

4Vn Herring Assessment

by

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Abstract

The purse-seine catch from the 1980/81 4Vn herring fishery was 3952 metric tons (t) approximately 500 t below the TAC. The catch rates declined relative to the 1979/80 fishery but are higher than the historical low estimated for the 1978/79 fishery. Effort has declined substantially during the last two fishing seasons. A large proportion of the catch by numbers was comprised of the 1977 and 1976 year-classes. The 1970 and earlier year-classes however still contributed significantly (~ 30% by weight). There has been a temporal trend in the geographical location of the catch. Since 1978/79 the catch has been taken to the north of Pt. Aconi. Coincident with the geographical shift, was the change in age composition towards younger year-classes. The tagging results suggest a greater affinity of fish tagged north of Pt. Aconi with the Gulf of St. Lawrence stocks, and fish tagged east of the Point with Atlantic coast of Nova Scotia stocks. Some problems in managing an overwintering fishery comprising a complex stock mixture such as that in 4Vn are discussed. From a biological viewpoint it would be preferable to have no exploitation during the winter period. If for economic reasons there is to be a winter fishery, methods of minimizing the exploitation on the Gulf of St. Lawrence component of the mixture are suggested.

Résumé

Les prises de hareng par les senneurs dans 4Vn au cours de la saison 1980/81 ont été de 3 952 tm, soit environ 500 tm de moins que le TPA. Comparés à ceux de 1979/80, les taux de capture accusent une diminution, mais ils sont encore supérieurs au creux historique qui avait été estimé pour 1978/79. Ces deux dernières saisons, l'effort a diminué de façon marquée. Les classes d'âge de 1977 et 1976 constituaient une forte proportion des prises en nombre. La contribution de la classe d'âge de 1970 et d'autres plus âgés était toutefois encore importante (~ 30 % en poids). Avec le temps, il y eut déplacement graduel de la position géographique des prises. Depuis 1978/79, ces dernières ont été effectuées au nord de la pointe Aconi. En même temps que ce déplacement, on a constaté un changement de composition par âge vers de plus jeunes classes. D'après les résultats d'étiquetages, les poissons marqués au nord de la pointe Aconi se rapprocheraient davantage des stocks du golfe du Saint-Laurent, alors que ceux marqués à l'est de la pointe Aconi auraient une plus grande affinité avec les stocks de la côte atlantique de la Nouvelle-Ecosse. Quelques-uns des problèmes de la gestion d'un mélange complexe de stocks comme ceux qui hivernent dans 4Vn sont discutés. D'un point de vue biologique, il serait préférable qu'il n'y ait pas d'exploitation en hiver. Si, pour des raisons économiques, il devait y avoir une pêche d'hiver, nous suggérons des moyens d'en minimiser les effets sur la composante du golfe du Saint-Laurent.

## Introduction

There are two components of the 4Vn herring fishery; a small fixed gear fishery in the spring and early summer months (< 500 t per year), and a larger mobile gear fishery on overwintering stocks in the late autumn and early winter months. The "winter" fishery prosecutes predominantly fall spawning fish (Sinclair et al. 1979) but their stock identity has not been clearly identified. The spring-summer fishery has not been well sampled. It is presumed to involve local stocks of both spring and fall spawners. The relationship between the two components of the fishery, if any, has not been established.

### Catch and CPUE Trends

The winter fishery, which began in 1969-70, was dominated by foreign fleets for the first two years. Subsequently it has been almost exclusively a Canadian purse-seine fishery. The temporal distribution of the 4Vn herring catches are shown in Table 1 and Figure 1. The initial sharp decrease in mobile gear catch in 1970-71 was due to a decrease in effort; catches improved in 1971-72 and 1972-73. However, the subsequent sharp decrease from 1972-73 to the present is at least partially due to a decline in the abundance of fish. Purse-seine catch in 1980-81 was 3952 t. (approximately 500 t < the TAC). The fixed gear catches do not parallel the mobile gear catch.

The catch during the 1980 fishing year (1 November 1979 - 31 October 1980) and the winter catch of the 1981 fishing year are shown by month and gear-type in Table 2. In 1979-80 approximately 80% of the catch was taken during a few days in early January. This phenomena was not repeated in 1980-81, the major portion of the catch being taken during November and December as has traditionally been the case.

Several catch per unit effort indices have been estimated from the purse-seine logs (catch per successful night, catch per night and catch per set). Since the proportion of the total catch accounted for by the log records is relatively good, the CPUE indices shown in Table 3 and Figure 1 can be considered as representative of the overall fishery. There is a good relationship between "catch per night" and "catch per successful night" but the "catch per set" values have been relatively constant except during 1978-79. There is considerable year-to-year variability in the catch-per-night indices. The trend however has clearly been downwards. There is some suggestion that the catch rates have increased during the past two fishing seasons, but only marginally. Effort has also declined substantially during 1979-80 and 1980-81, partially due to the better catch rates experienced in 4Wa.

### Age Composition

The biological sampling of the purse-seine fishery has been consistently good since 1973-74. The average tonnes to sample ratio the last three years has been 80, 90 and 66 respectively. The 1980-81 age composition by months is shown in Table 4. A large proportion of the catch by numbers was comprised of the 1977 (age 4) and 76 (age 5) year-class (the birthday is defined here as November 1st). The 1970 and older year-classes did nevertheless contribute significantly (~ 30% by weight).

The historical % age composition (1973-74 to 1980-81) are shown in Figure 12. From 1973-74 to 1977-78, the 1970 year-class dominated the fishery. No subsequent year-classes prior to the 1976 and 1977 were strongly represented. From this distribution it would appear that during the 1970's most year-classes made their greatest % contribution to the catch at age 5, thus it appears that recruitment is not complete until age 5. If so, the 1977 year-class may be stronger than the 1976. The catch-at-age matrix and the mean weights-at-age are shown respectively in Tables 5 and 6.

### Temporal Changes in Geographic Distribution of Catch

In Figures 2a, b, and c the catch distributions by month are shown. As in 1979-80 the major portion of the catch was taken off Ingonish. In Figures 3 to 11 and 1980-81 to 1972-73 catch locations are shown. The major point is the shift that occurred between 1977-78 and 1979-80. The traditional area of the fishery was from 1972-73 to 1977-78 between Pt. Aconi and Scatarie as well as between Scatarie and Fourchu Head. During these years the 1970 year-class dominated the catch. The 1978-79 season's catch distribution shifted to the north. The trend continued during the last two seasons. Coincident with the geographical shift, was the change in age composition towards younger year-classes (Fig. 12).

### Tagging Results

In an attempt to identify the relationships of the fish caught in the winter fishery with other herring fisheries, tagging has been carried out during the three fishing seasons (1977-78, 1978-79, 1979-80), with more than 18,000 fish tagged. The results of returns up to March 1980 were summarized in some detail by Sinclair et al. (1980). Only an update of returns since then, and some general conclusions, will be attempted in this assessment.

If the returns within 4Vn during the same fishing season are excluded, there were 155 returns from the most recent tagging operation (1979-80) (Table 7a and Figure 13). A fair proportion (24 tags) were caught by the small fixed gear fishery in 4Vn itself during the spring fishery. Another 27 were returned from the new "edge" fishery in the Cape Breton Channel. An additional 24 tags were returned from various fisheries in the Gulf. Overall all the returns indicate a strong affinity of the 4Vn winter fishery with the Gulf of St. Lawrence and perhaps "local" stocks in 4Vn itself.

