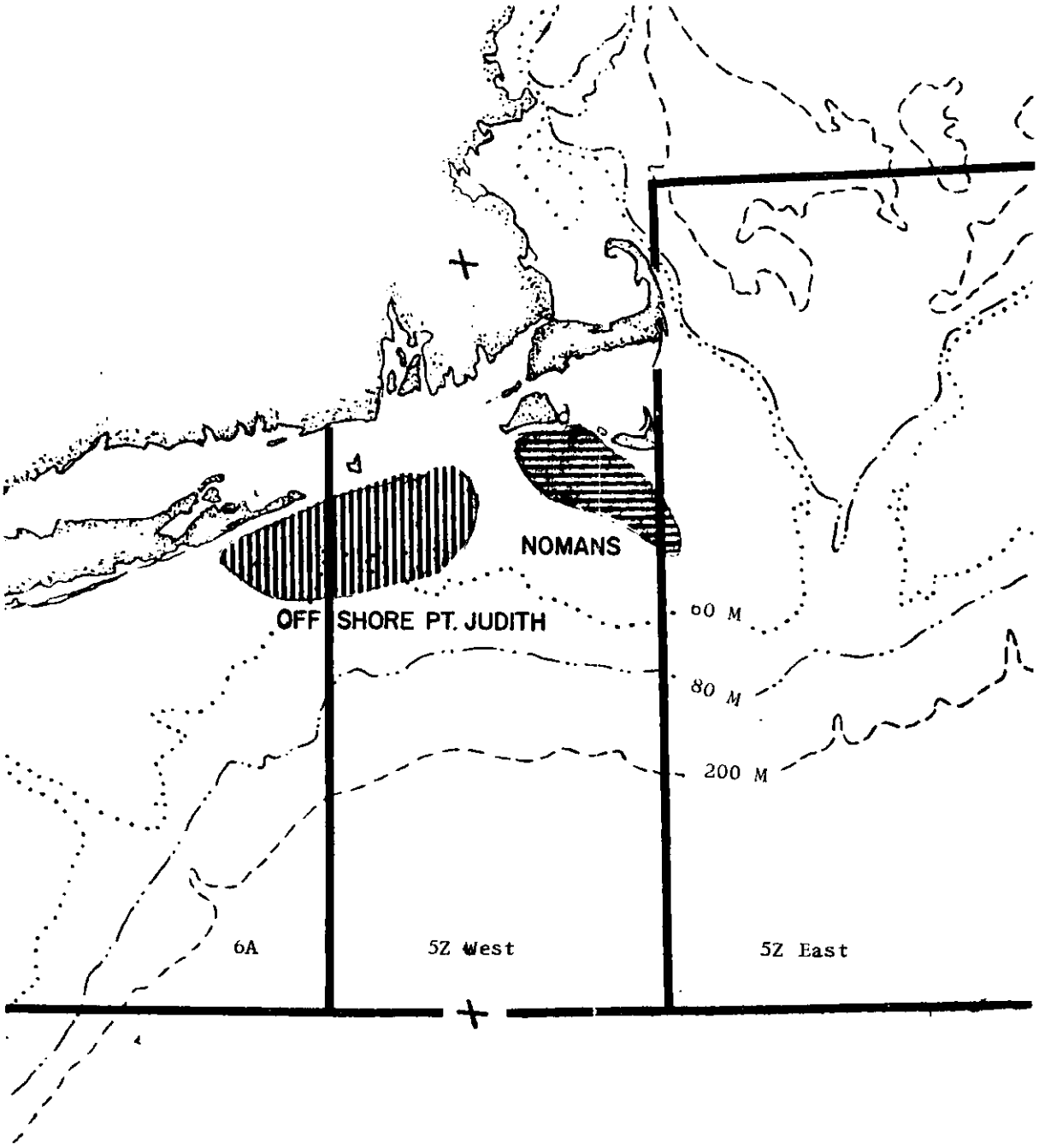

Figure 1. Areas of U. S. A. industrial fisheries, taken from "Edwards, R. L. and L. Lawday, 1960, Species Composition of Industrial Trawl - Fish Landings in New England, 1958". U. S. Fish and Wildlife Service, Special Scientific Report - Fisheries No. 346.

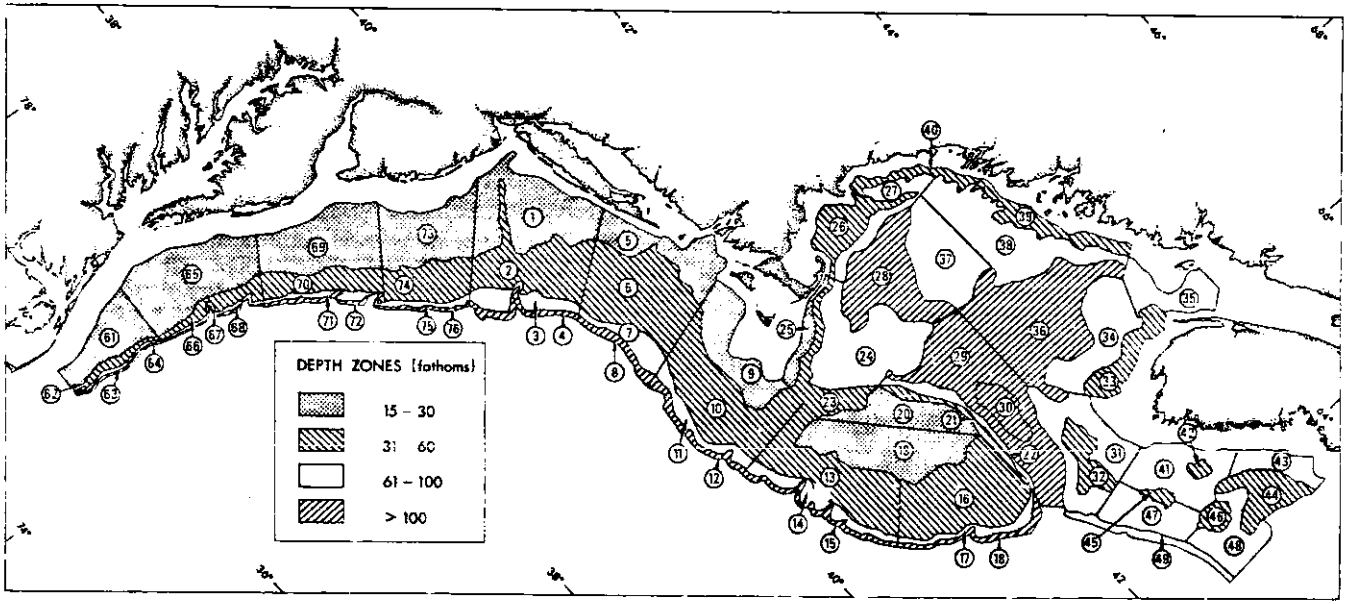

Figure 2. Sampling strata used in U.S.A. and U.S.S.R. groundfish surveys. Joint U.S.A.-U.S.S.R. surveys in SA "5 and 6" occupied strata 1-25 and 61-76. U.S.A. surveys also included strata 26-49 in spring and autumn.

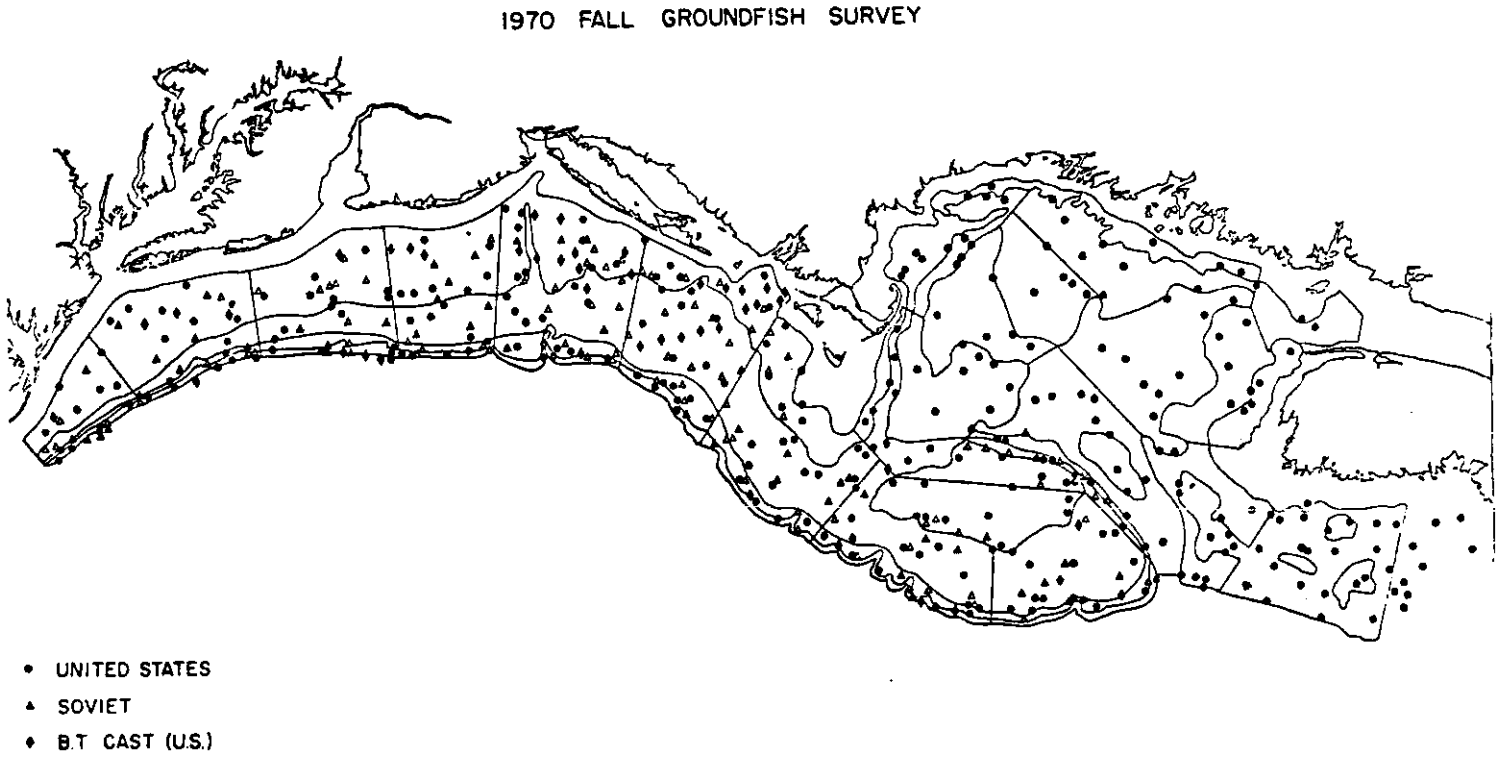

Figure 3. Station pattern for autumn groundfish survey in 1970.

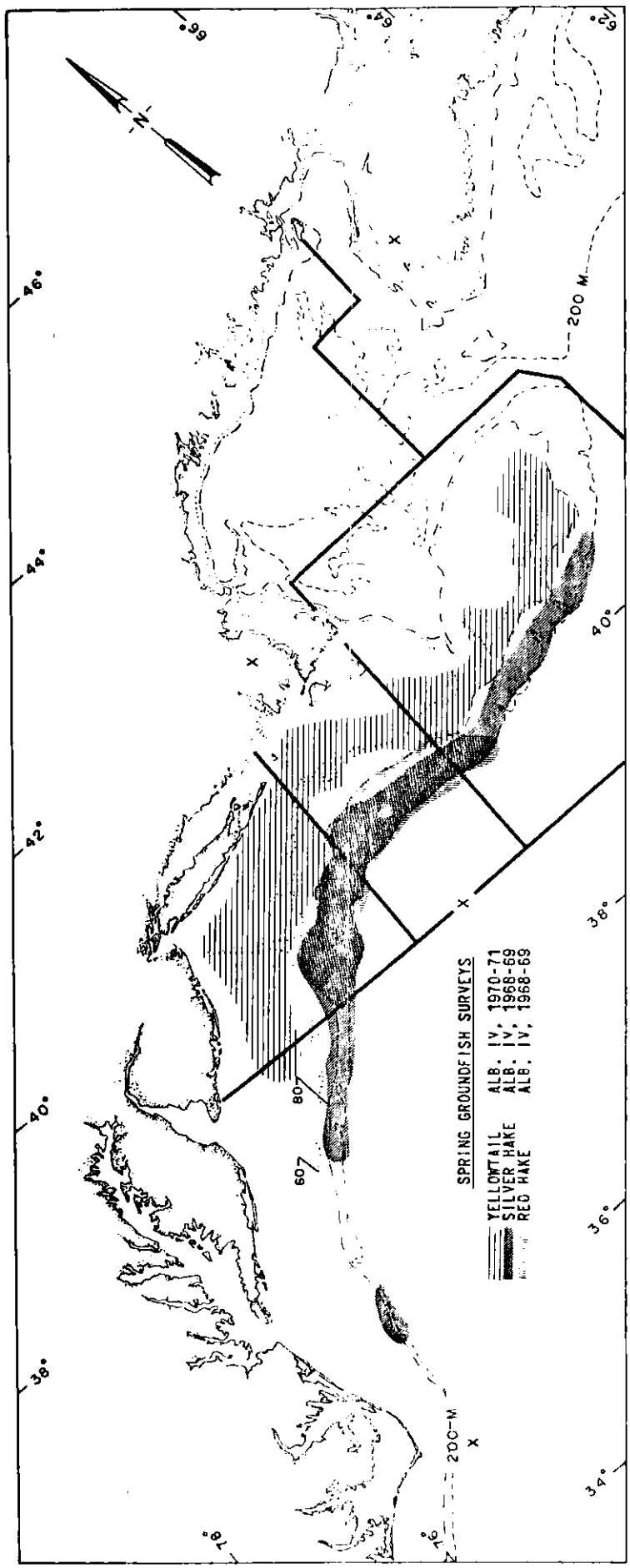

Figure 4. Aggregations of red and silver hake, and yellowtail flounder, based on plots of individual catches (greater than 20 pounds) on two consecutive spring surveys combined.

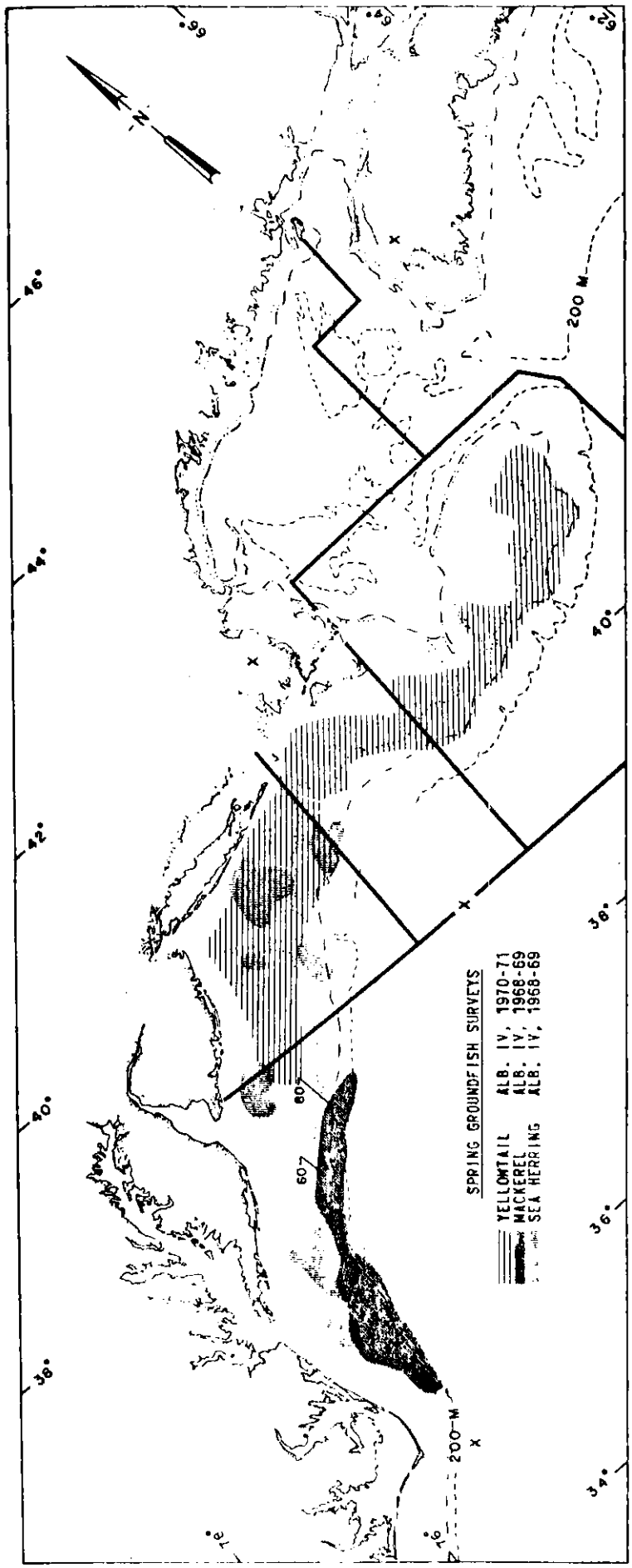

Figure 5. Aggregations of sea herring, mackerel, and yellowtail flounder, based on plots of individual catches on two consecutive spring groundfish surveys combined.

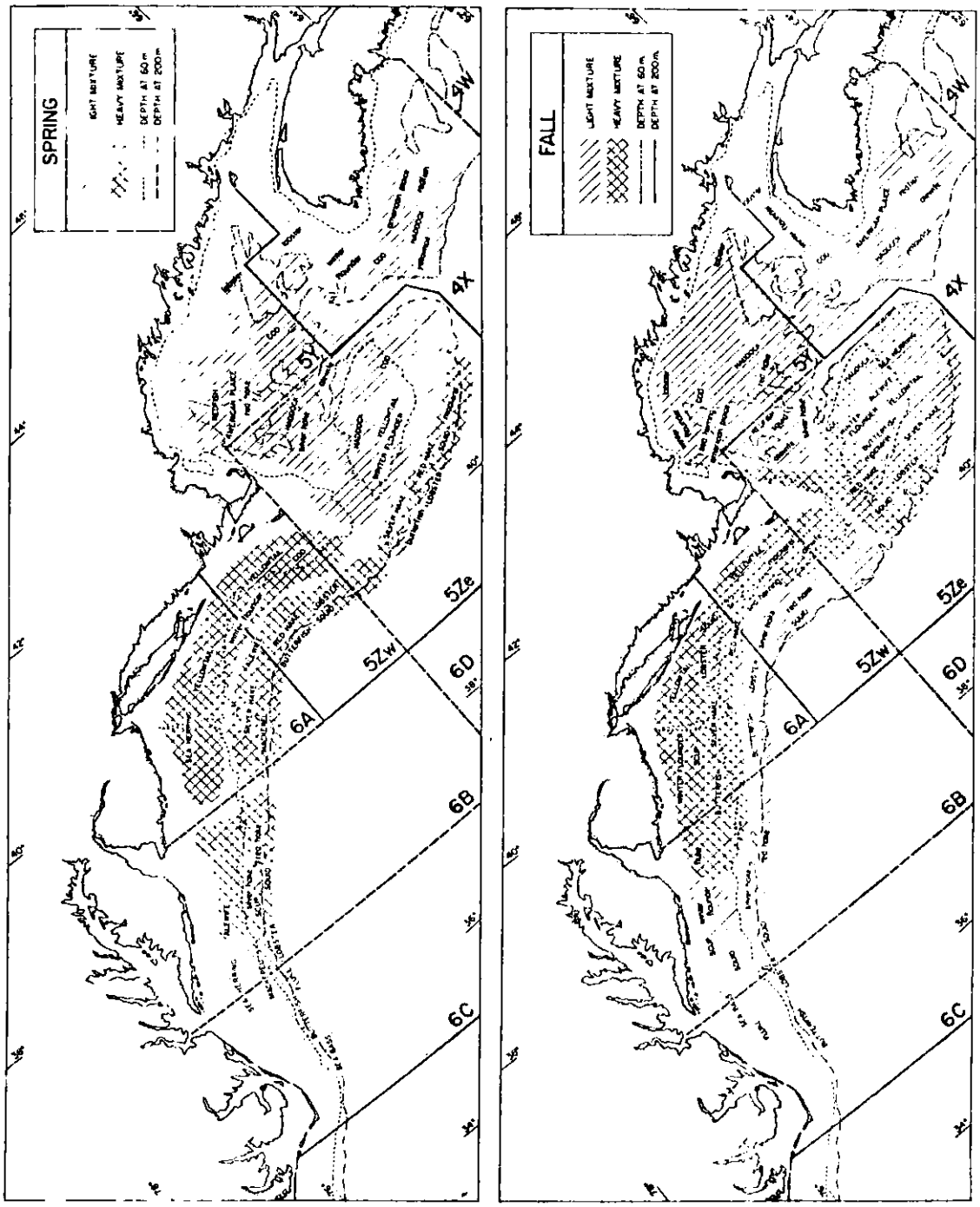

Figure 6. Generalized picture of mixture of important species vulnerable to bottom trawling - based on plots of individual catches of groundfish surveys. (see Appendices for sample plots)