The comparison of the results between tagging operations in the three fishing years are of interest. Due to the differences in the geographical area of the fishery each year, the tagging locations also differed. In the 1977-78 operation, most of the tags were applied in the area between New Waterford and Scatarie, from small catches made close inshore. In the 1978-79 operation, the majority of tags were applied in the Bird Islands area, the location of the earlier large catches in the 'traditional' mobile fleet fishery. In the 1979-80 operation, the majority of tags were applied in the Bird Island to Ingonish Bay area. The recovery results are summarized in Tables 7a, b, c, and Figures 13,

14, and 15. The two tagging operations north and northwest of Pt. Aconi (1978-79 and 1979-80) resulted in returns predominantly from the Gulf, whereas the returns from the tagging operation to the east of Pt. Aconi came predominantly from "Eastern", "Southern" and southwest Nova Scotia shores. As noted above, there was a shift in the geographical location of the majority of the fishery in the 1978-79 season (Figs. 3-11) from an area largely between Pt. Aconi and Gabarus prior to 1978-79, to an area largely to the north and northwest of Pt. Aconi. Coincident with this change was a change in the age compositions (Fig. 12) and of course a change in the pattern of distribution of tagged fish.

Additional information on the relationship of the fish caught in 4Vn with the adjacent management units can be obtained from recoveries of fish, tagged in 4WX and 4T between 1974 and 1978, in the 4Vn fisheries (Table 8). These results suggest a small, but consistent, movement of fish from the adjacent areas into 4Vn during winter.

### Management Considerations

The available biological information indicates that the fishery prosecutes a stock mixture which probably varies with time, and for which some of the components are being managed during other phases of their migration, thus no rigorous biological methods for estimating a TAC are appropriate. Two of the component stocks or stock complexes (4WX and 4T herring) are being managed in their respective management units without consideration of the fishing mortality incurred in 4Vn. Since the catches have been historically as high as 17,000 t and the 4T stock is at present a seriously depleted level of abundance, the fishing mortality in this fishery is of some significance. Based on biological considerations it would be preferable that there be no "overwintering" fishery in 4Vn; the spring and summer 4Vn fixed gear fishery is believed to prosecute the "local" stocks. Elimination of the "overwintering" fishery should result in no long-term loss of yield to the overall east coast herring fishery since the component larger migratory populations overwintering in 4Vn would still be available to various fisheries during their summer distribution.

If for economic reasons it is desirable to maintain a purse seine fishery in 4Vn it probably should be limited to a low TAC and that the location of catch be defined to minimize the fishing mortality imposed on the two major components stocks (4T and 4WX). In 1981-82 this would mean limiting the catches as much as possible to the east of Pt. Aconi and southwest of Scatarie since a major proportion of catch from this area is believed to belong to the healthier 4WX management unit.

### References

- Sinclair, M., W.T. Stobo and A. Sinclair. 1979. Status of 4Vn herring fishery 1978-79. CAFSAC Research Document 79/40.
- Sinclair, M., W.T. Stobo and J. Simon. 1980. 1979-1980 4Vn herring assessment. CAFSAC Research Document 80/50.

Table 1. Annual (Oct-Oct) herring landing (t) in 4Vn.

	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81
Canadian Fixed Gear	492	407	252	91	296	235	225	74	142	162	116	212	226	74	120	310	327	261	-
Canadian Mobile Gear	-	-	-	-	-	2	2044	5335	2917	10681	17537	16285	14297	5546	12831	7078	3332	2865	3952
Foreign Mobile Gear	-	-	18	-	17	-	11465	11050	344	1	10	578	270	188	-	-	-	-	-
Total Mobile Gear	-	-	18	-	17	2	13509	16385	3261	10682	17547	16863	14567	5734	12831	7078	3332	2865	3952
TAC																11000	8000	3000	4500*

\* with possibility of upwards revision to 6000 t during season if "warranted".

Table 2. Seasonal distribution of herring catch by gear type in 4Vn.

	1979			1980										1981	
	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Purse Seine	6.6	640	2218	-	-	-	-	-	-	-	-	-	1154	2410	388
Trap	-	-	-	-	-	-	23.6	68.4	-	-	-	-	-	-	-
Drift Gillnet	2.3	-	-	-	-	15	81.4	49.5	4.1	-	-	2.3	3.4	-	-
Set Gillnet	-	-	-	-	-	-	-	.4	-	-	-	-	-	-	-
Unspecified	-	-	-	-	-	-	.1	.2	16.1	-	-	-	-	-	-

Table 3. CPUE indices for the 4Vn herring purse seine fishery.

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YEAR	Catch (t) per successful night	Catch (t) per night	Catch (t) per set
71-72	115 <sup>1</sup>	-	-
72-73	90.8	88.7	45.4
73-74	82.0	64.6	43.2
74-75	85.8	70.6	37.8
75-76	52.4	34.7	33.5
76-77	78.1	62	37.7
77-78	70.4	39.6	35
78-79	23.6	10.8	12.8
79-80	77.5	61.4	33.7
80-81	45.6	31.4	20.6

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<sup>1</sup> From previous assessments

Table 4. 4Vn herring catch-at-age ( $\times 10^{-3}$ ) for the 1980-81 purse seine fishery\*

	2	3	4	5	6	7	8	9	10	11+
November	0	80	784	429	132	122	242	328	604	959
% No.	0	2.2	21.3	11.7	3.6	3.3	6.6	8.9	16.4	26.2
December	0	128	2172	2655	755	479	372	384	502	1729
% No.	0	1.4	23.7	28.9	8.2	5.2	4.1	4.2	5.5	18.9
January	43	310	835	862	173	44	0	5	86	0
% No.	1.8	13.1	35.4	36.6	7.3	1.9	0	< 1	3.6	0
TOTAL	43	518	3791	3946	1060	645	614	717	1192	2688
% numbers	<1	3.4	24.9	25.9	7.0	4.2	4.0	4.7	7.8	17.7
% weight	<1	1.4	14.1	20.3	6.8	4.4	5.2	6.6	11.8	29.5

\* Fish aged as if birthday on November 1st.



Table 5. 4Vn herring catch-at-age matrix.

Ages*	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81
2	43	116	1	0	0	0	0	43
3	3798	5116	671	16	7	26	3172	518
4	43737	4156	1544	2986	110	441	3437	3791
5	14264	33189	1848	5103	2377	1413	1671	3946
6	4435	6430	7846	4136	2800	1443	741	1060
7	2955	2417	2571	17602	1442	878	1004	645
8	3176	2304	1123	8379	7622	847	607	614
9	2841	2242	892	3401	4056	1701	873	717
10	3842	2842	1006	2431	1202	1838	879	1192
11+	4969	5401	3461	5451	3098	1915	750	2688
TOTAL	84060	64213	20963	49505	22714	10502	13134	15214
TONNES	16863	14354	5734	12831	7078	3332	2865	3952

\* Birthday Nov. 1

Table 6. 4Vn herring weights-at-age (gms).

Age	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81
2	34	52	41	-	-	-	-	36
3	85	102	93	105	110	120	103	104
4	162	145	157	141	175	189	152	146
5	182	203	203	187	220	211	207	201
6	218	235	249	219	245	258	255	252
7	251	256	273	256	272	289	289	267
8	302	287	292	275	308	302	324	332
9	325	314	332	295	346	338	366	361
10	350	334	361	319	377	376	400	395
11+	367	362	382	333	383	397	417	431

Table 7a. Tag return update (to March 31, 1981) for 11,101 fish tagged in 4Vn December 10-January 7.