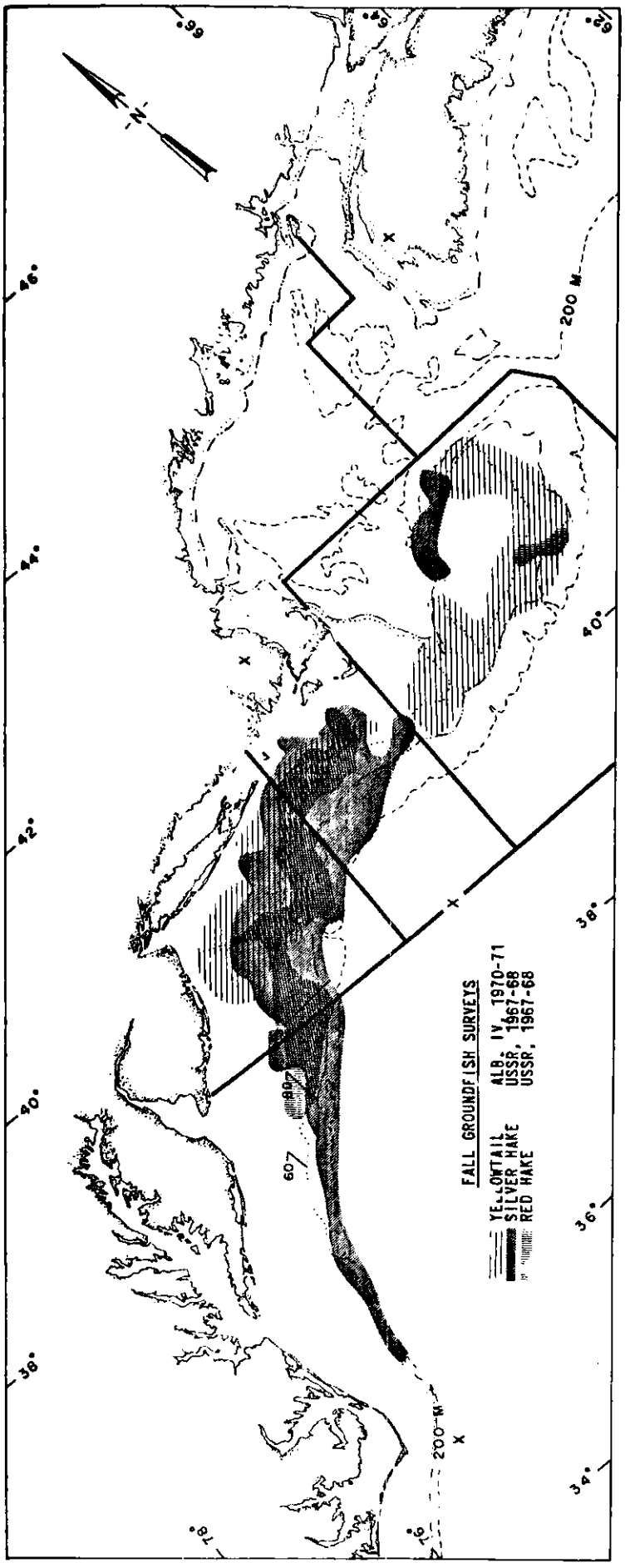

Figure 7. Aggregations of red and silver hake, and yellowtail flounder, based on plots of individual catches (greater than 20 pounds) on two consecutive fall surveys combined.

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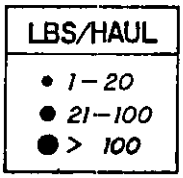
APPENDIX I

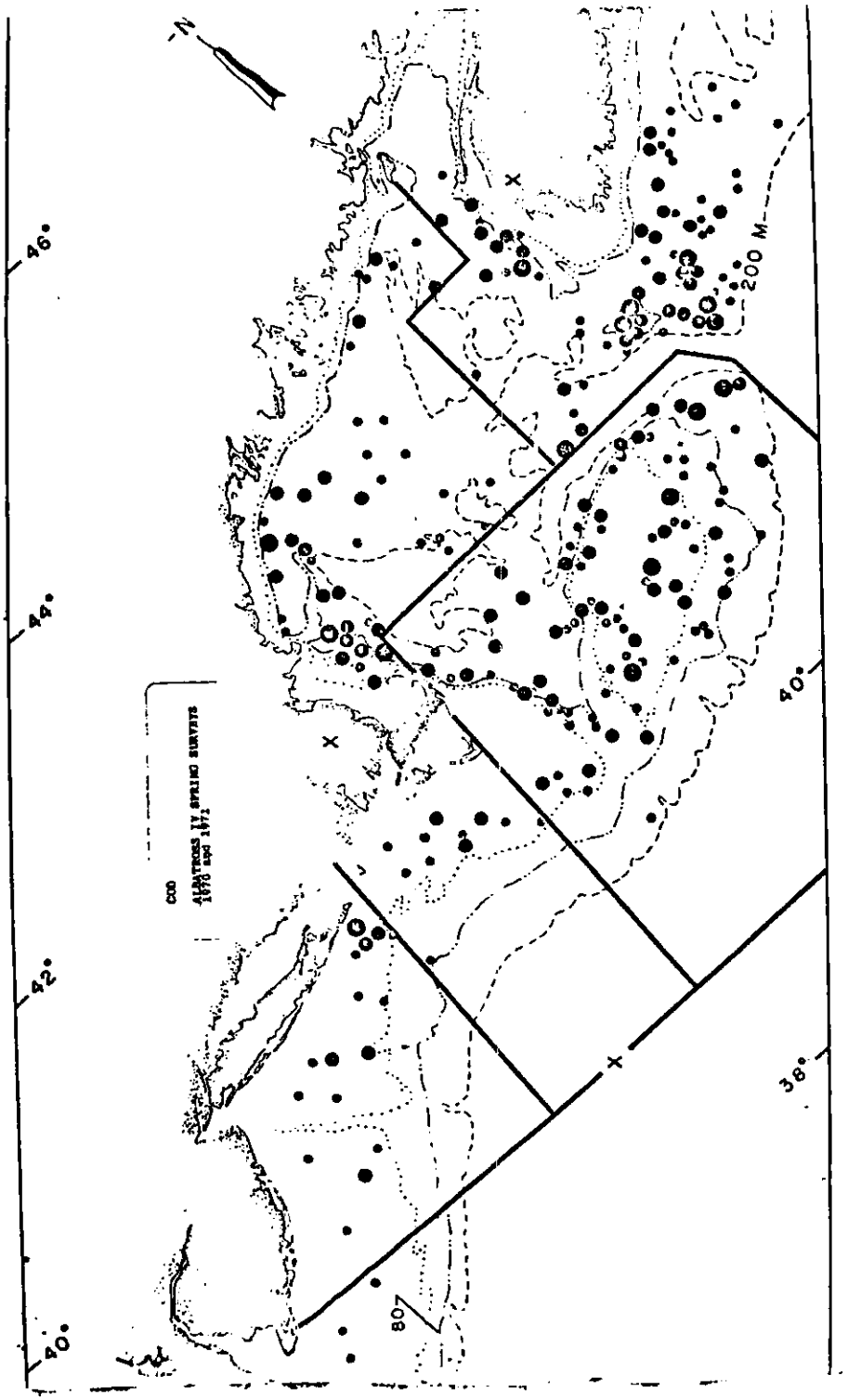
Plots of individual catches of 16 species taken on spring groundfish surveys by U.S.A. (strata sampled are shown in Figure 2). Species include:

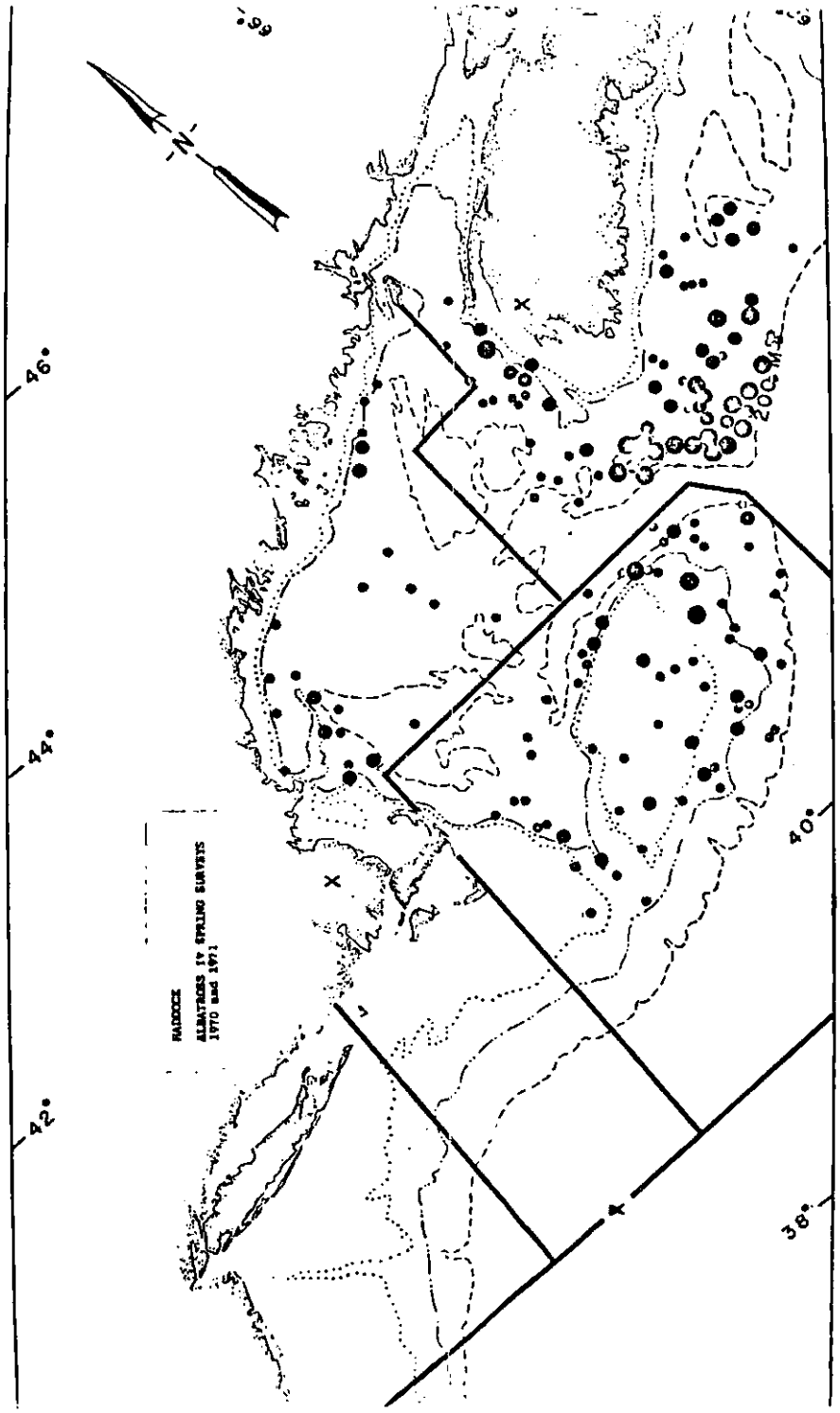
Cod
Haddock
Redfish
Yellowtail flounder
Winter flounder
Sea herring
Mackerel
Alewife
Red hake
Silver hake
Butterfish
Squid (Loligo)
Fluke (Summer flounder)
Scup
Sea Bass
Lobster

Note that in nearly all cases, catches for two consecutive years are shown on one chart.

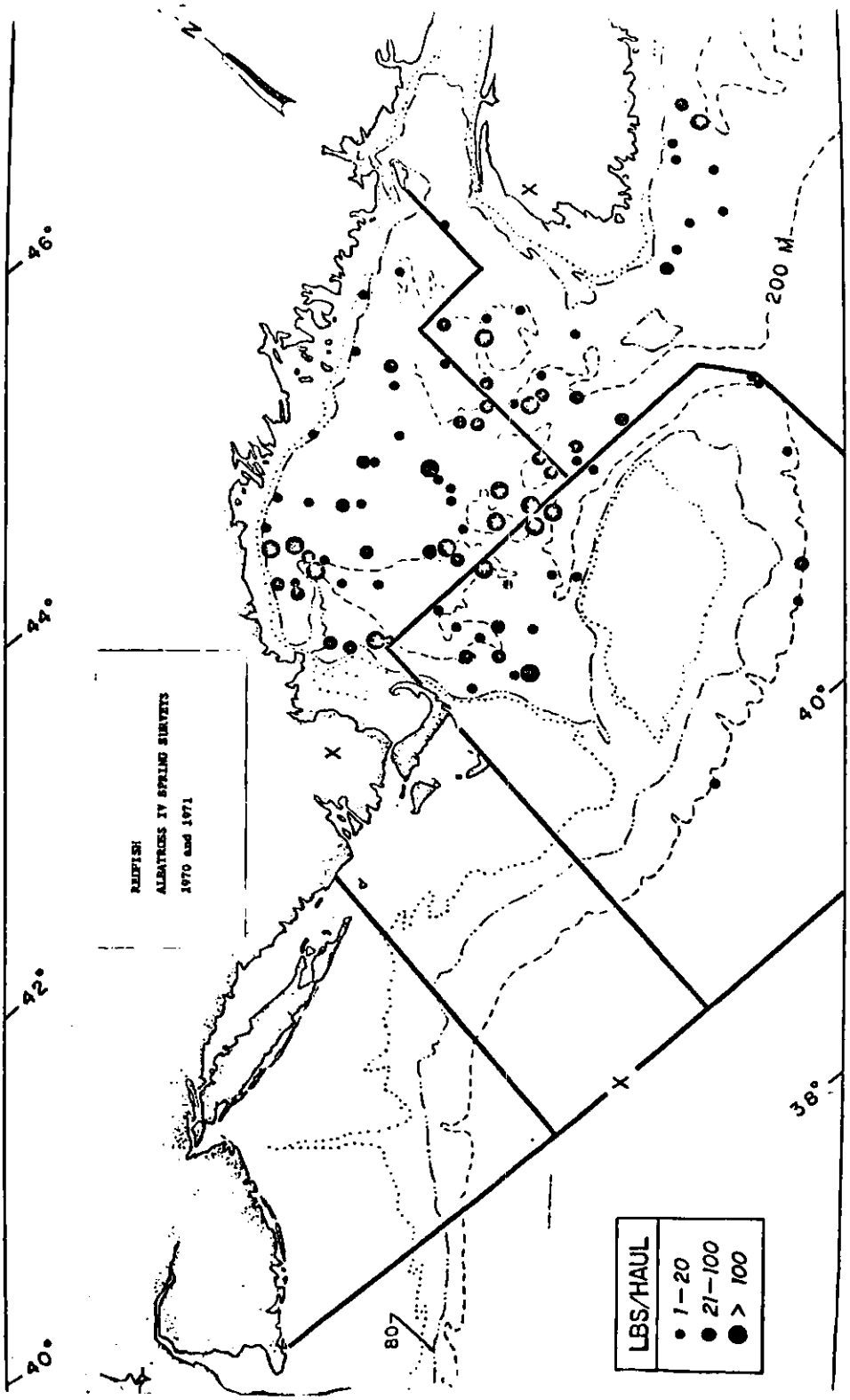
The same scale (shown below) relating size of catch to size of dot is used for all plots in both Appendices.



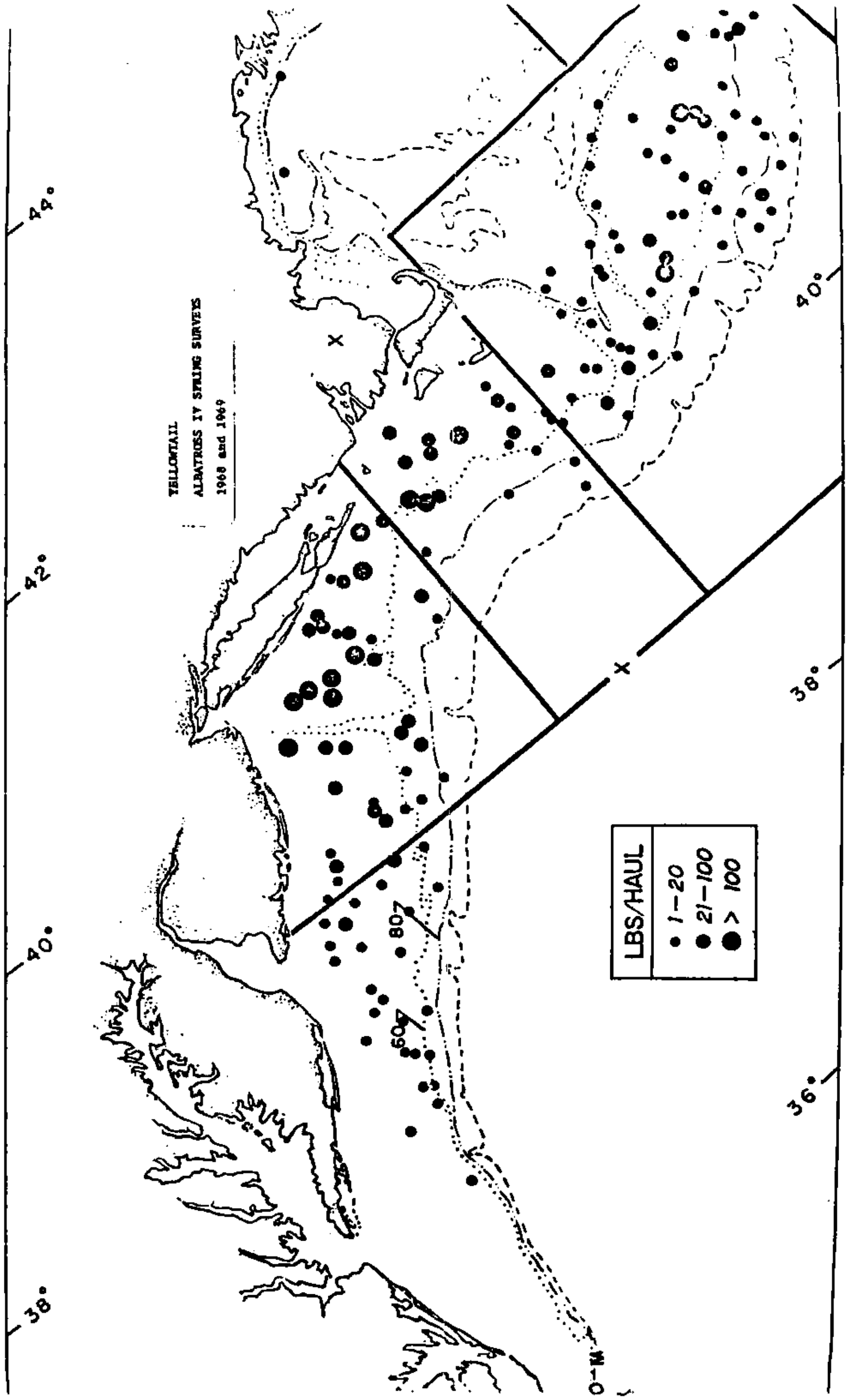

N
46°
44°
42°
40°
40°
36°
200 M
807
COD

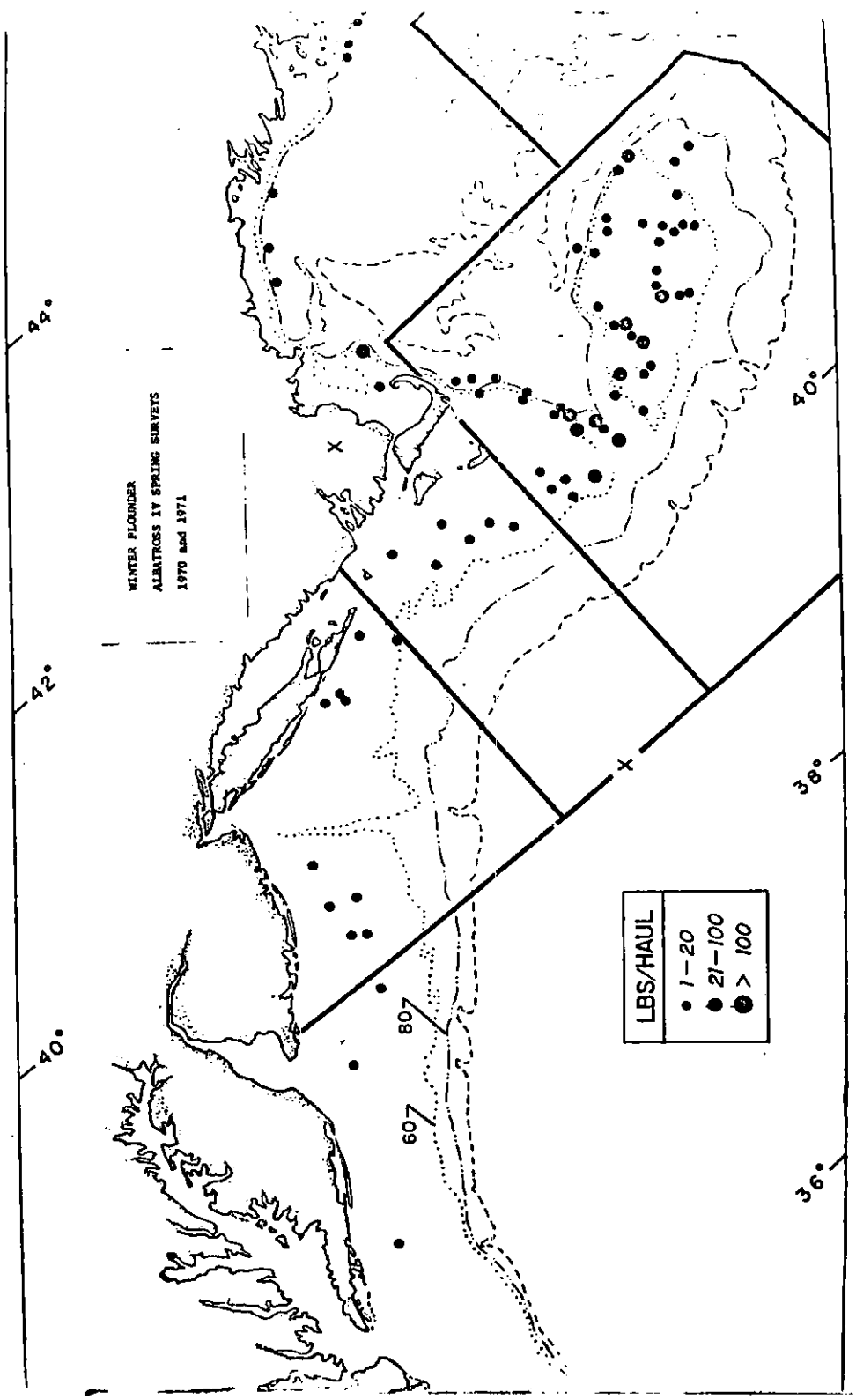

69°
N
46°
44°
42°
40°
36°
PADDOCK
ALBATROSS IV SPRING SURVEYS
1970 and 1971

B 1

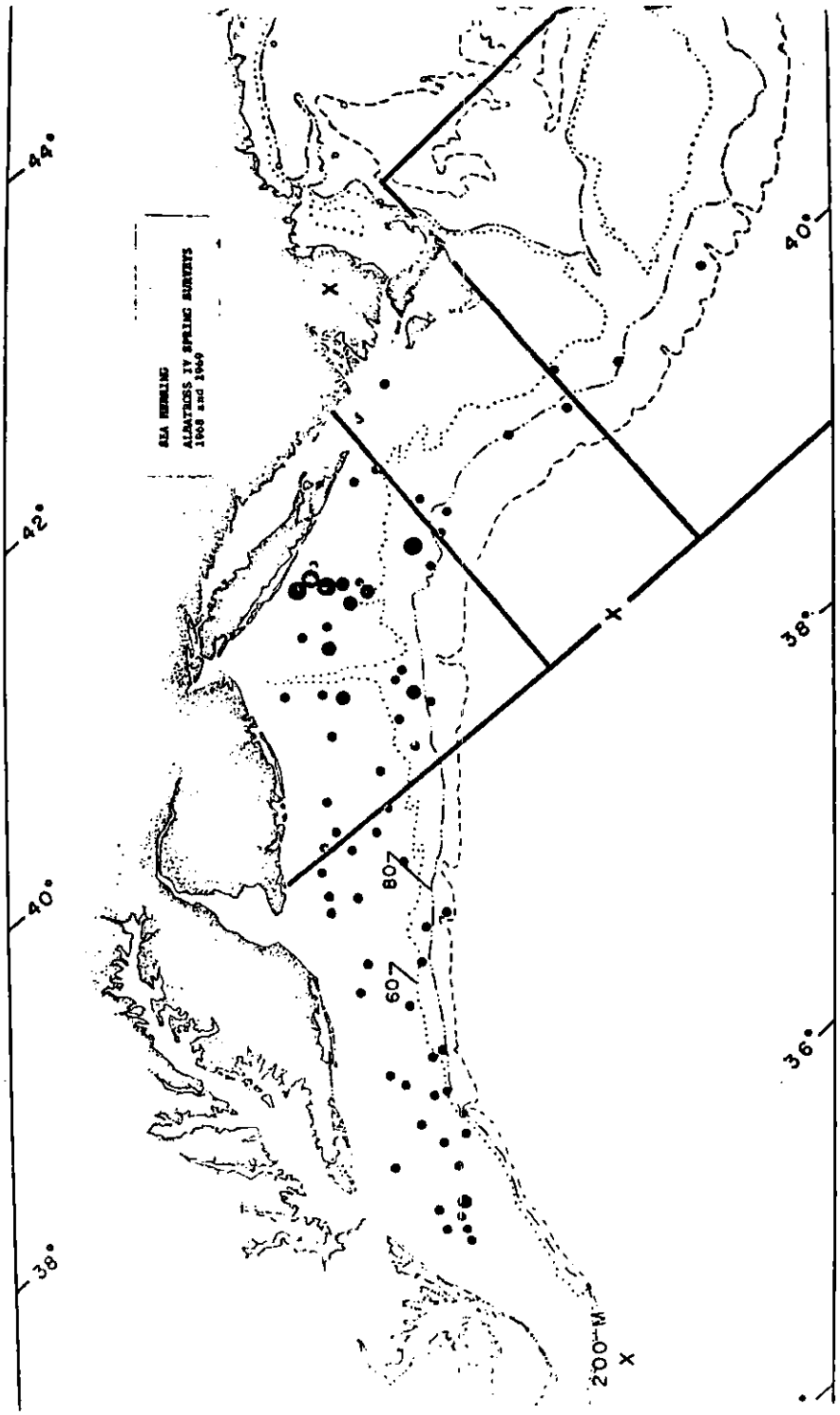

REDFISH
ALBATROSS IV SPRING SURVEYS
1970 and 1971
LBS/HAUL
• 1–20
● 21–100
● > 100
200 M
46°
44°
42°
40°
40°
38°
80
N

B 2

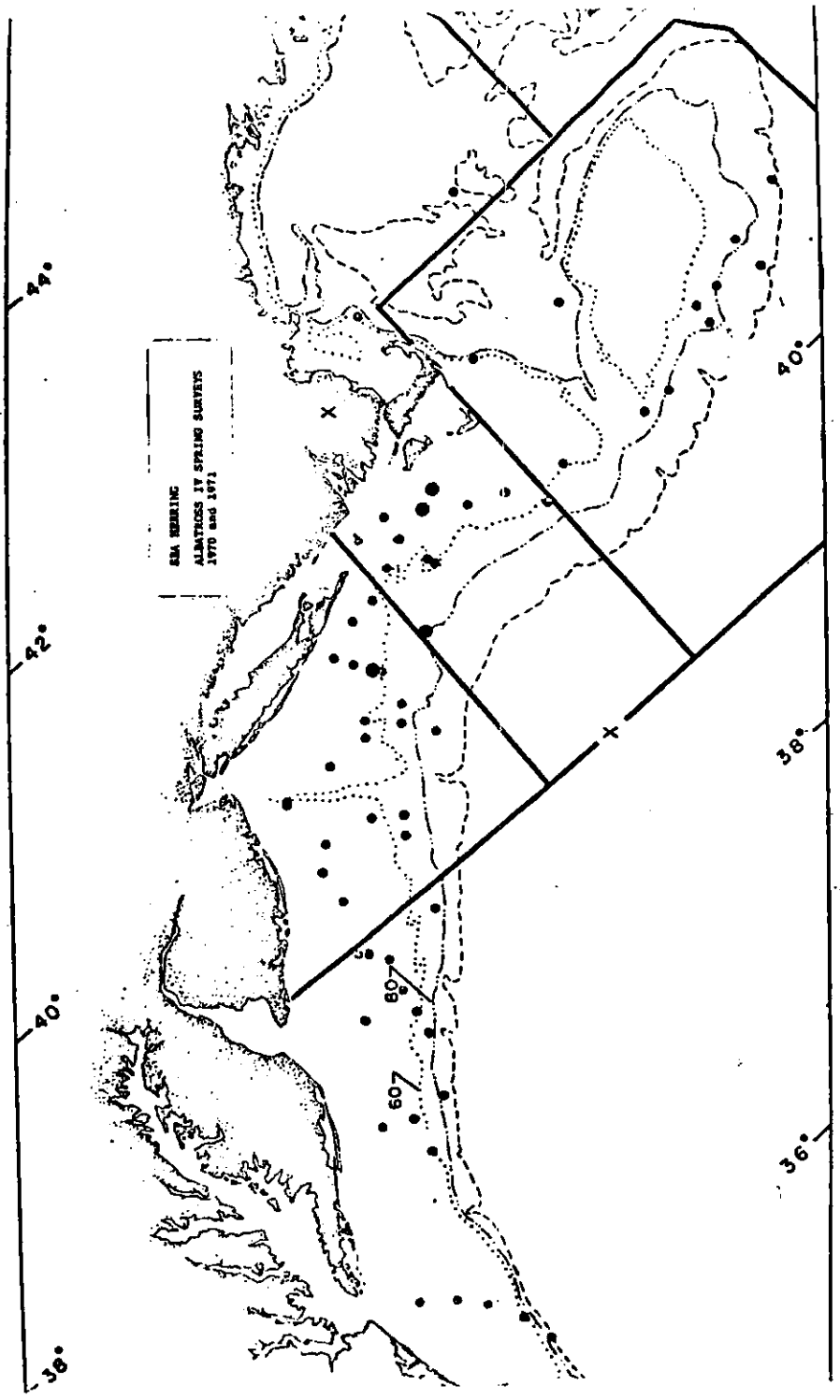

YELLOWTAIL
ALBATROSS IV SPRING SURVEYS
1968 and 1969
LBS/HAUL
1–20
21–100
> 100
44°
42°
40°
38°
36°
60
80


WINTER FLOUNDER
ALBATROSS IV SPRING SURVEYS
1970 and 1971
LBS/HAUL
1-20
21-100
> 100
44°
42°
40°
40°
38°
36°
80
60