	Dec 10-Feb 28 1979/80	Mar 1-June 30 1980	July 1-Oct 31 1980	Nov 1-Feb 28 1980/81	Mar 1-June 30 1981
4Vn	882 (P.S.)	24 (Fixed)	-	62 (P.S.)	-
4Wa	7 (P.S.)	3 (Fixed)	-	8 (P.S.)	
4T Edge	-	27 (P.S.)	-	-	-
Western Gulf	-	-	2 (P.S.)	4 (P.S.)	-
Southern Gulf	-	4 (Fixed)	9 (Fixed)	-	-
4X SWNS	-	-	3 (P.S.)	-	-
4R	-	2 (P.S.)	-	-	-

Table 7b. Recaptures from 3993 tags in 4Vn, Nov 9-Dec 2, 1978

Recapture Location	Nov 1-Feb 28 1978-79	Mar 1-June 30 1979	July 1-Oct 31 1979	Nov 1-Feb 28 1979-80	Mar 1-June 30 1980	July 1-Oct 31 1980	Nov 1-Feb 28 1980-81	Mar 1-June 30 1981
4Vn	66	2	-	74	1	-	7	-
4W	9	5	-	5	-	-	1	-
4T Edge	-	10	-	-	3	-	-	-
Western Gulf	-	-	1	1	-	-	-	-
Southern Gulf	-	-	1	-	-	-	-	-
4X	-	-	-	-	-	-	-	-
Southshore	-	-	-	-	-	3	-	-
S. W. N. S.	-	-	1	-	-	1	-	-
Bay of Fundy (N.S.)	-	-	1	-	-	1	-	-
4R	-	1	-	-	-	-	-	-

Table 7c. Recaptures from 3063 herring tagged in 4Vn, Nov 26-Dec 15/77 (to Apr/81).

	Nov 1-Feb 28	Mar 1-June 30 1978	July 1-Oct 31	Nov 1-Feb 28	Mar 1-June 30 1979	July 1-Oct 31	Nov 1-Feb 28	Mar 1-June 30 1980
4Vn	11	-	-	14	-	-	3	-
4W	78	-	1	4	-	-	-	-
4T Edge	-	-	-	-	1	-	-	-
Southern Gulf	-	-	1	-	-	-	-	-
4X Southshore	-	2	1	-	-	-	-	-
S.W.N.S.	-	3	6	-	-	-	-	-
Bay of Fundy	-	-	2	-	-	-	-	-
4R	-	-	-	-	1	-	-	-

Table 8. Recaptures within 4Vn of herring tagged in other areas.

Tagging Location	Date	Winter 77-78	Summer 78	Winter 78-79	Summer 79	Winter 79-80	Summer 80	Winter 80-81
Campobello Is.	July 74	-	1	-	-	-	-	-
Southwest N.S.	Aug 74	-	-	-	-	1	-	-
Magdalen Is.	May 76	-	-	-	-	1	-	-
Gaspé Coast	Aug-Sept 76	2	-	2	-	-	-	-
Southwest N.S.	Aug-Sept 77	-	-	4	-	1	-	-
Subdiv 4Wa	Jan 78	-	-	1	-	-	-	-
Souris P.E.I.	Oct 78	-	-	1	-	2	-	-
Subdiv 4Wa	Dec 78	-	-	-	-	8	-	2

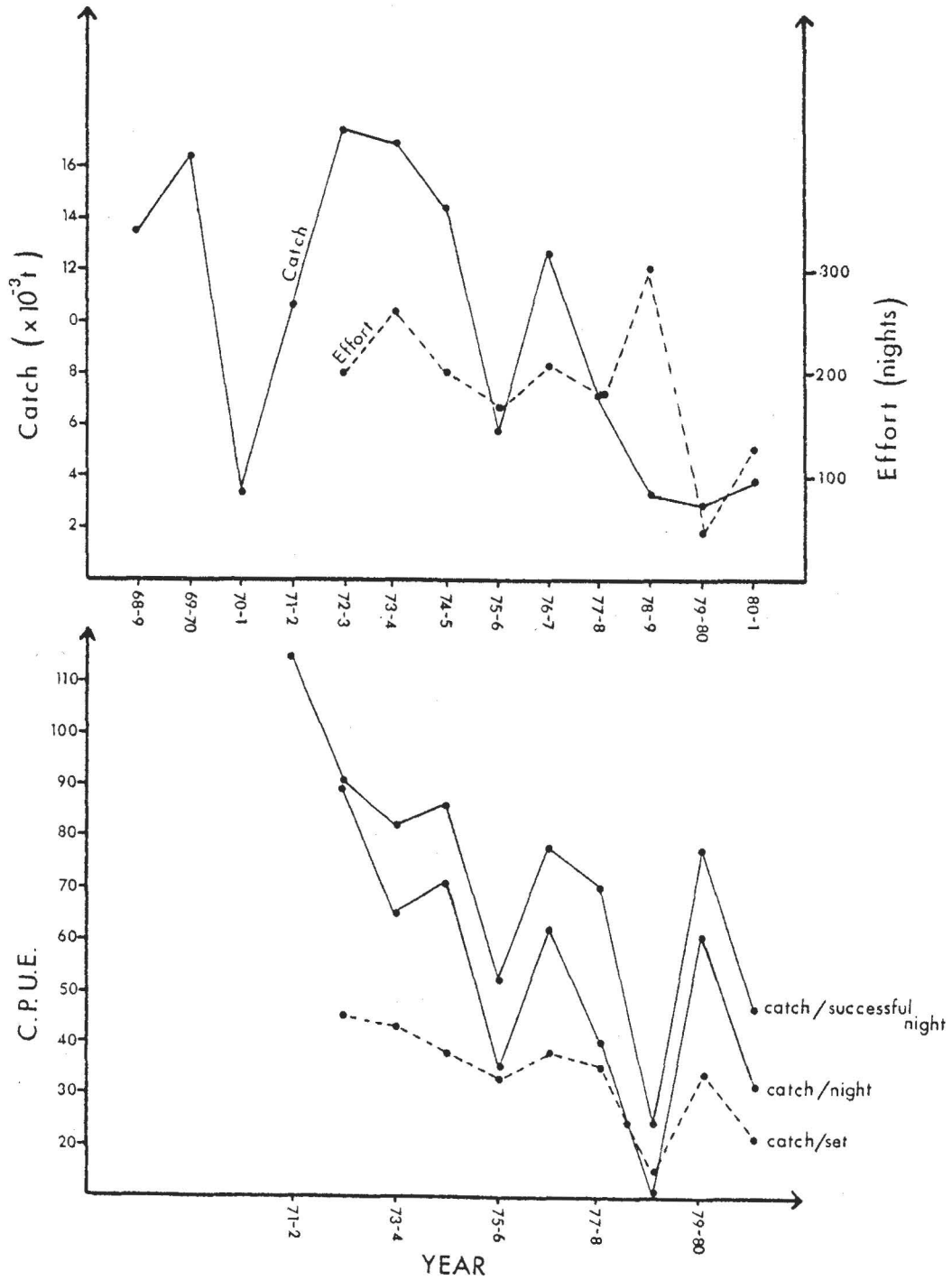


Figure 1. Distribution of catch, effort and CPUE for the 4Vn purse-seine fishery. Effort is the catch divided by catch/night.

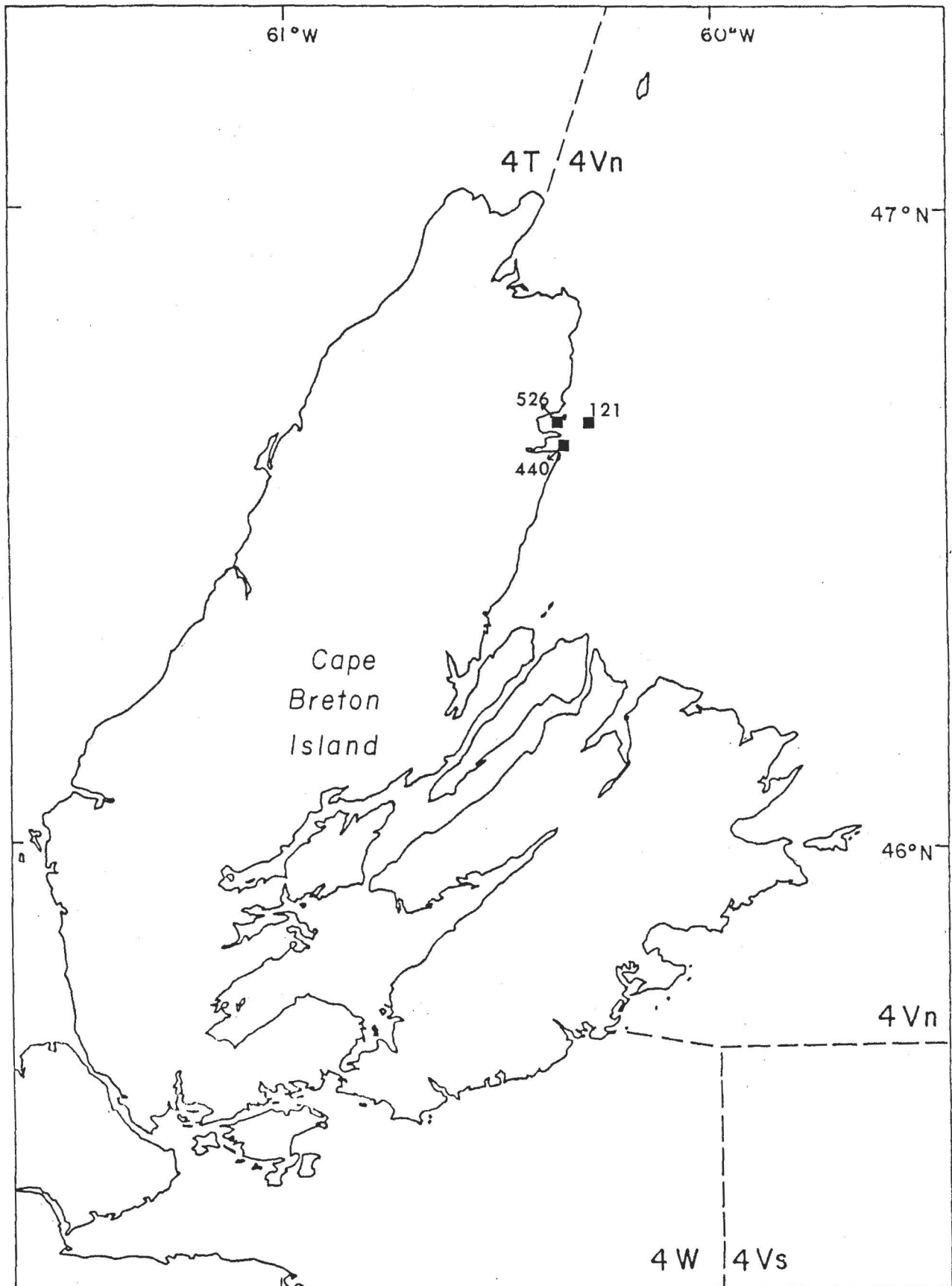


Figure 2a. Purse-seine catch distribution from log books November 1980.

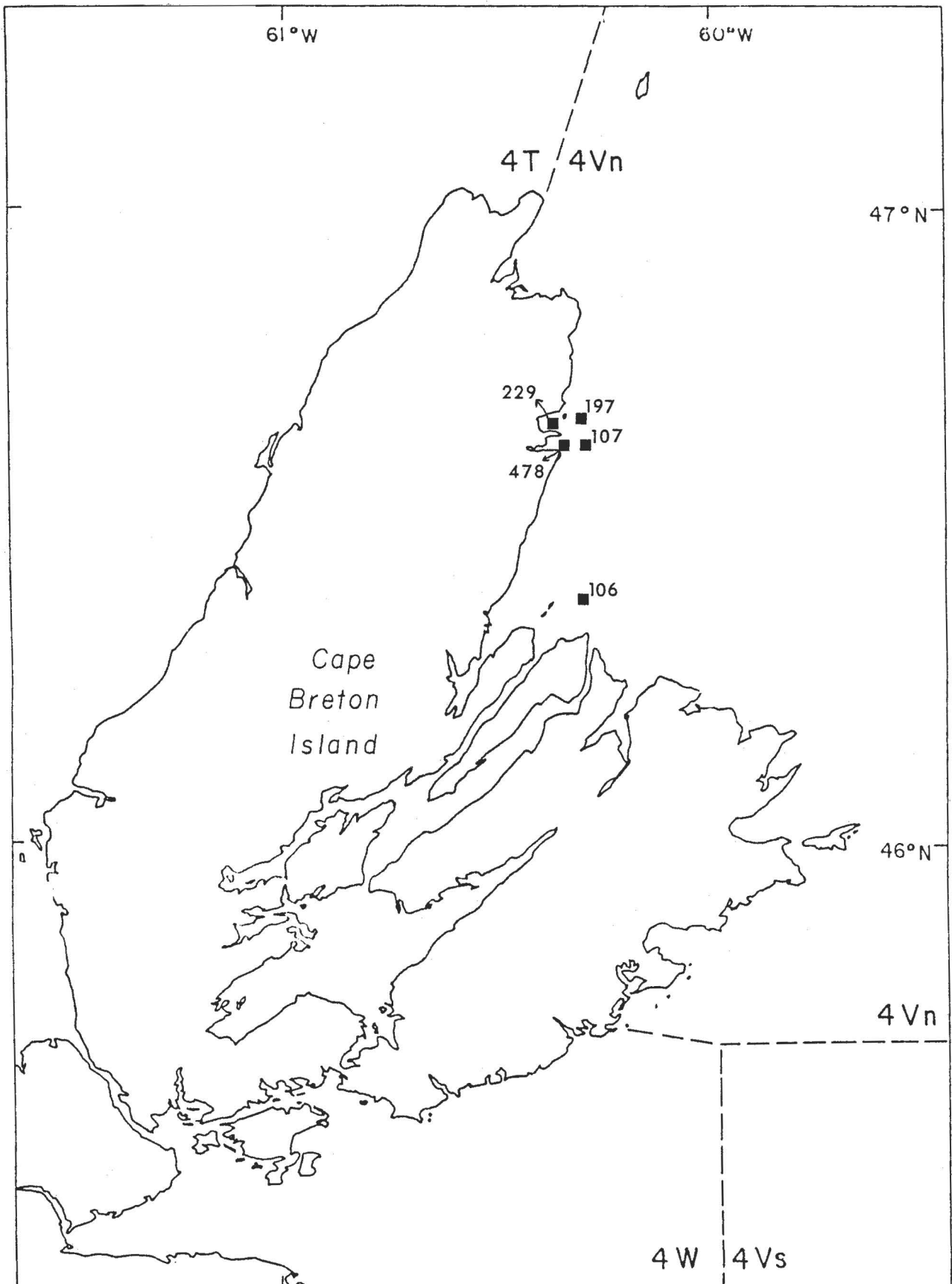


Figure 2b. Purse-seine catch distribution from log books December 1980.