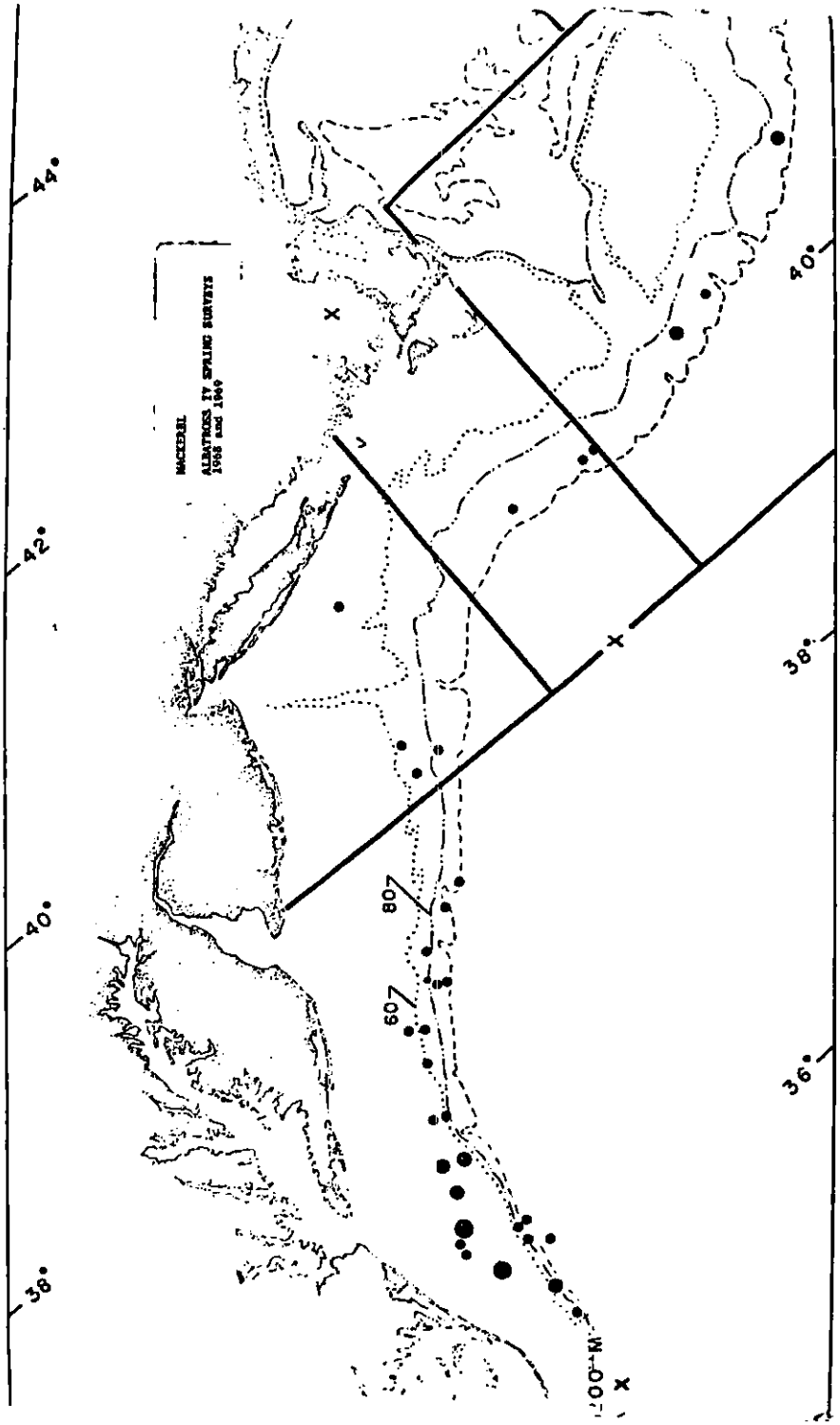
B 4


44°
42°
40°
38°
40°
38°
36°
807
607
200 M
SEA HERRING
ALBATROSS IV SPRING SURVEYS
1968 and 1969

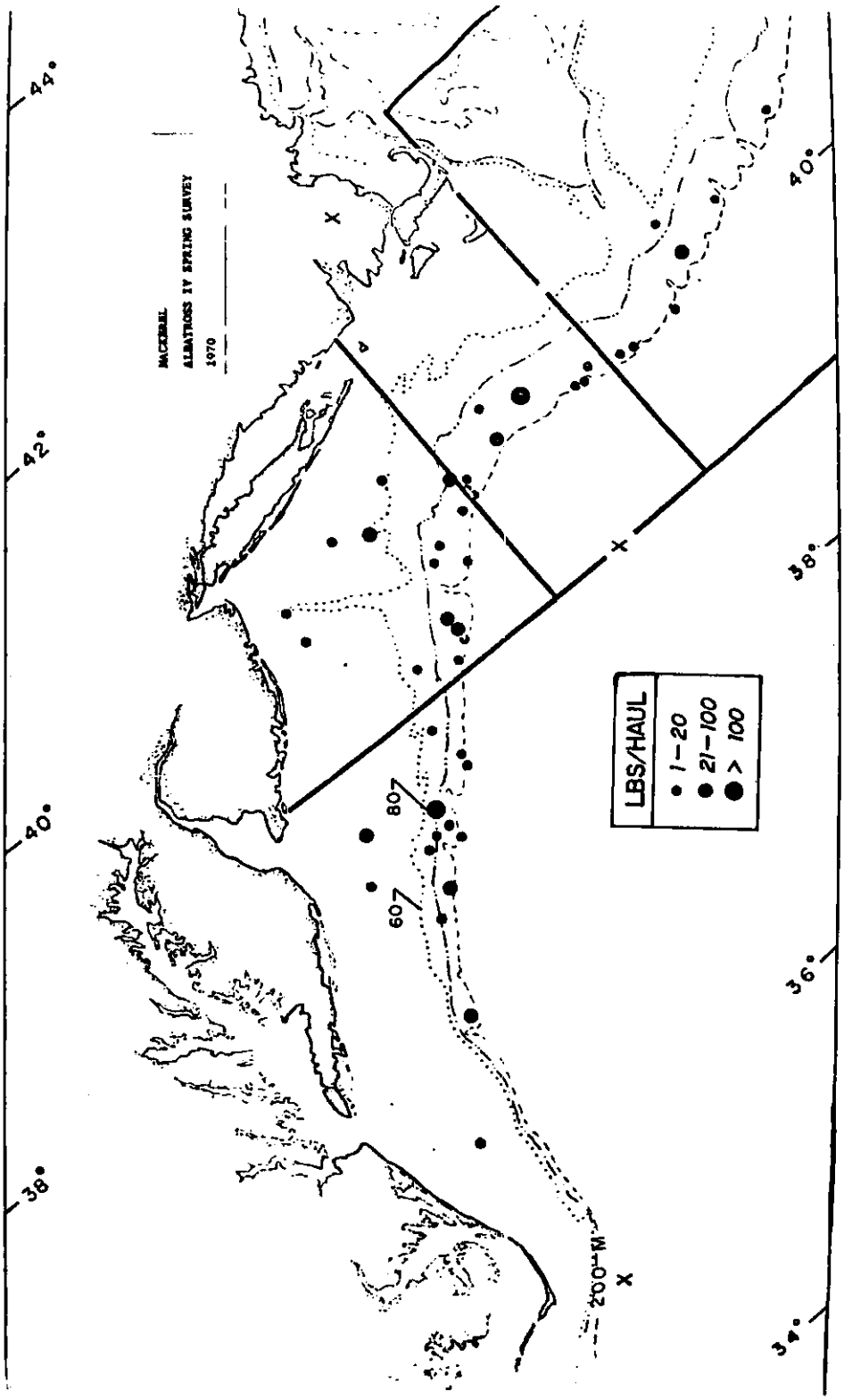
B 5

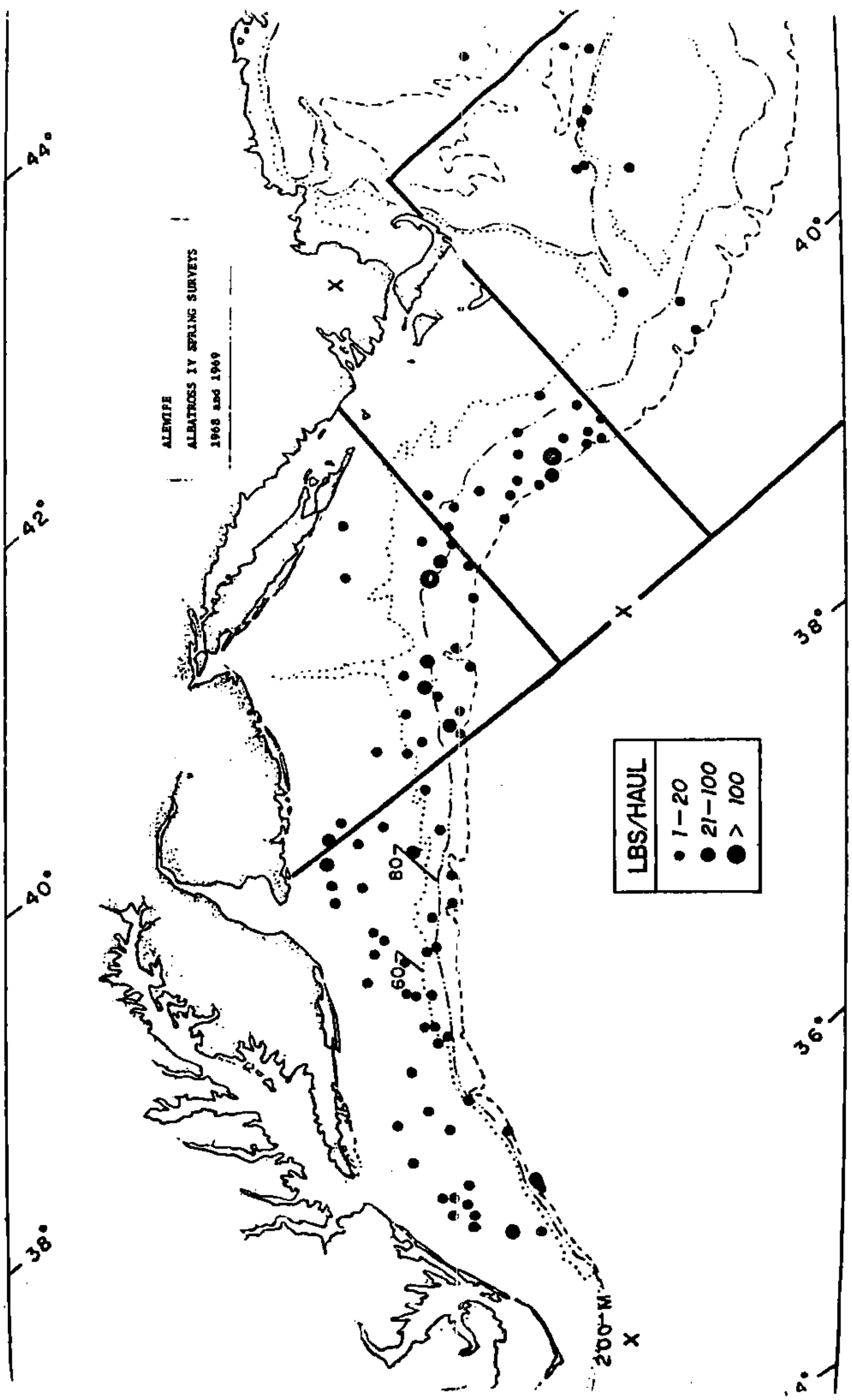

44°
42°
40°
38°
36°
40°
38°
36°
80
60
7
SEA HERRING
ALBATROSS IV SPRING SURVEYS
1970 and 1971

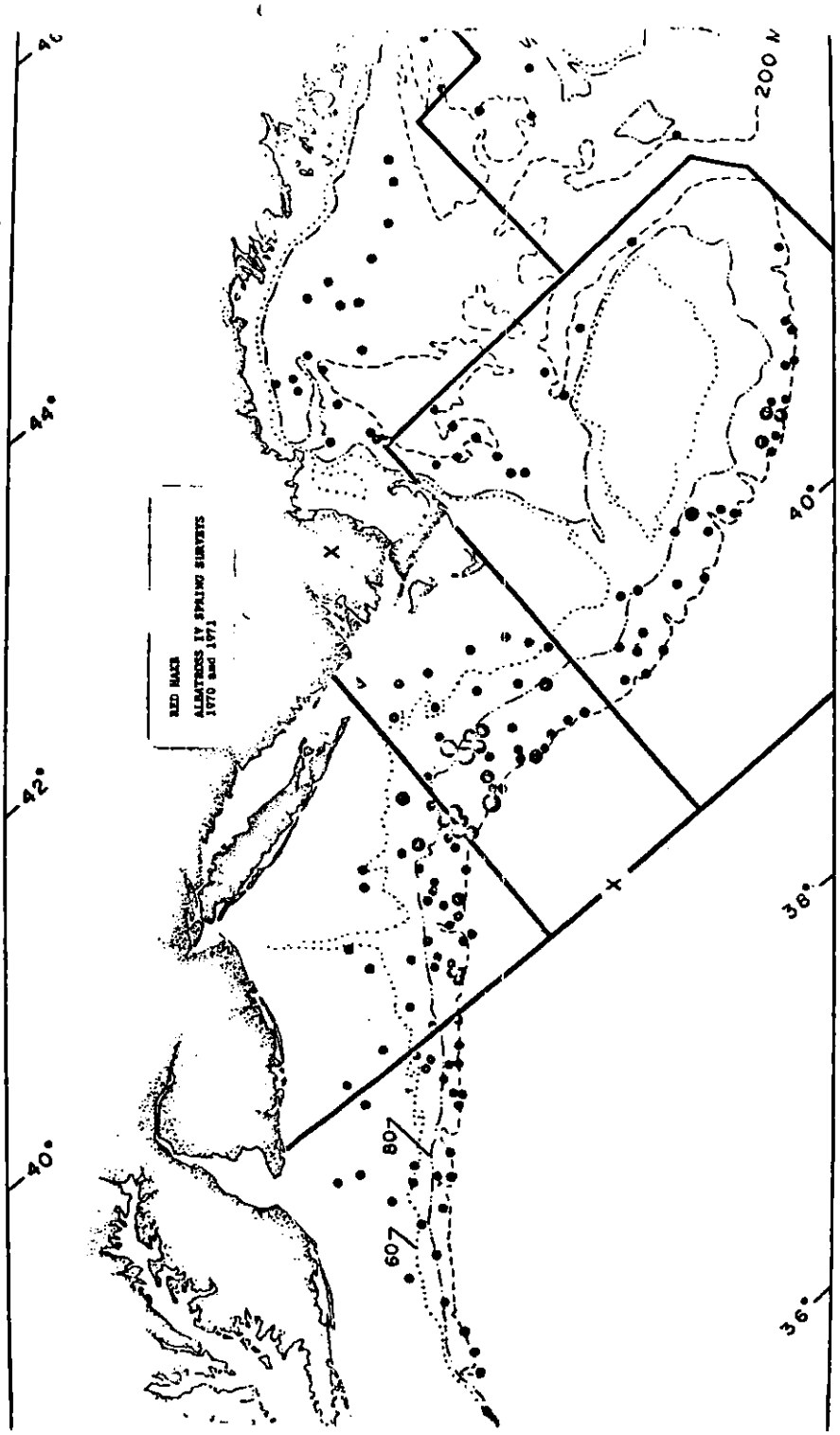
B 6


MACKEREL
ALBATROSS IV SPRING SURVEYS
1968 and 1969
44°
42°
40°
38°
40°
38°
36°
80
60
70°

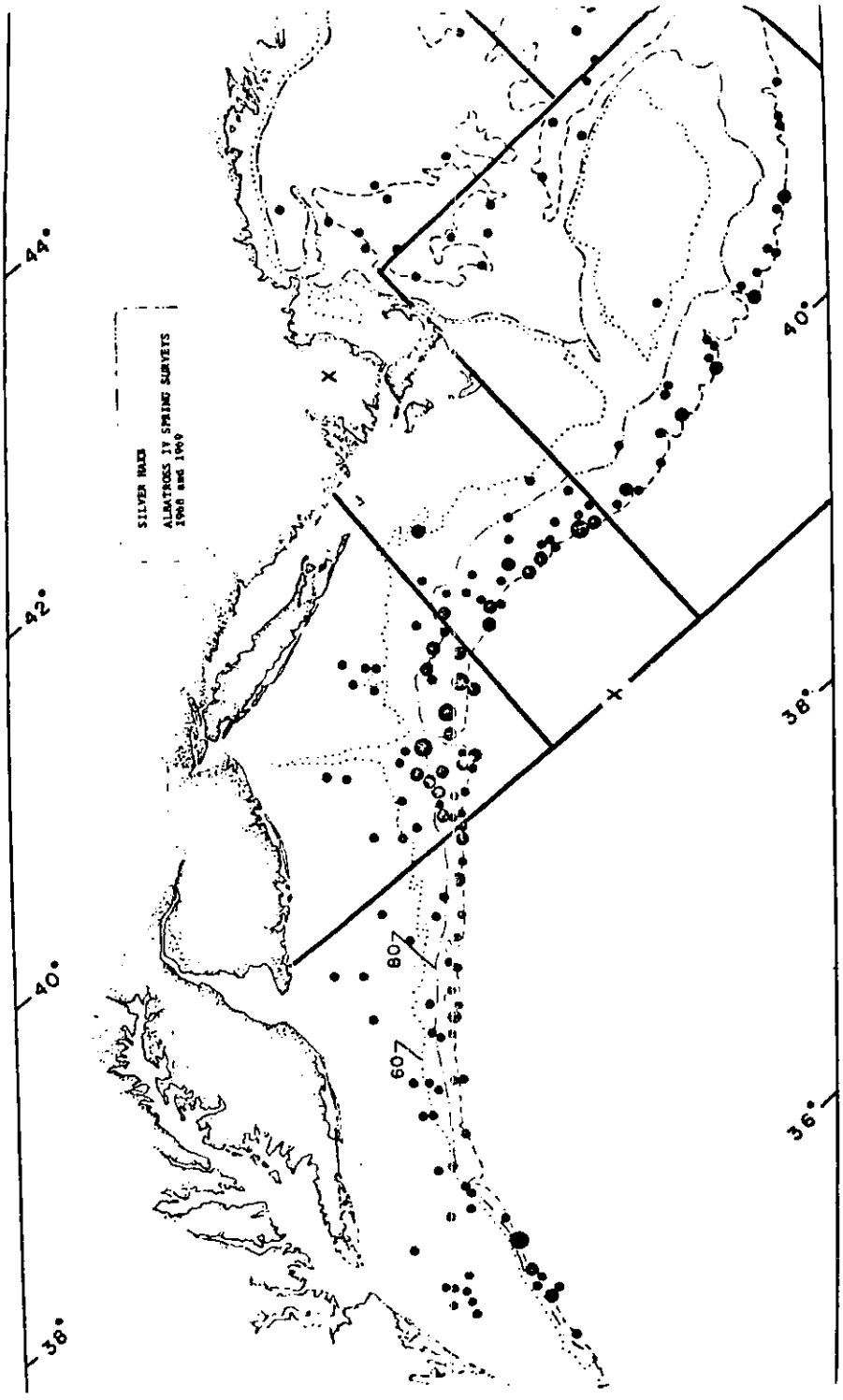
B 7


MACKEREL
ALBATROSS IV SPRING SURVEY
1970
LBS/HAUL
• 1-20
● 21-100
● > 100
44°
42°
40°
38°
36°
34°
80°
70°
60°
807
607
200 M