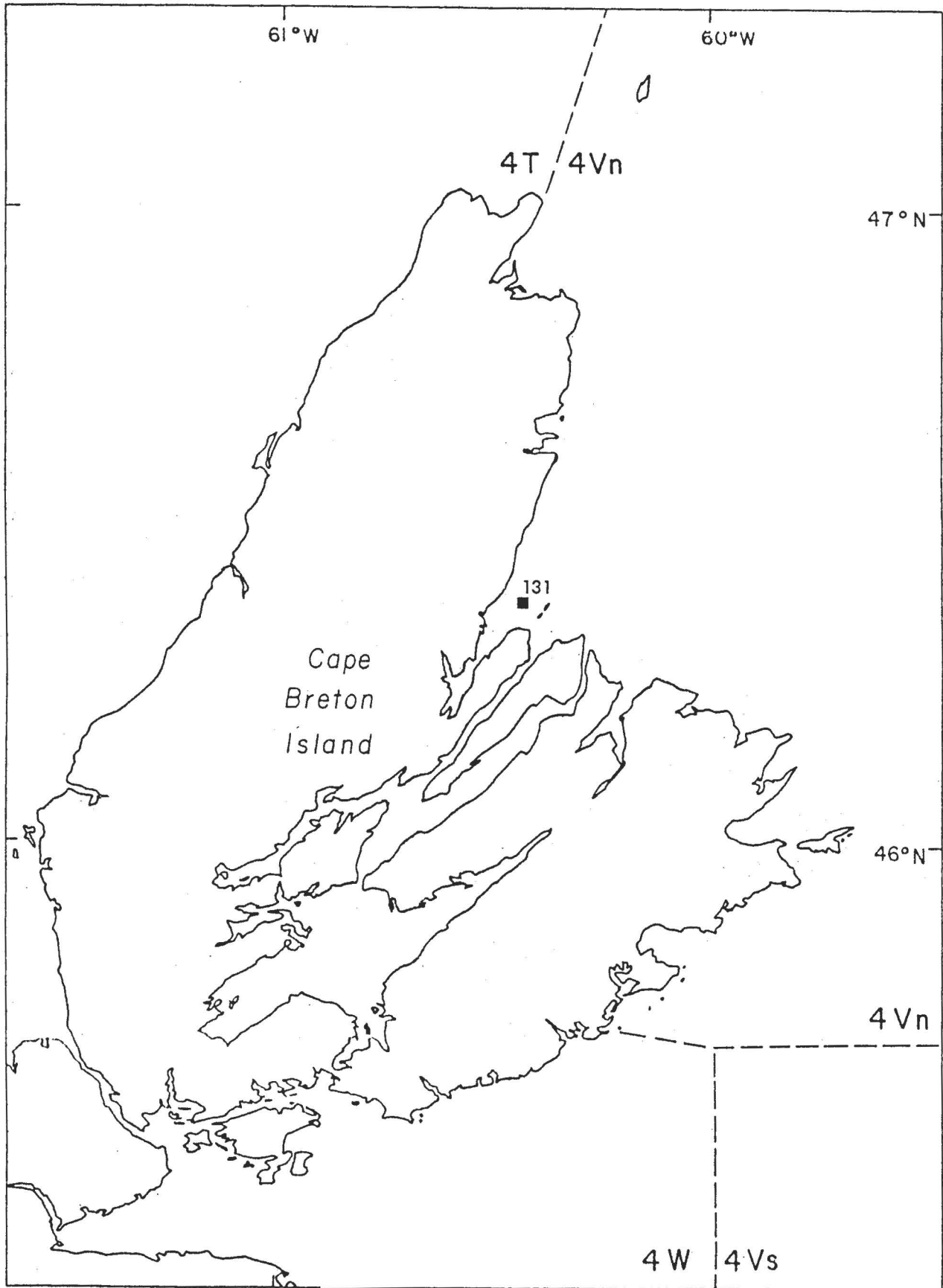


Figure 2c. Purse-seine catch distribution from logbooks January 1981.

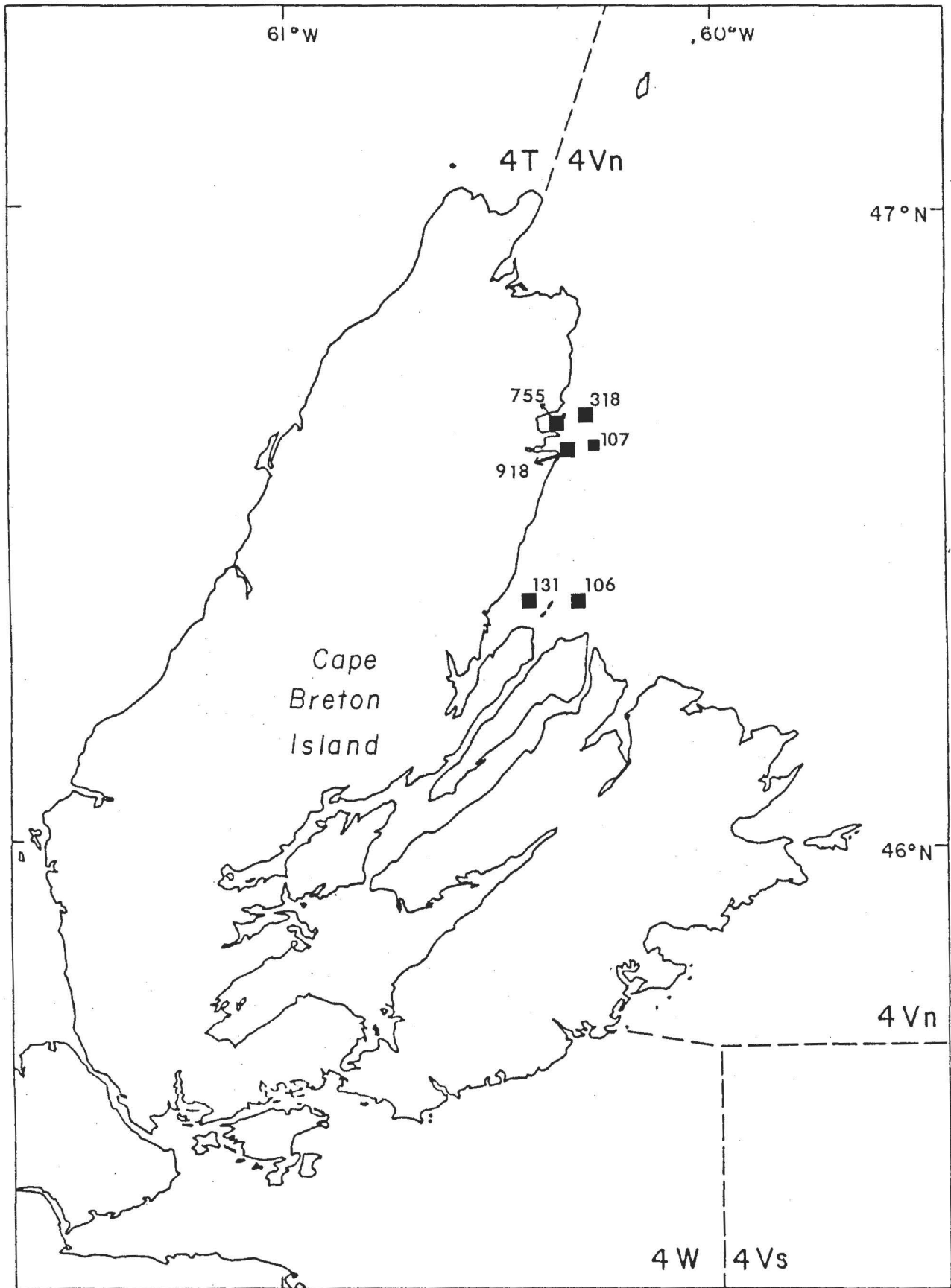


Figure 3. 1980/81 Catch distribution (from purse-seine log books) only 59% of the catch was accounted for by the log records.

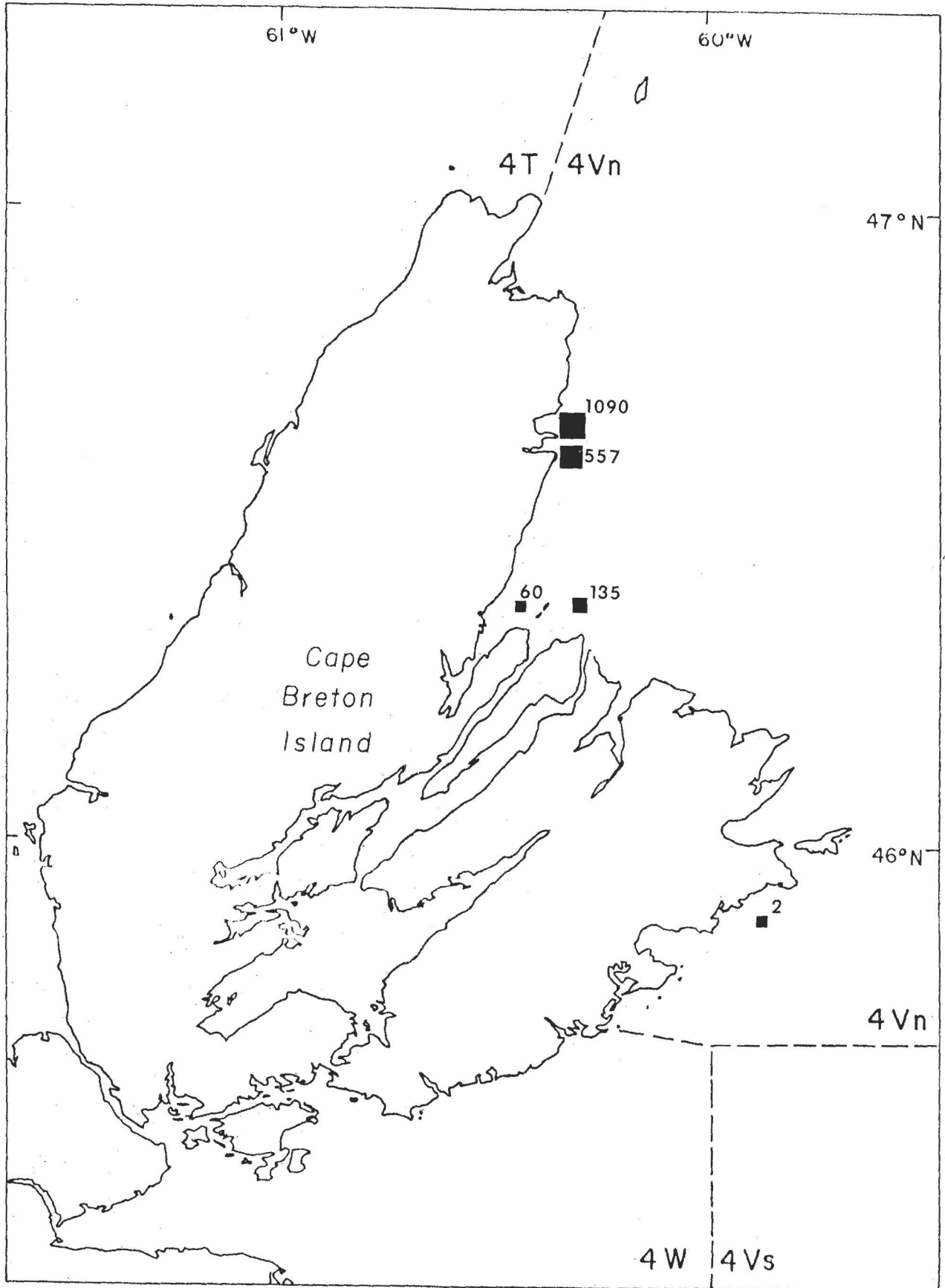


Figure 4. 1979/80 Catch distribution (from logbooks).

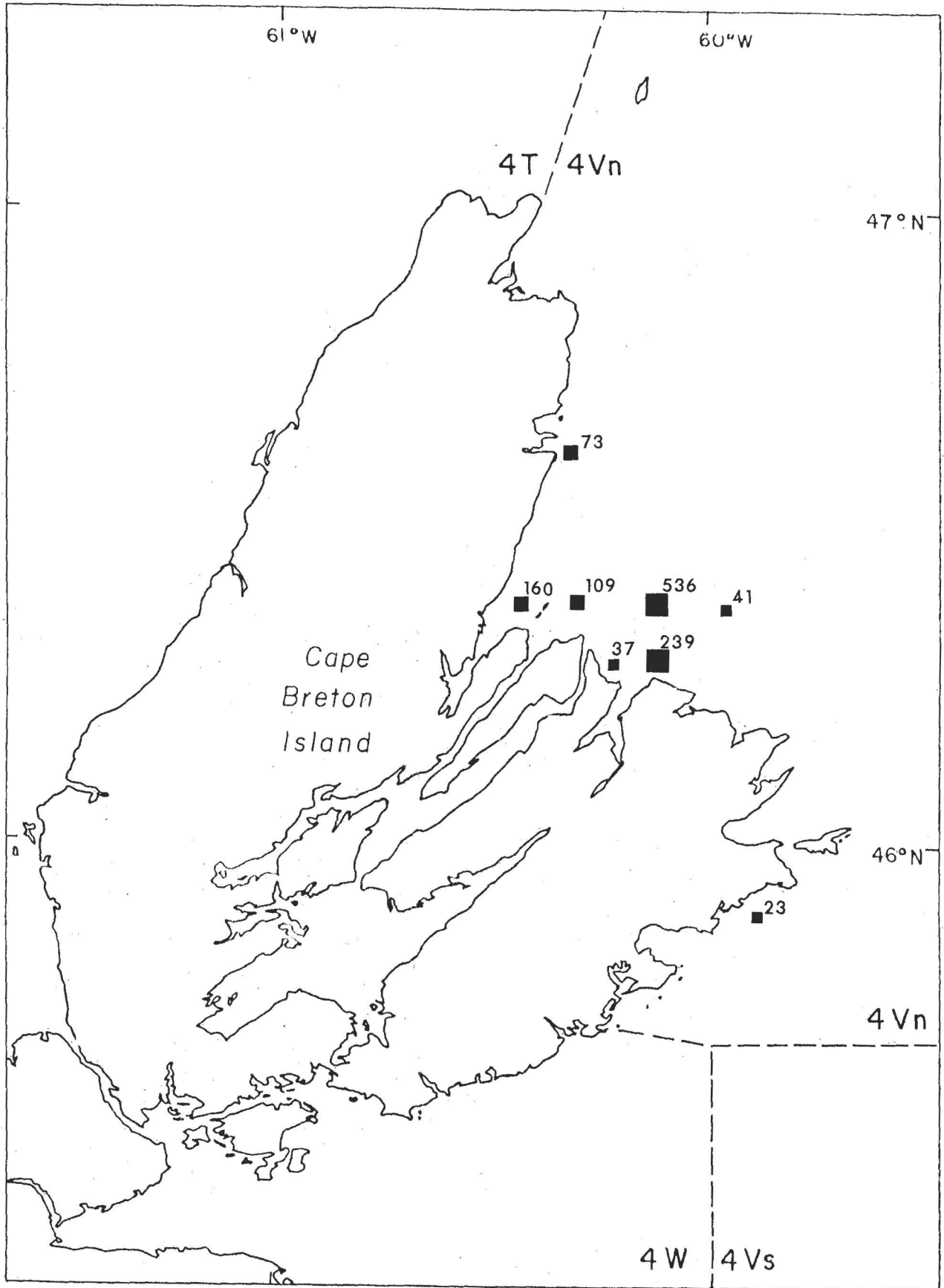


Figure 5. 1978/79 Catch distribution (from logbooks).