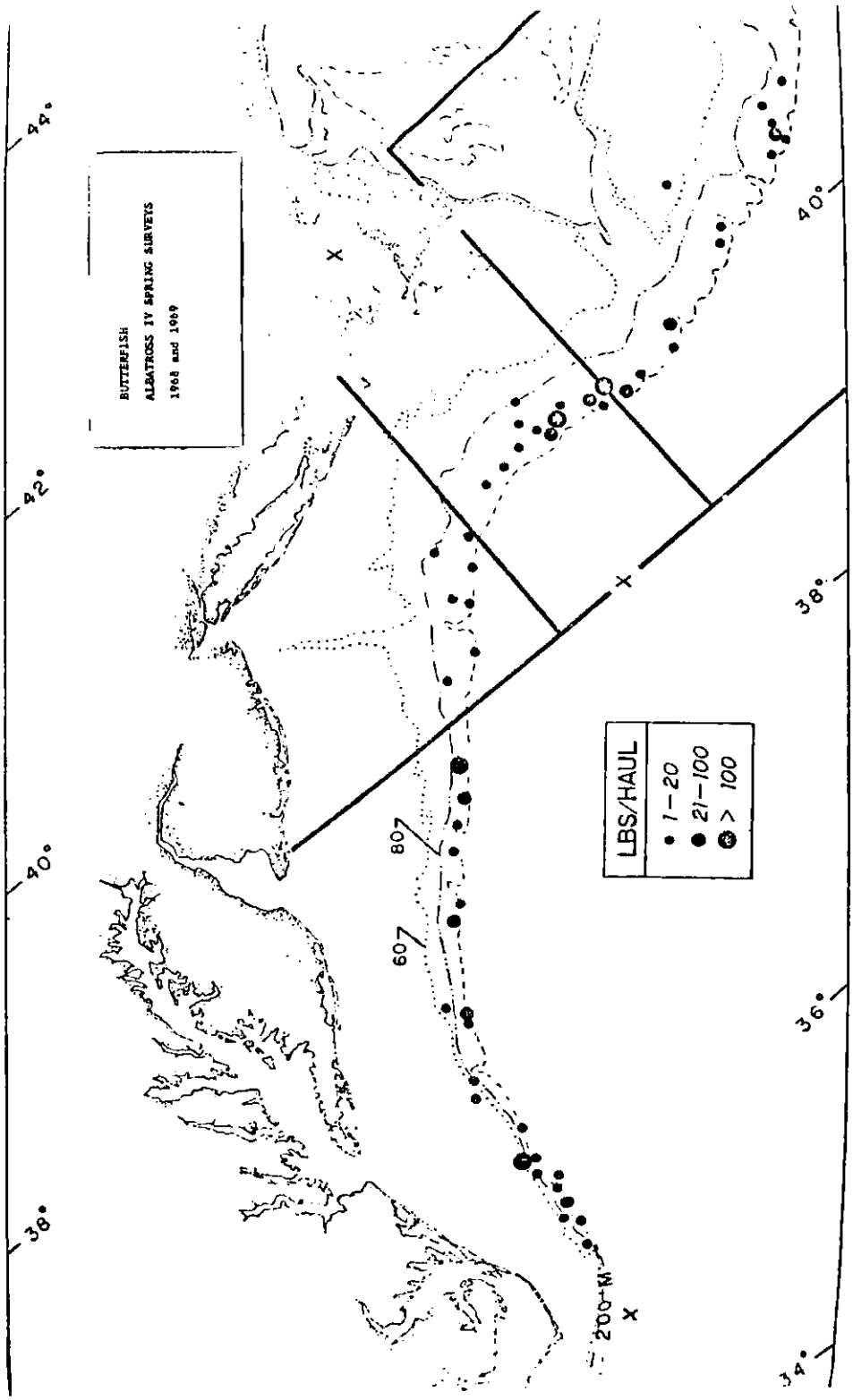

ALEWIFE
ALBATROSS IV SPRING SURVEYS
1968 and 1969
LBS/HAUL
1-20
21-100
> 100
200 M
80
60
44°
42°
40°
38°
40°
38°
36°


200 M
44°
42°
40°
40°
36°
36°
80
60
RED HAKE
ALBATROSS IV SPRING SURVEYS
1971 and 1972

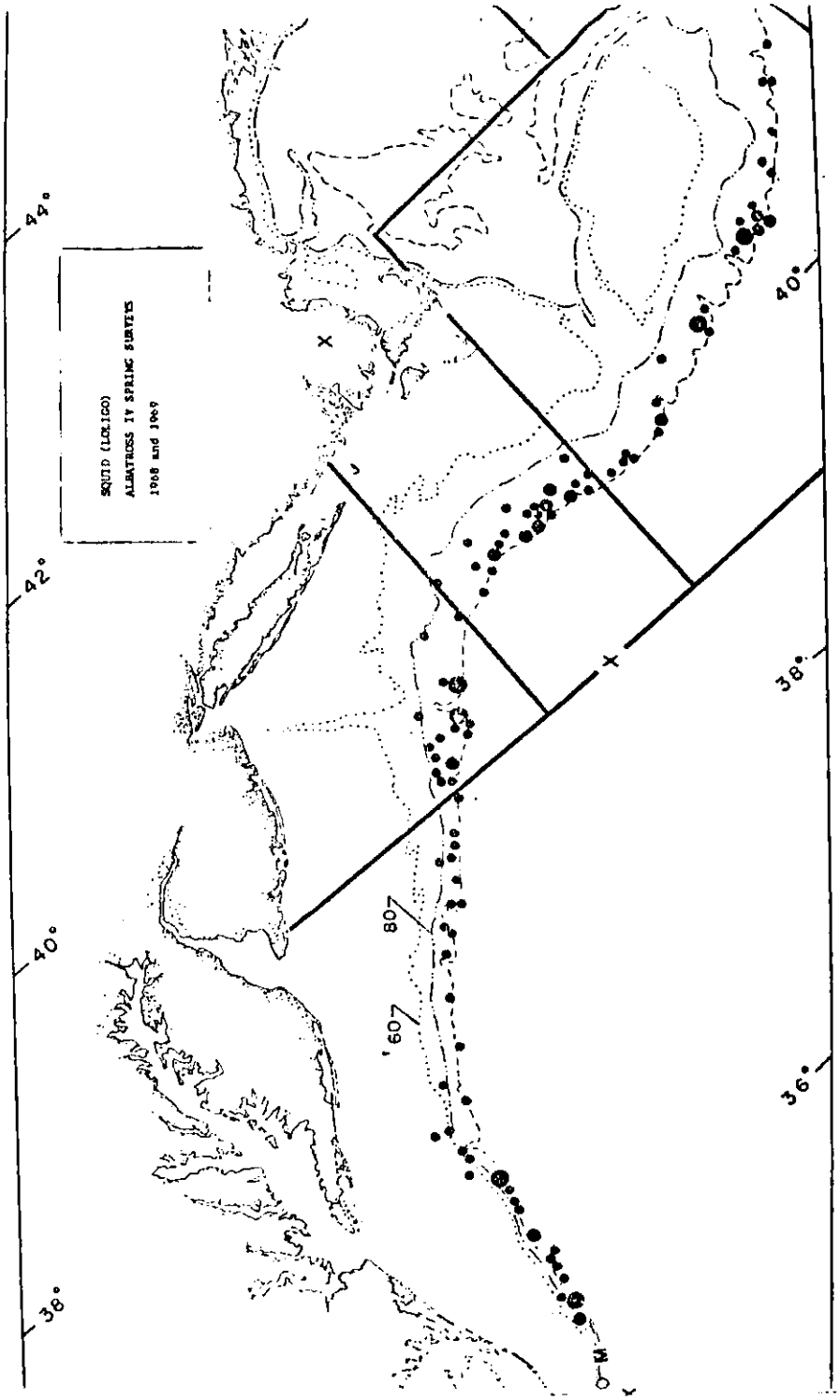
B 10

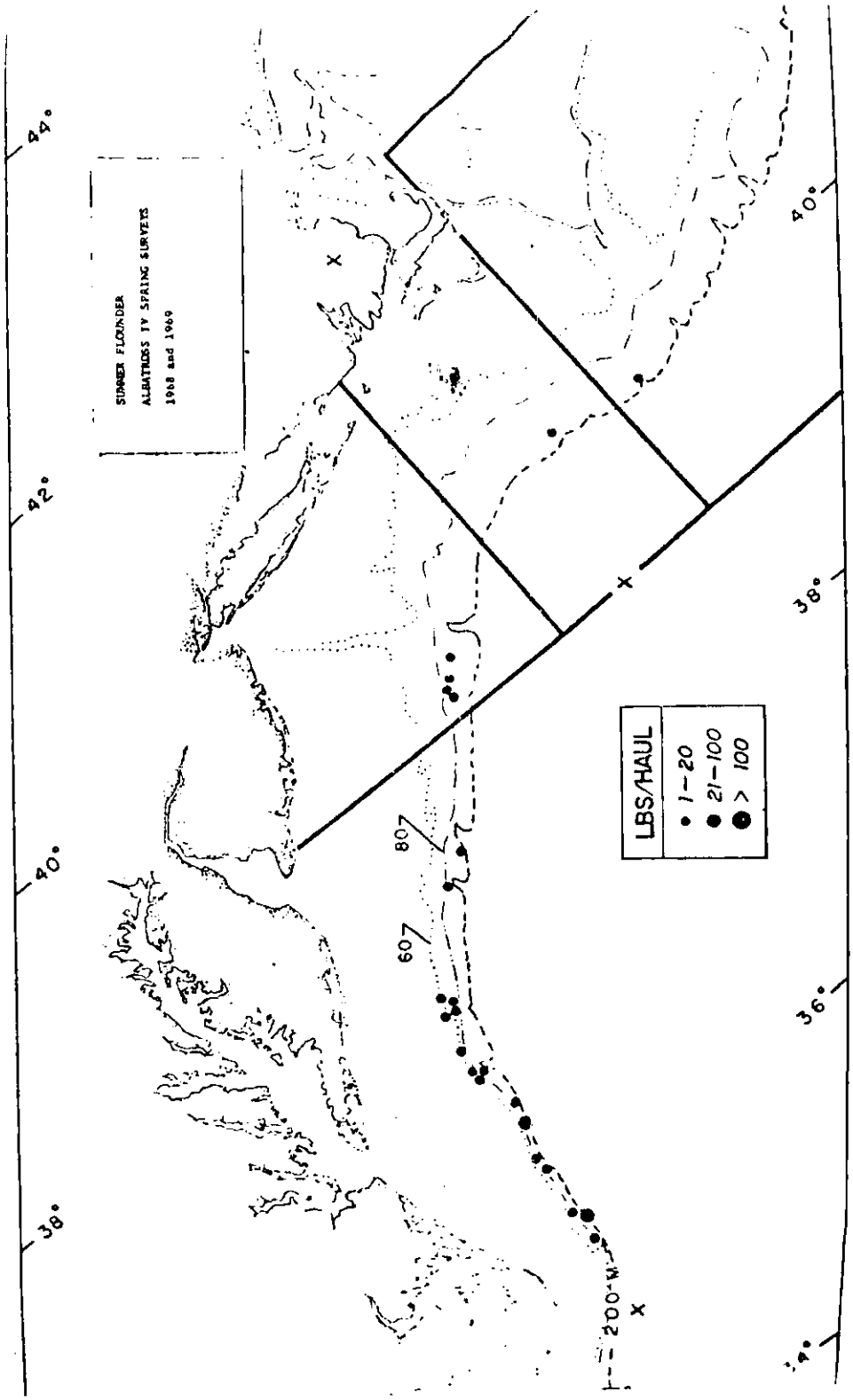

SILVER HAKE
ALBATROSS IV SPRING SURVEYS
1968 and 1969
44°
42°
40°
38°
40°
38°
36°
807
607

B 11

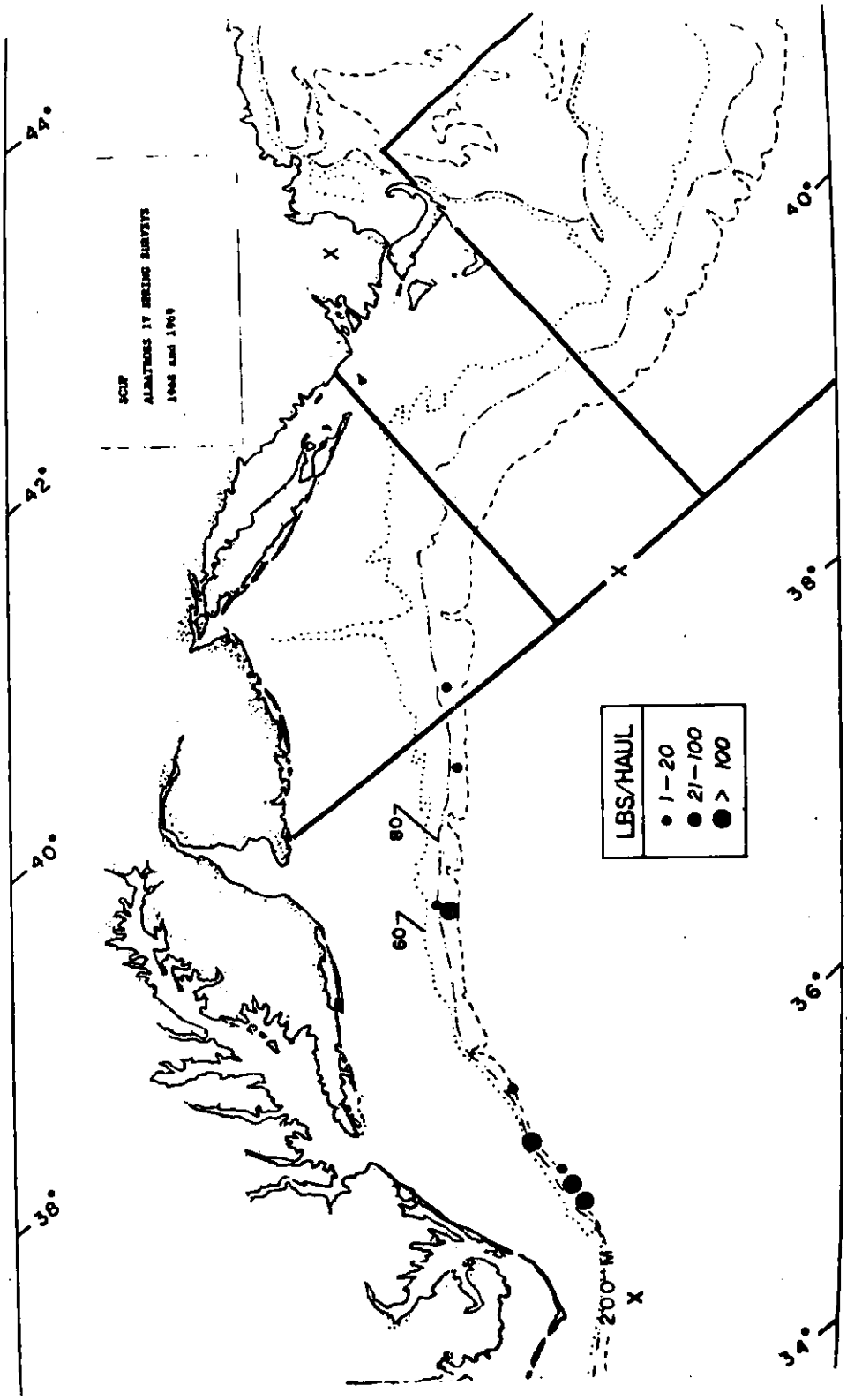

BUTTERFISH
ALBATROSS IV SPRING SURVEYS
1968 and 1969
LBS/HAUL
1-20
21-100
> 100
44°
42°
40°
38°
36°
34°
80
60
200 M

B 12

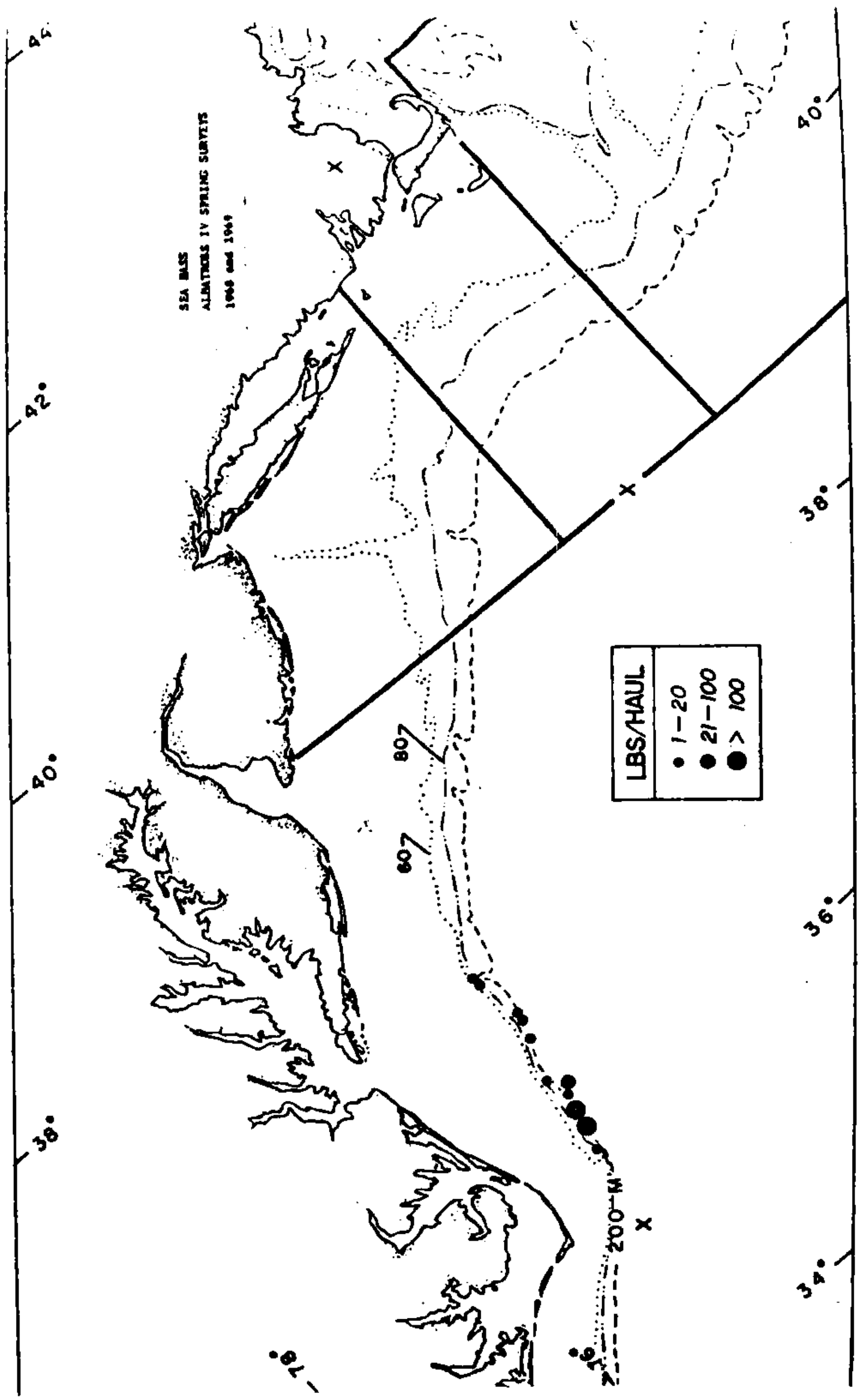

SQUID (LOLIGO)
ALBATROSS IV SPRING SURVEYS
1968 and 1969
44°
42°
40°
38°
40°
38°
36°
80
60
M


SUMMER FLOUNDER
ALBATROSS IV SPRING SURVEYS
1968 and 1969
LBS/HAUL
• 1-20
● 21-100
● > 100
44°
42°
40°
38°
36°
34°
40°
38°
36°
807
607
200 M

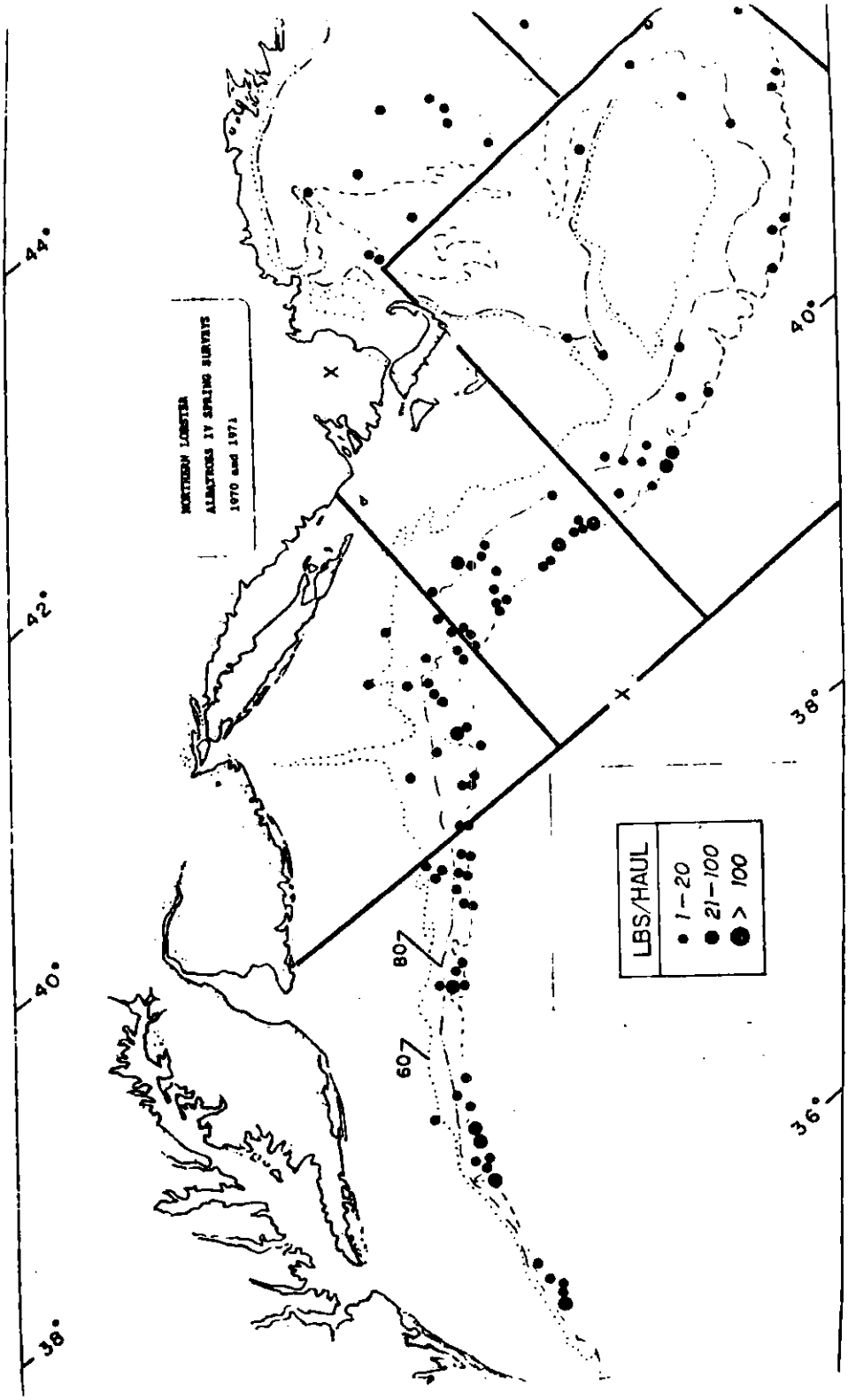
B 14



C 1


SEA BASS
ALBATROSS IV SPRING SURVEYS
1968 and 1969
LBS/HAUL
1-20
21-100
> 100
200 M
44°
42°
40°
38°
36°
34°
78°

C 2

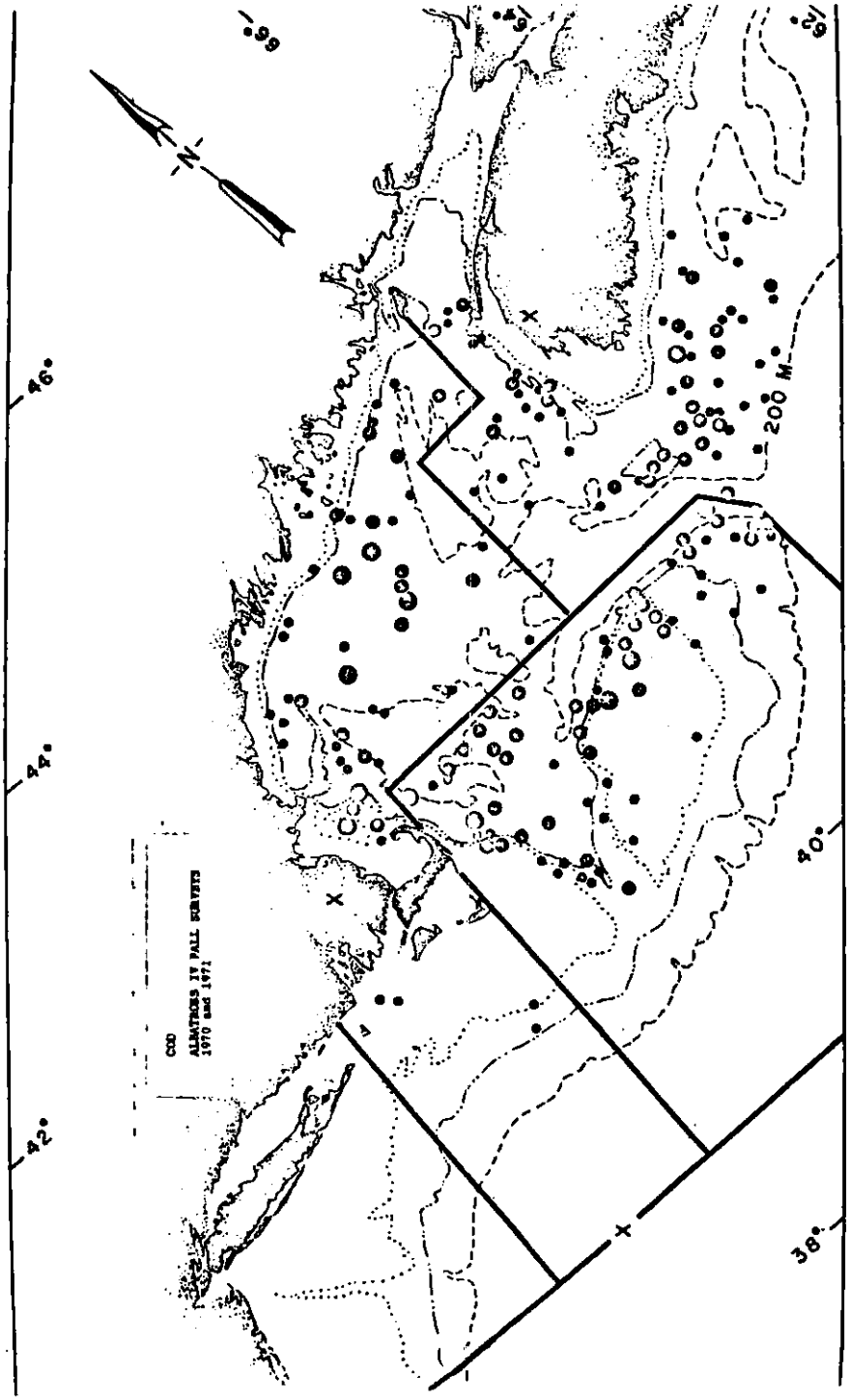

NORTHERN LOBSTER
ATLANTIC STATES SPRING SURVEYS
1970 and 1971
LBS/HAUL
• 1-20
● 21-100
● > 100
44°
42°
40°
38°
40°
38°
36°
80
60

C 3

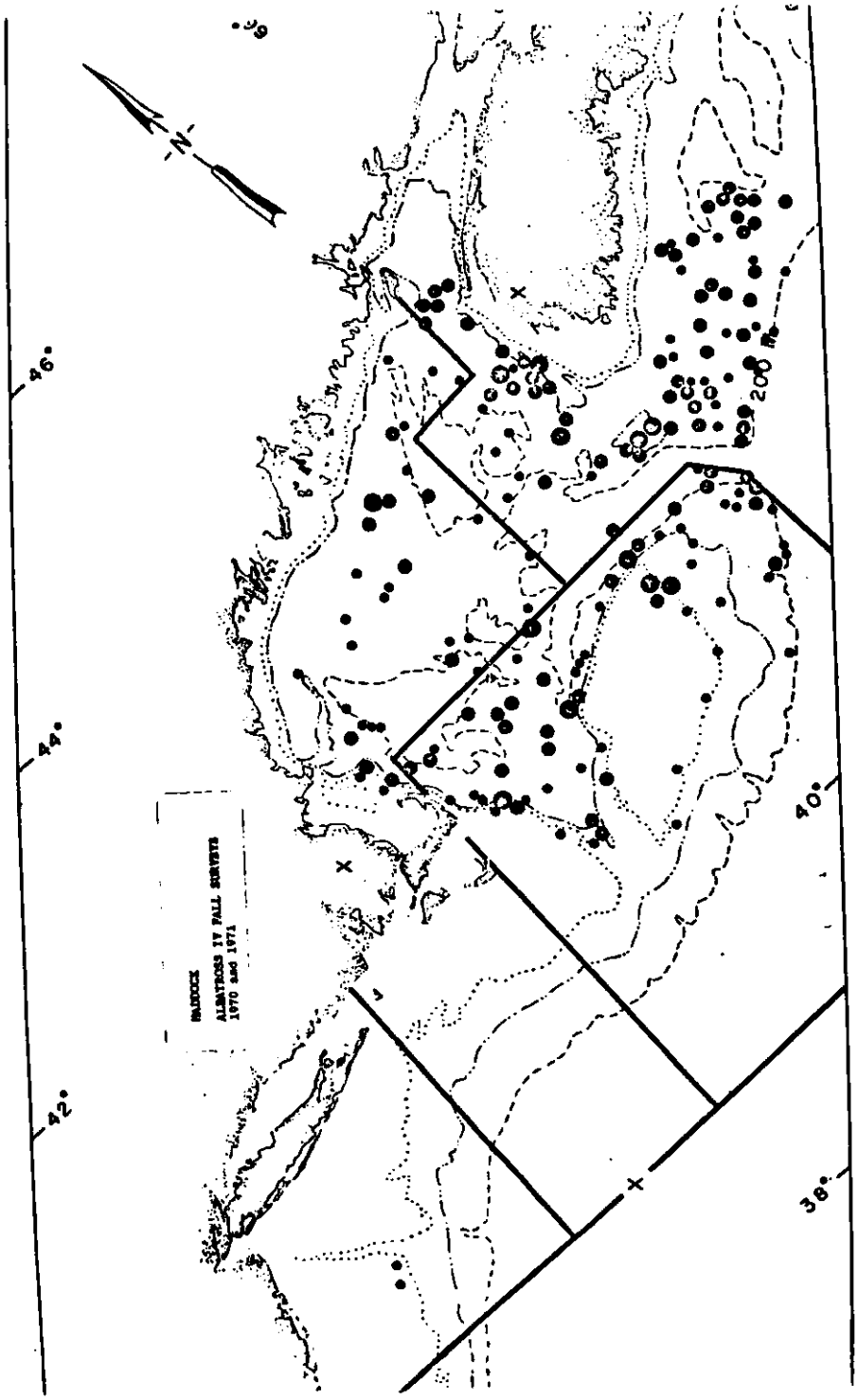
Serial No. 2911
(D.c. 3)