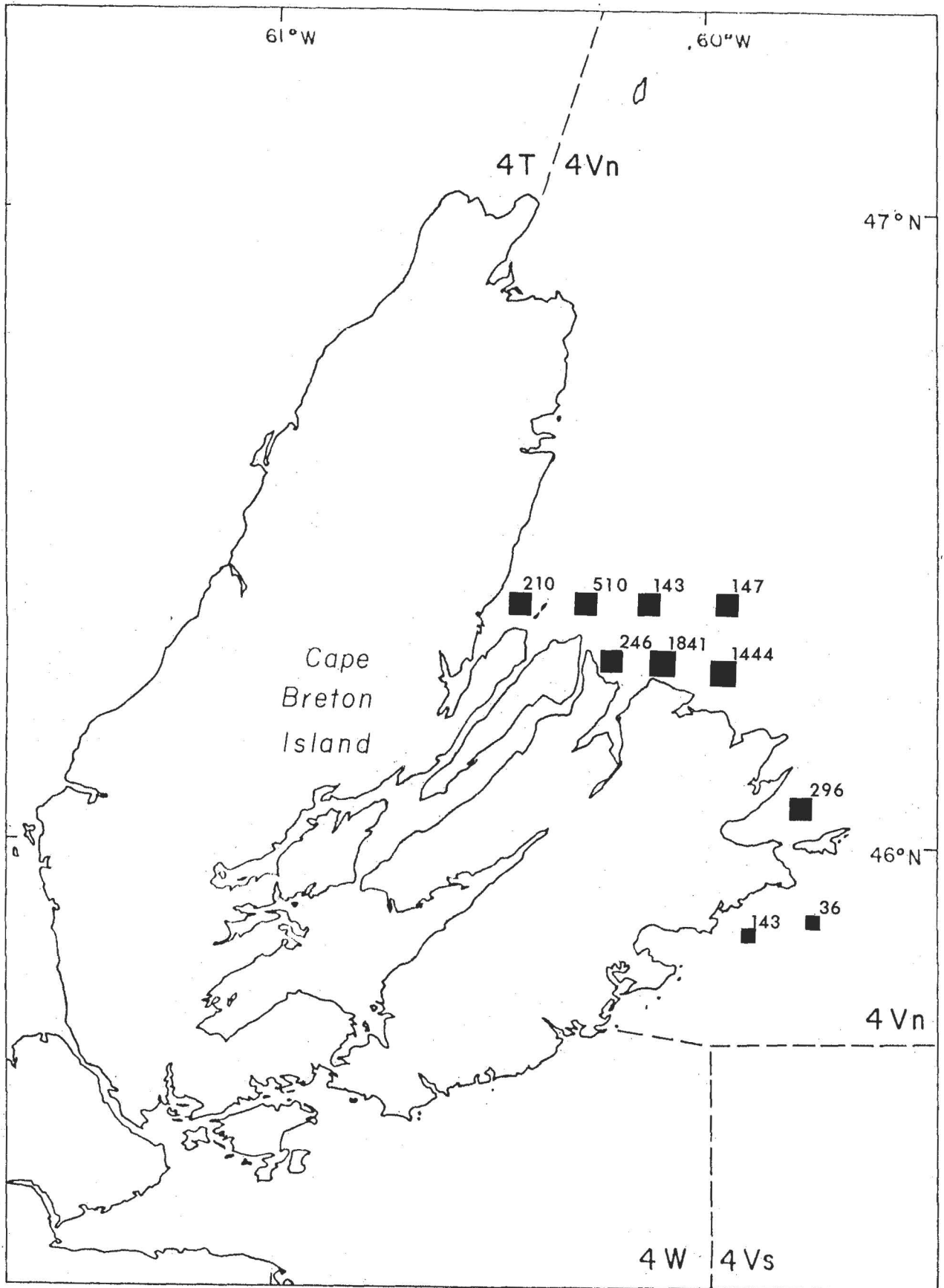


Figure 6. 1977/78 Catch distribution (from logbooks).

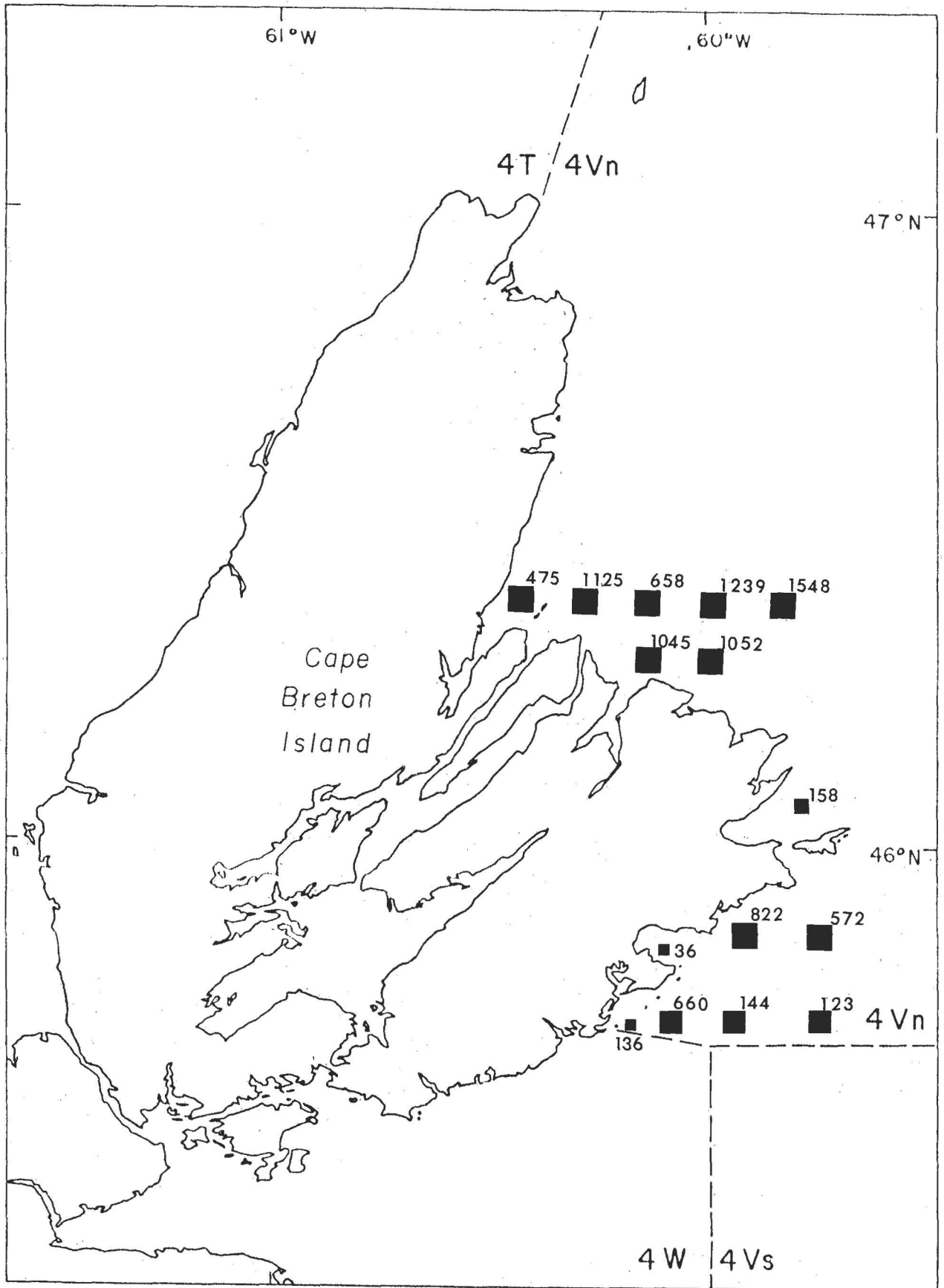


Figure 7. 1976/77 Catch distribution (from logbooks).