ICNAF Res.Doc. 73/9
APPENDIX II

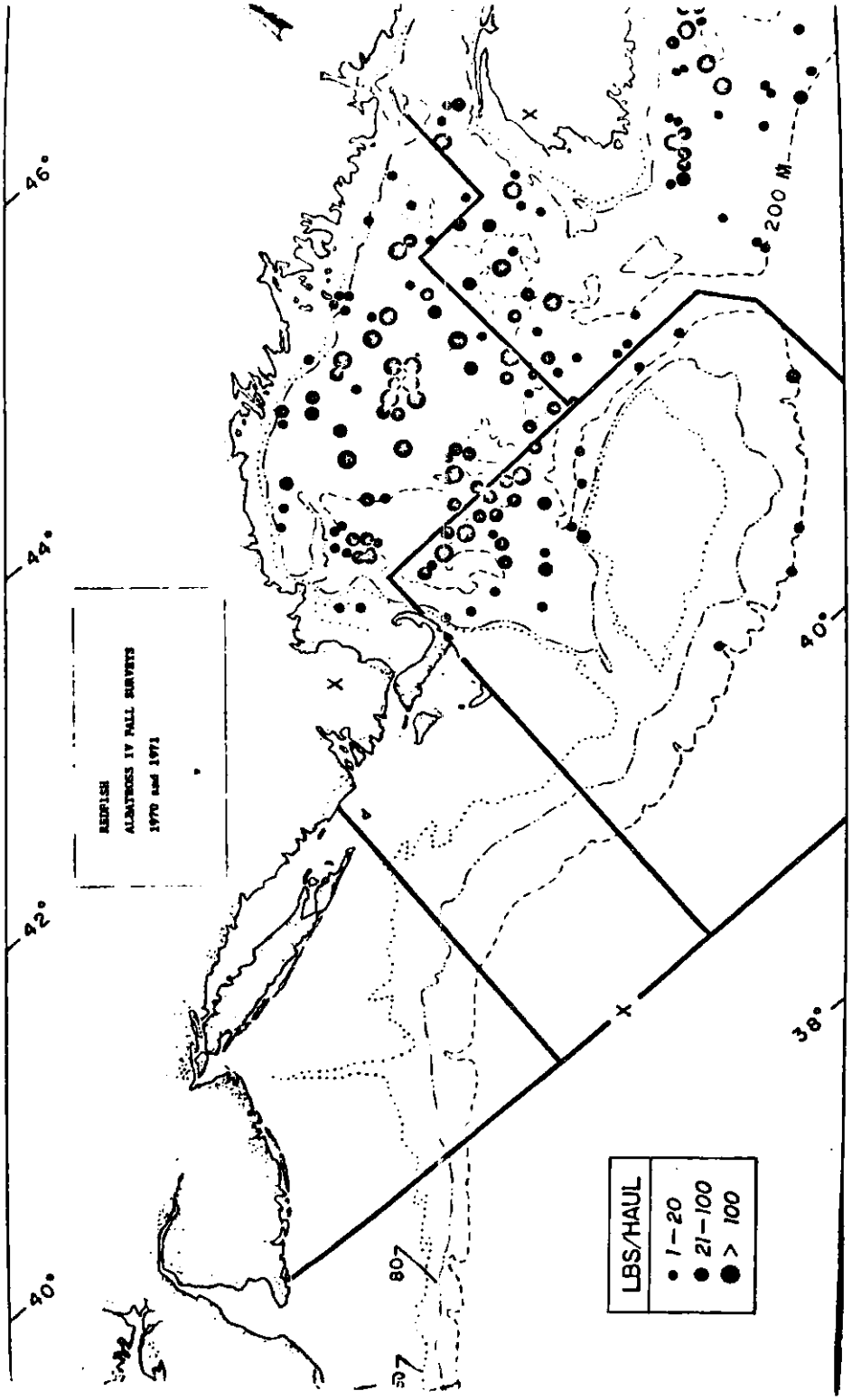
Plots of individual catches of 16 species (see Appendix I) taken on autumn (fall) groundfish surveys. All strata shown in Figure 2 were sampled by U.S.A.; only strata 1-25, 61-76 were sampled by U.S.S.R.


69°
N
46°
44°
42°
40°
38°
200 M
COD
ALBATROSS IV FALL SURVEYS
1970 and 1971

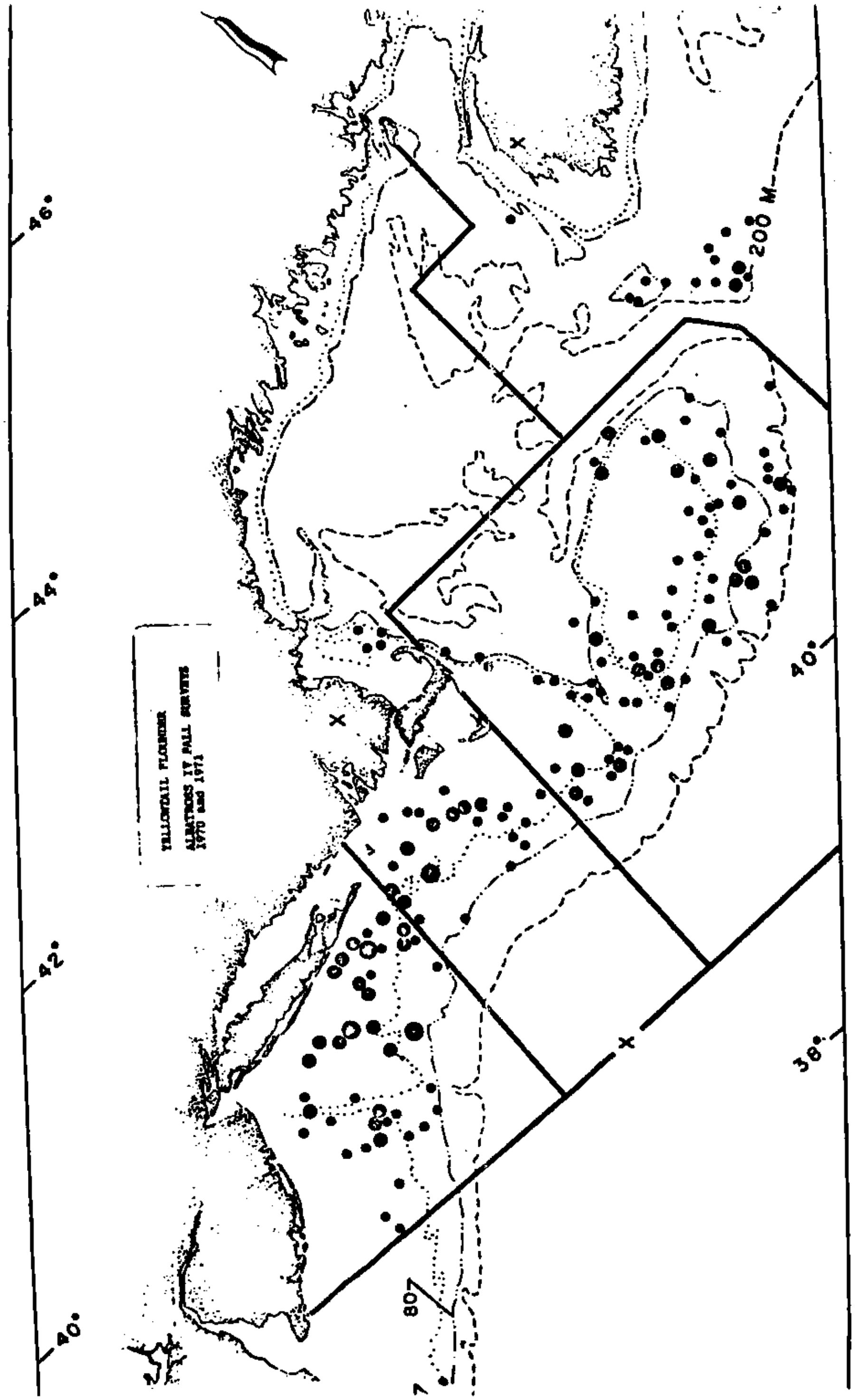
C 5

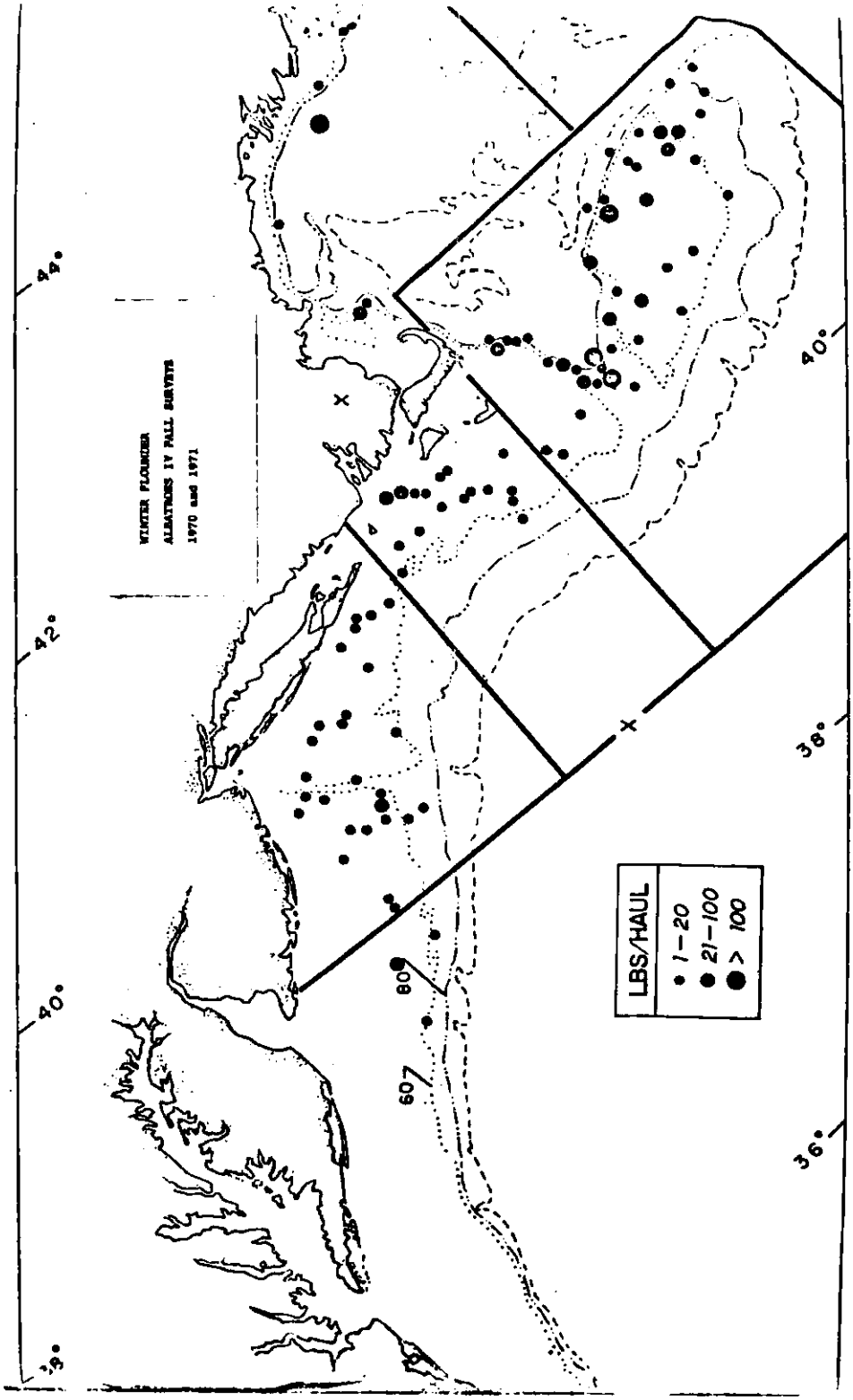

N
46°
44°
42°
40°
38°
200 m
HADDOCK
ALBATROSS IV FALL SURVEYS
1970 and 1971

C 6

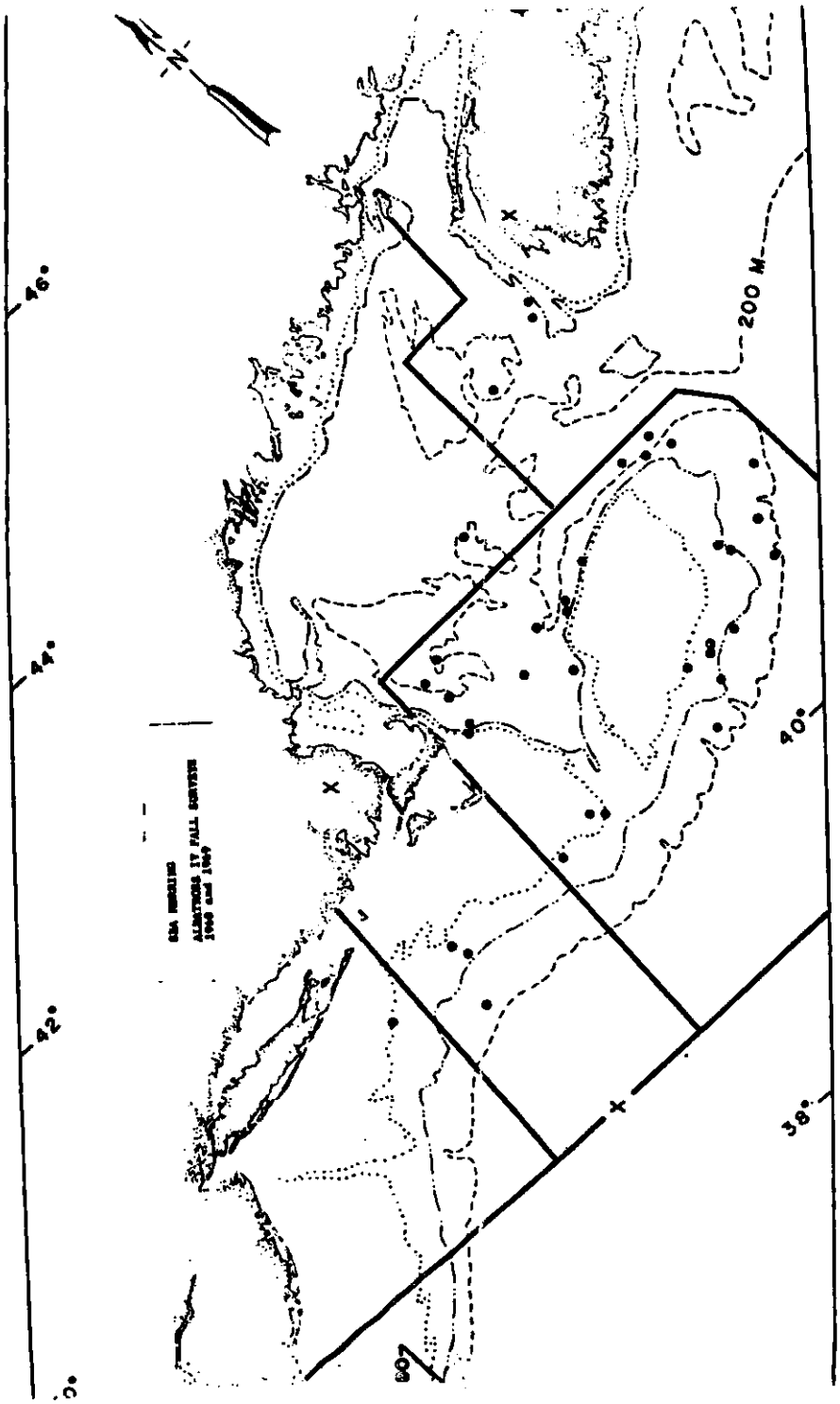

REDFISH
ALBATROSS IV FALL SURVEYS
1970 and 1971
LBS/HAUL
• 1–20
● 21–100
● > 100
200 M
46°
44°
42°
40°
40°
38°
80
70

C 7

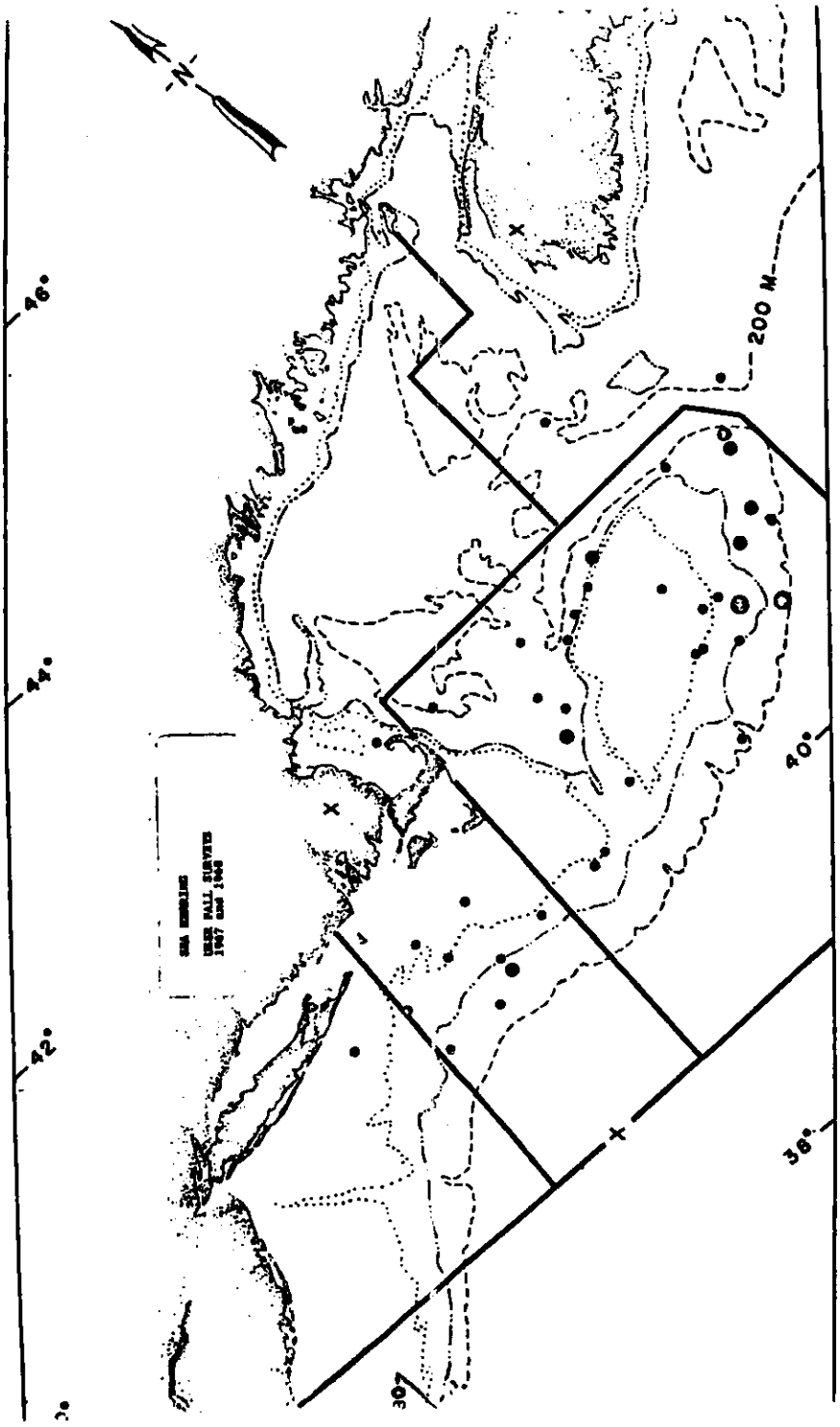

YELLOWTAIL FLOUNDER
ALBATROSS IV FALL SURVEYS
1970 and 1971
46°
44°
42°
40°
40°
38°
200 M
80


WINTER FLOUNDER
ALBATROSS IV FALL SURVEYS
1970 and 1971
LBS/HAUL
• 1-20
● 21-100
● > 100
44°
42°
40°
38°
36°
40°
38°
80
607

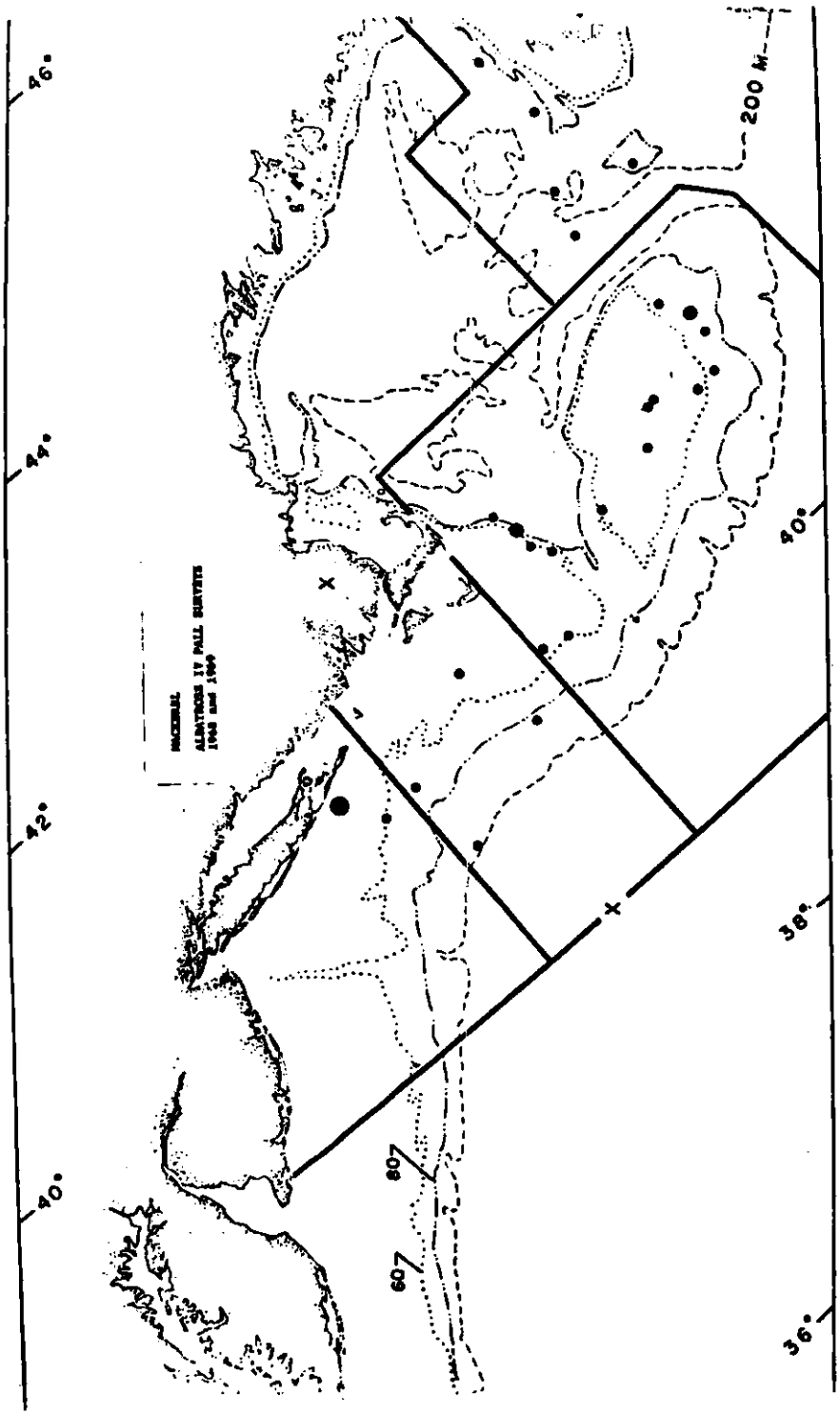
C 9

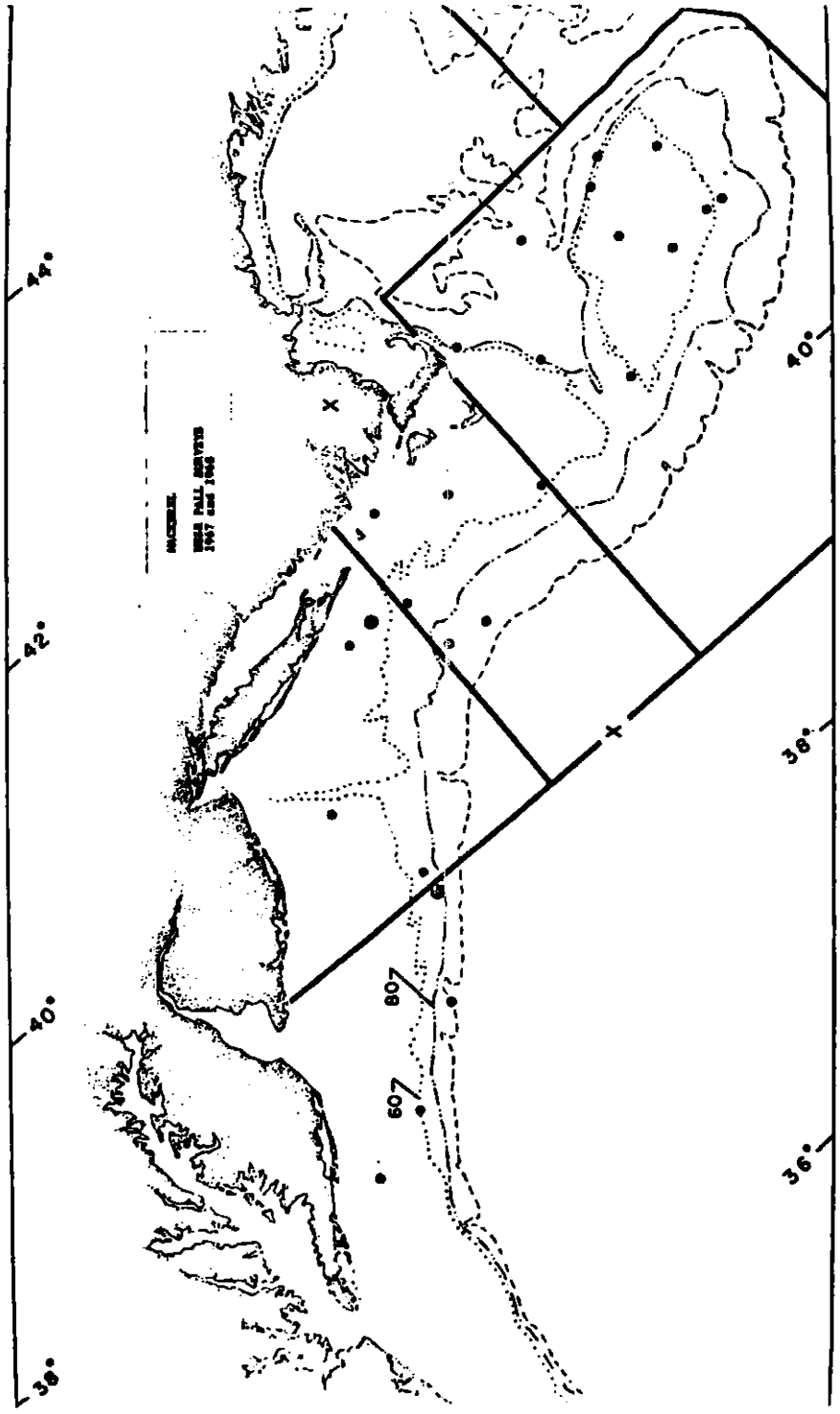

N
46°
44°
42°
40°
38°
200 M
SEA SURVEYS
ALBATROSS IV FALL SURVEYS
1968 and 1969

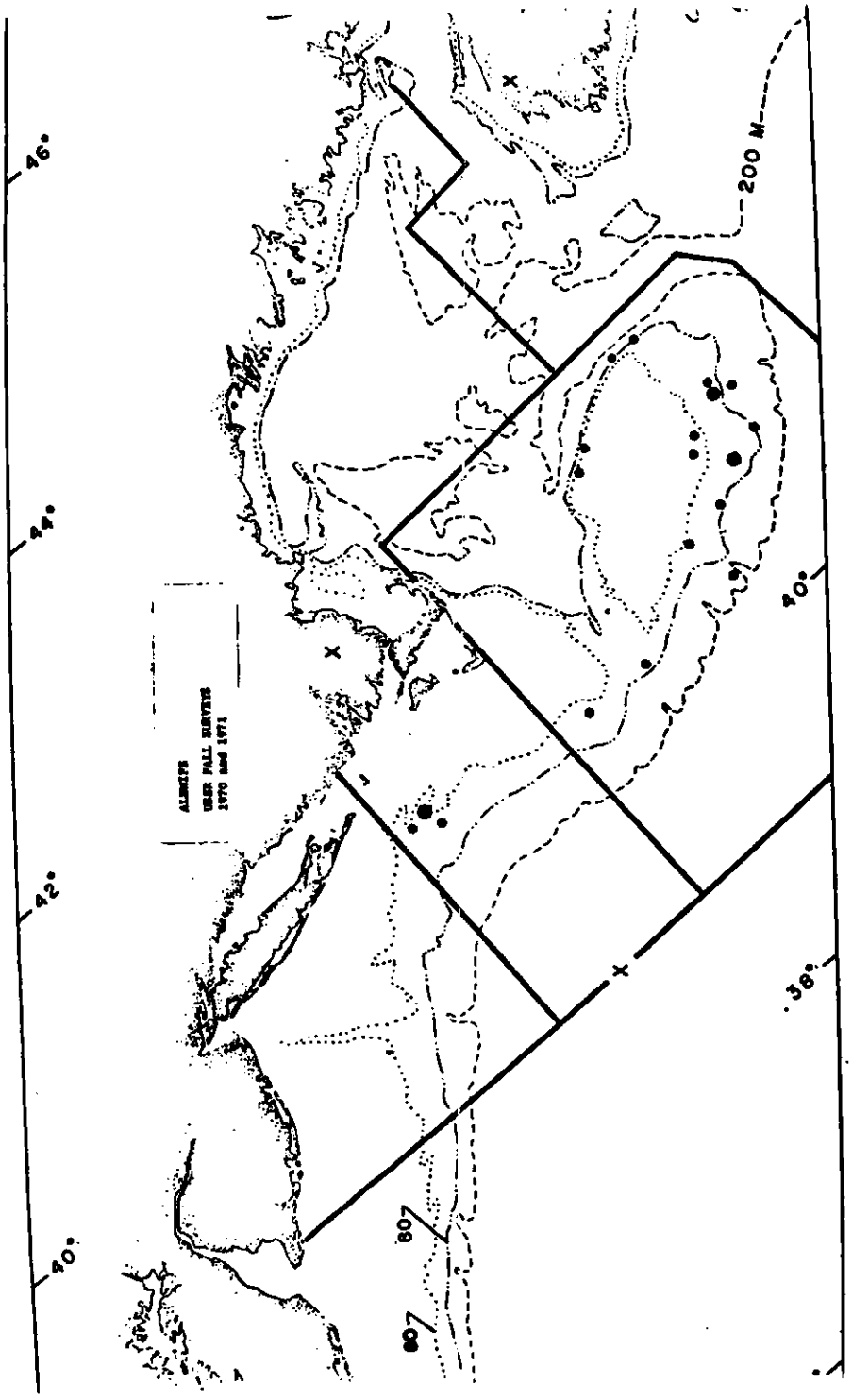
C 10



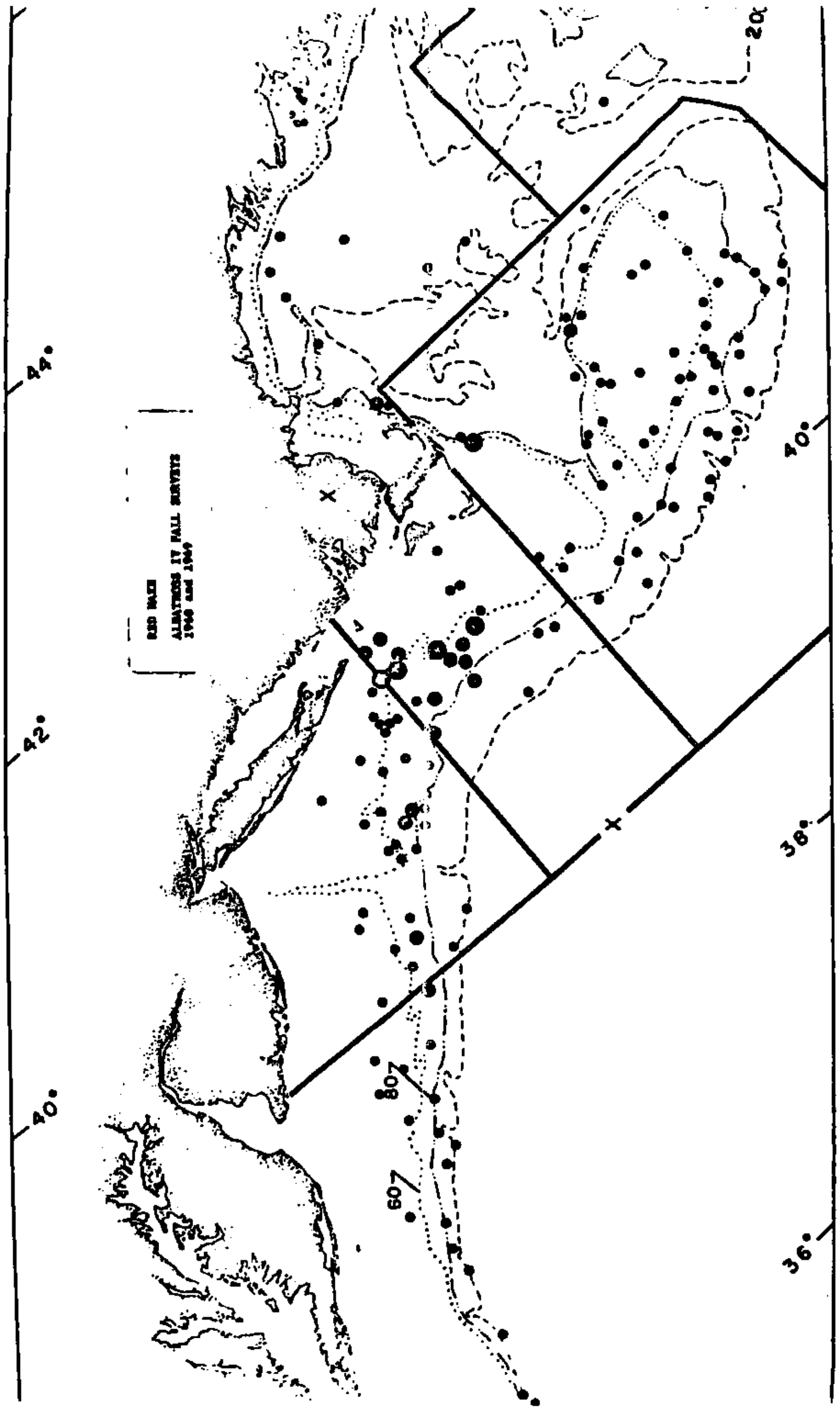
C 11


46°
44°
42°
40°
40°
38°
36°
200 M
807
807

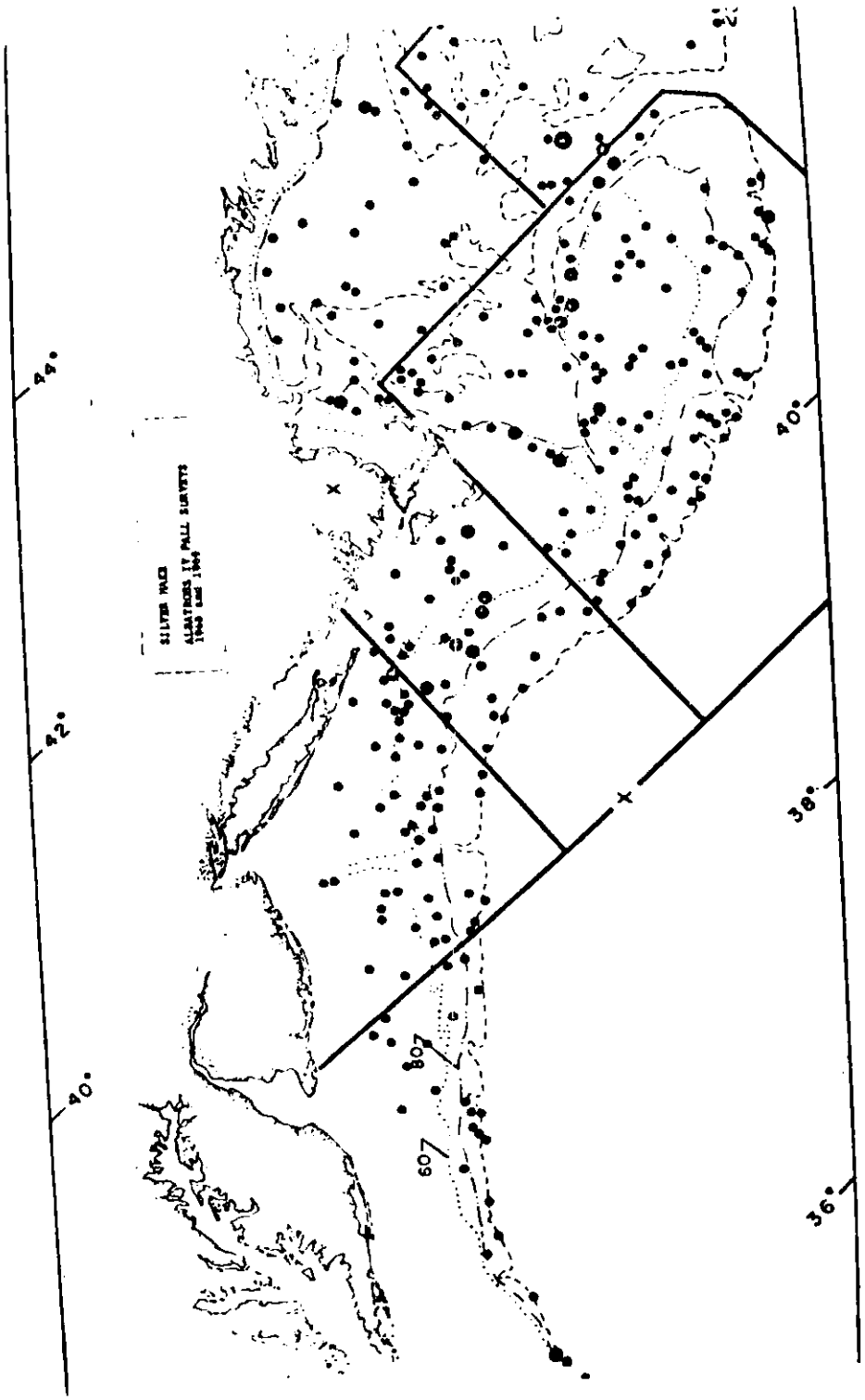

44°
42°
40°
38°
40°
36°
36°
807
607



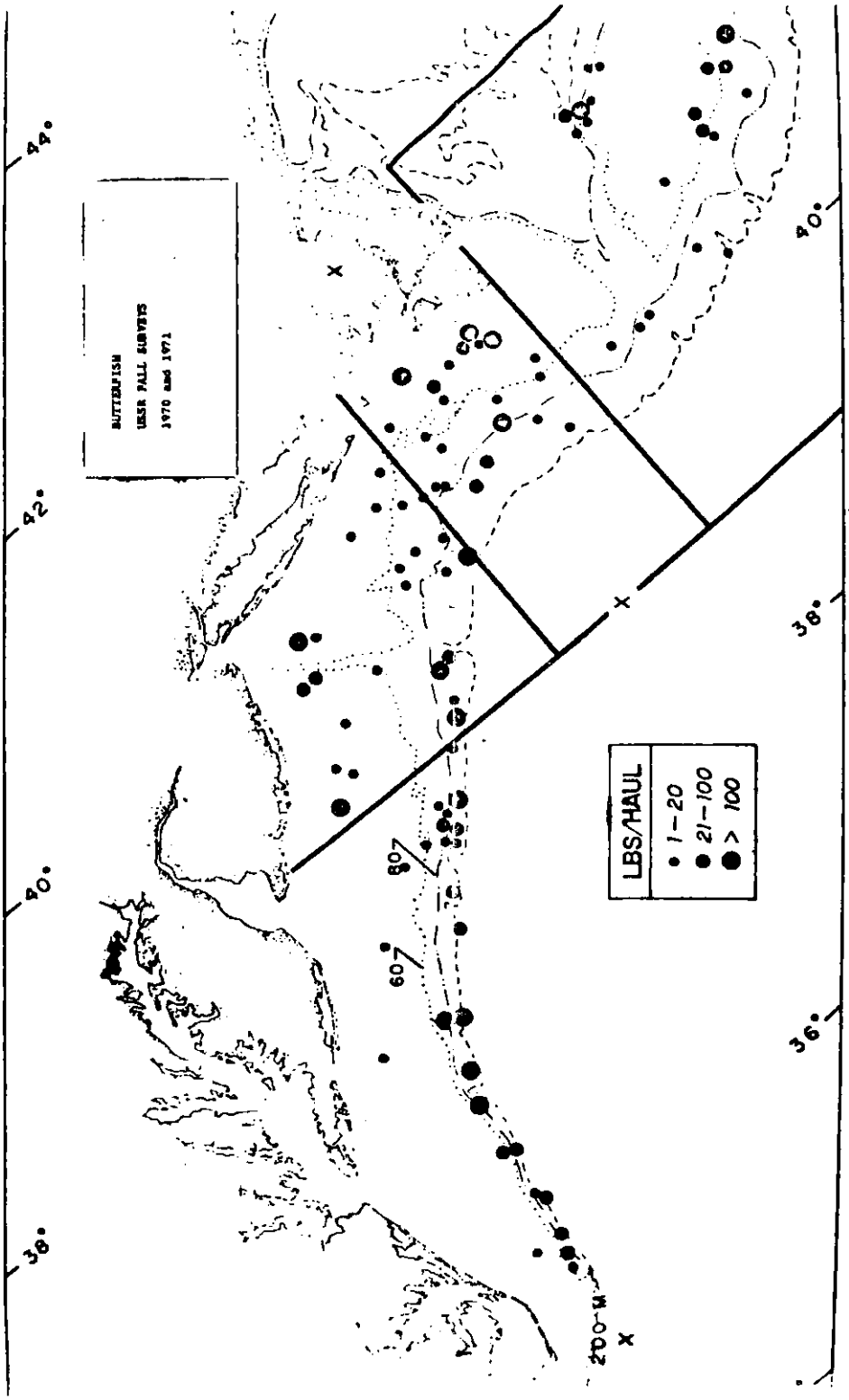
C 14



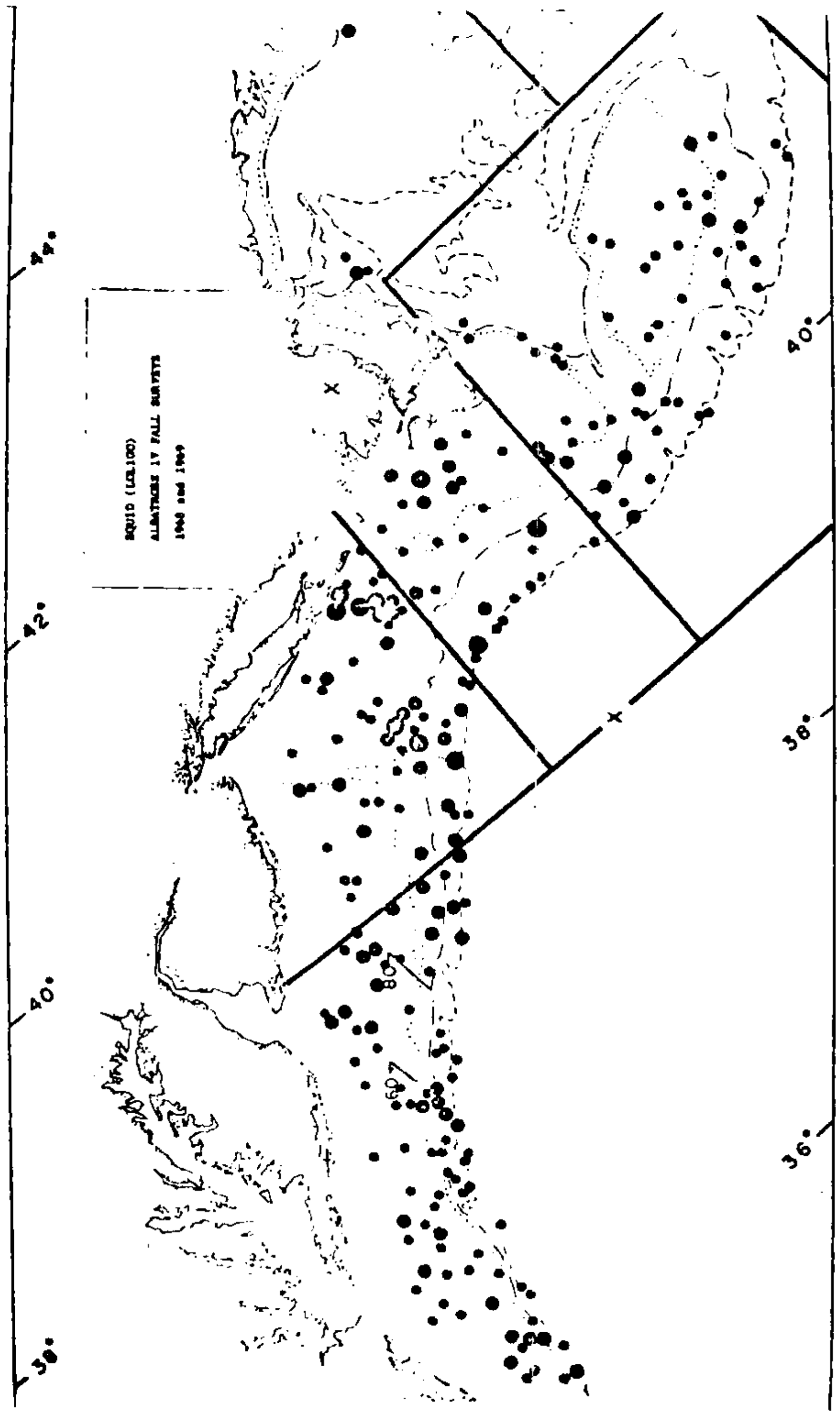
D1

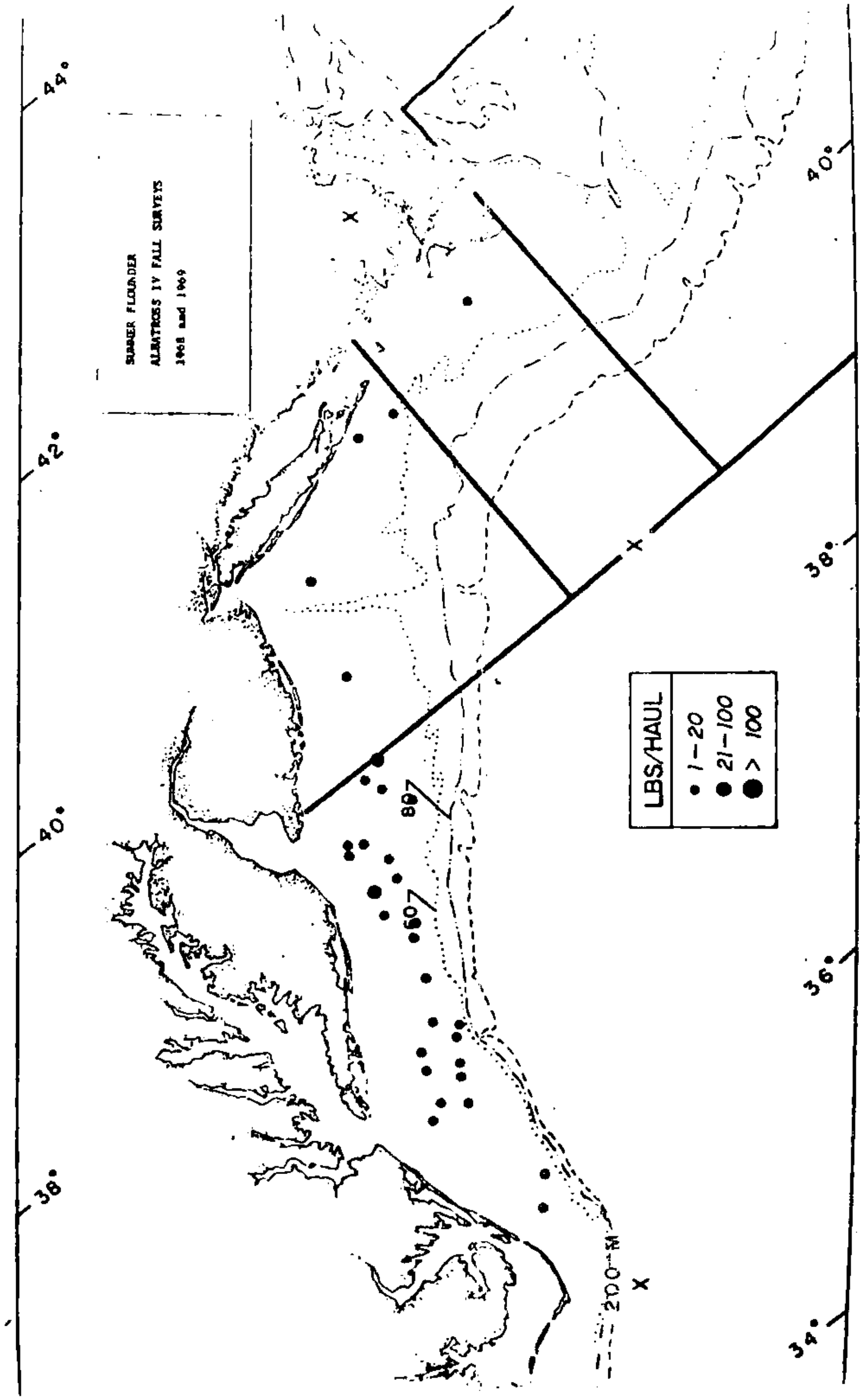


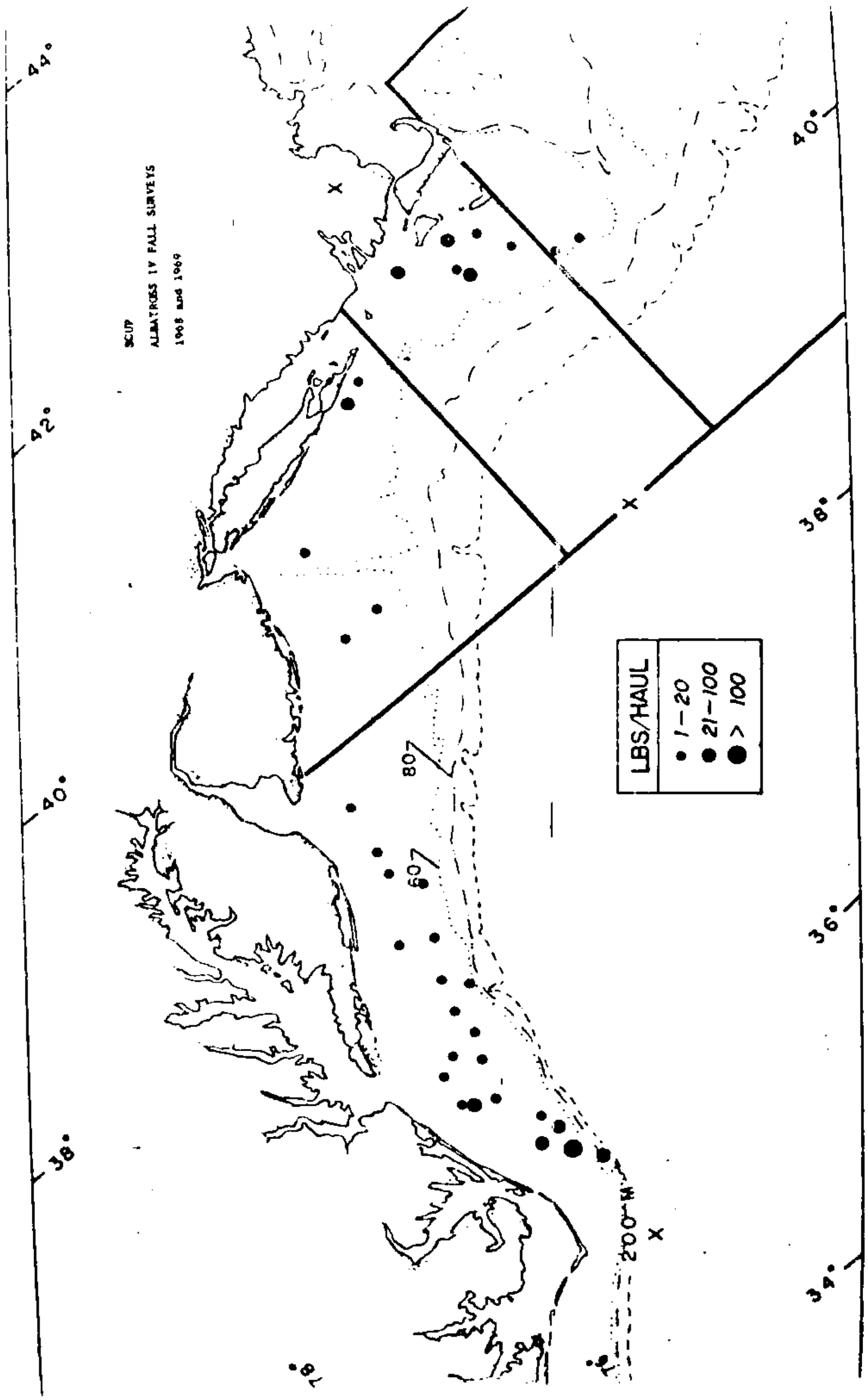
D 2

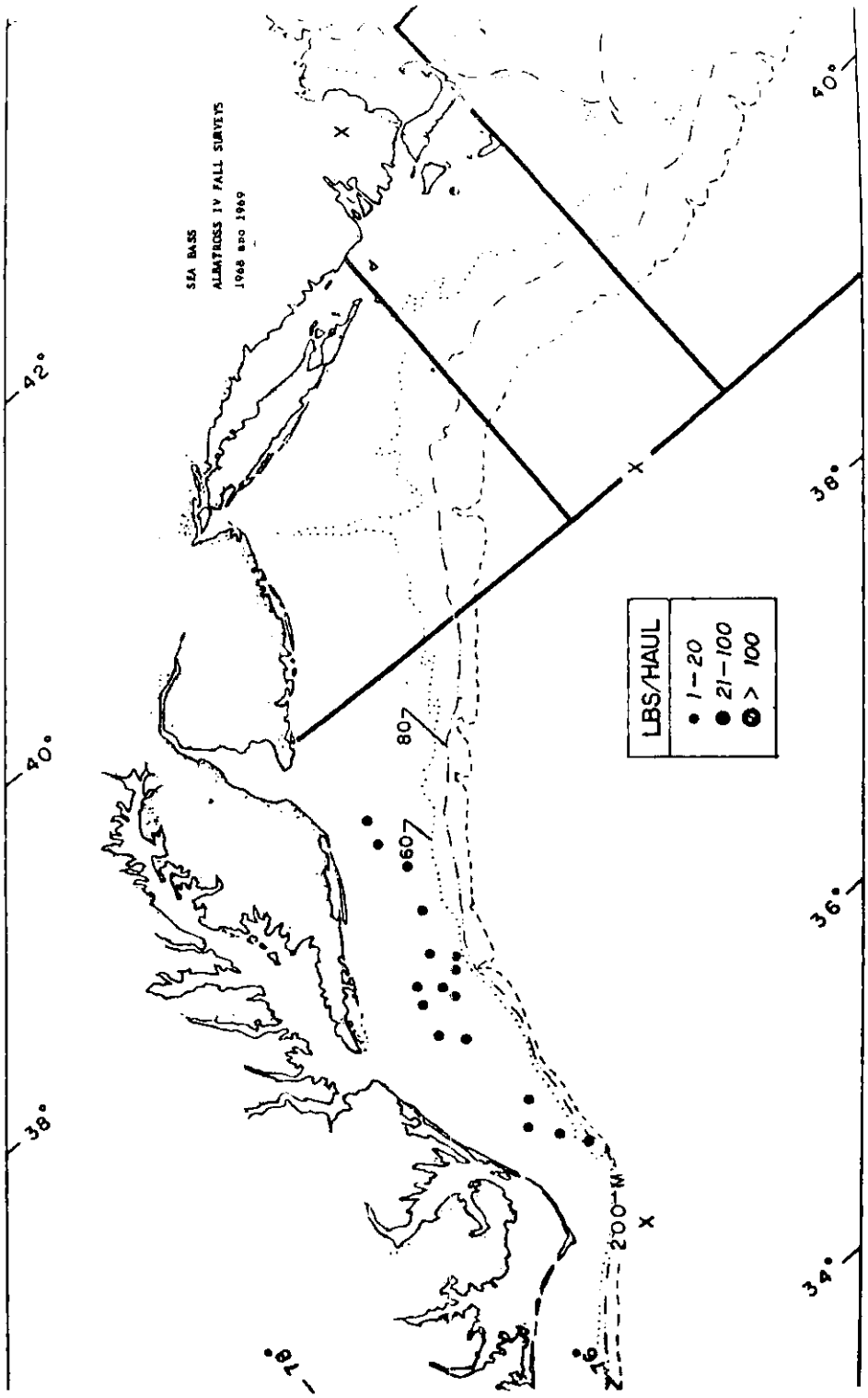

BUTTERFISH
USSR FALL SURVEYS
1970 and 1971
LBS/HAUL
• 1-20
● 21-100
● > 100
44°
42°
40°
38°
40°
38°
36°
80
60
200 M

D 3

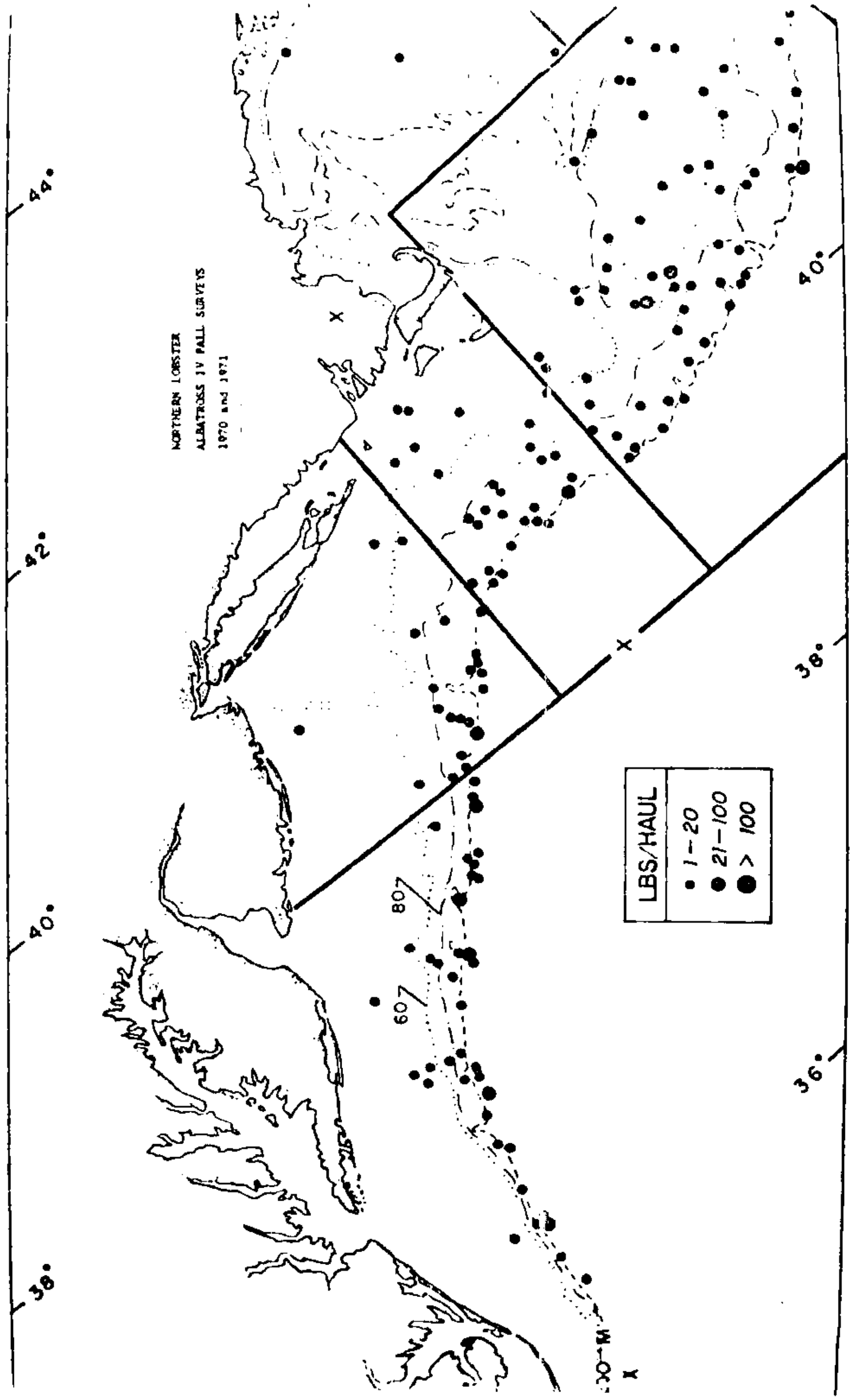

SQUID (LOLIGO)
ALBATROSS IV FALL SURVEYS
1968 and 1969


SUMMER FLOUNDER
ALBATROSS IV FALL SURVEYS
1968 and 1969
LBS/HAUL
1-20
21-100
> 100
200 M
80
60
44°
42°
40°
38°
36°
34°


SCUP
ALBATROSS IV FALL SURVEYS
1968 and 1969
LBS/HAUL
1-20
21-100
> 100
200 M
44°
42°
40°
38°
36°
34°
807
607


SEA BASS
ALBATROSS IV FALL SURVEYS
1968 and 1969
LBS/HAUL
• 1–20
● 21–100
⊙ > 100
42°
40°
38°
36°
34°
80°
76°
60
80
200-M

D 7


NORTHERN LOBSTER
ALBATROSS IV FALL SURVEYS
1970 and 1971
LBS/HAUL
1-20
21-100
> 100
44°
42°
40°
38°
36°
80
60

D 8