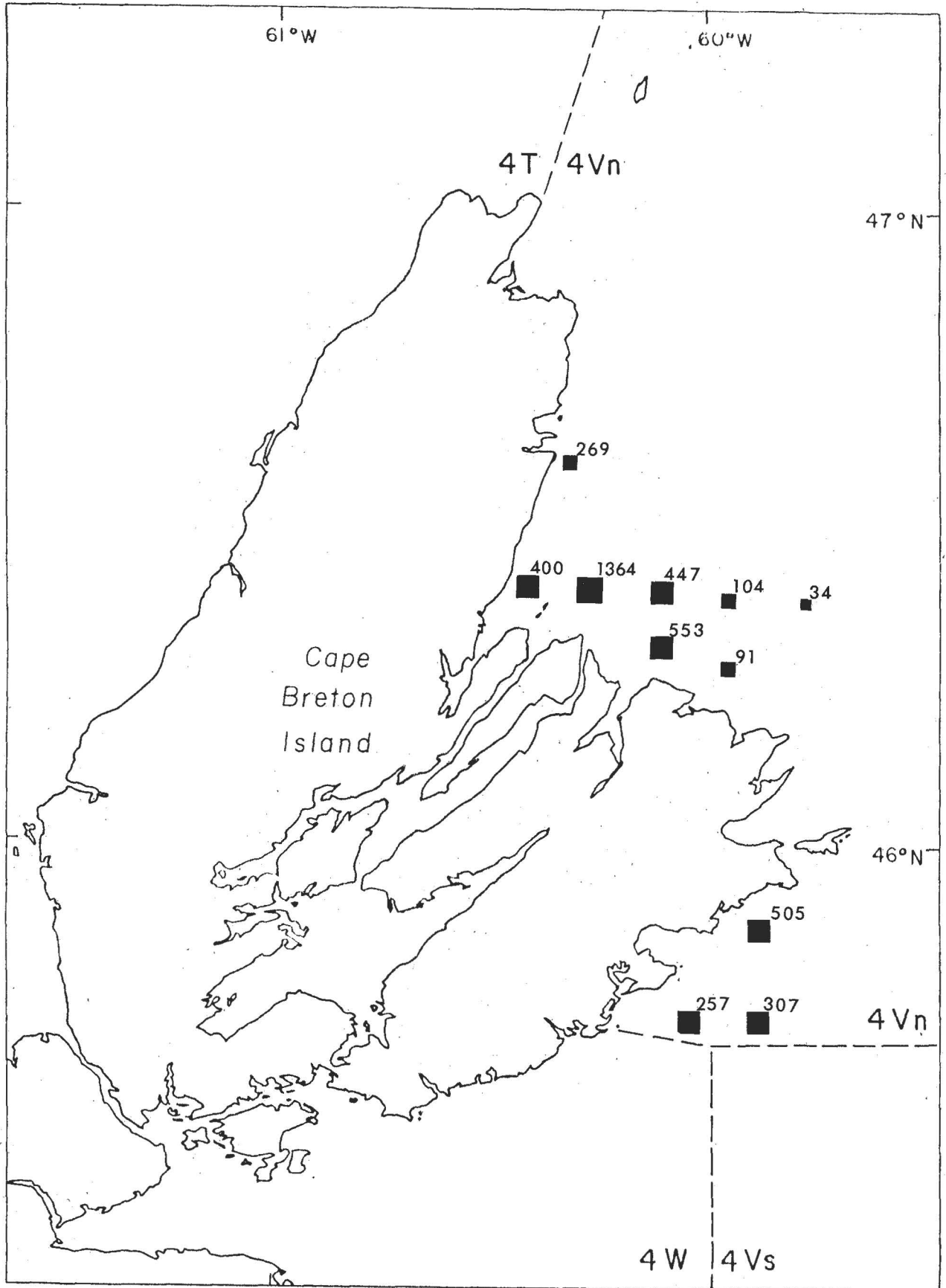


Figure 8. 1975/76 Catch distribution (from logbooks).

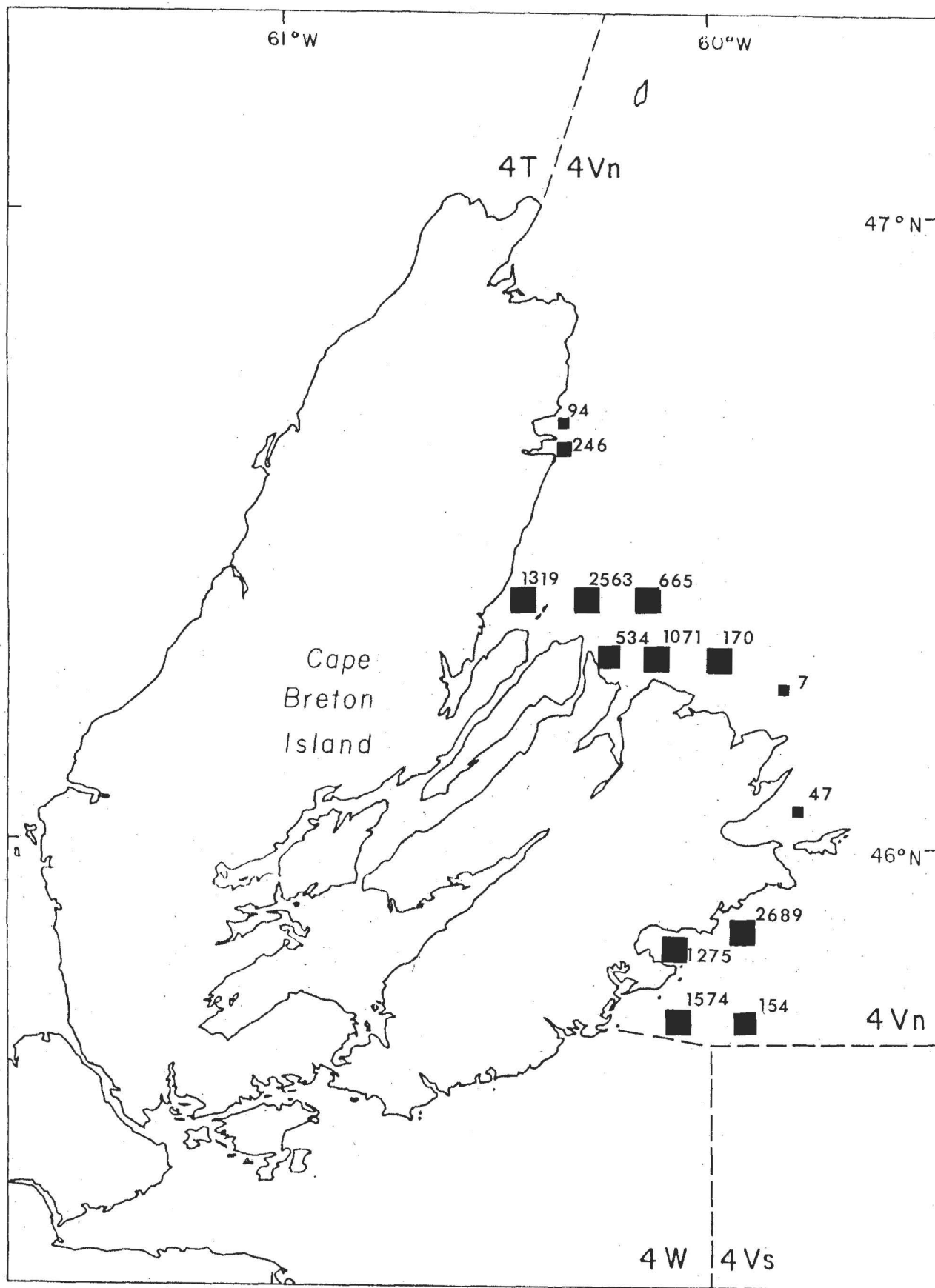


Figure 9. 1974/75 Catch distribution (from logbooks).



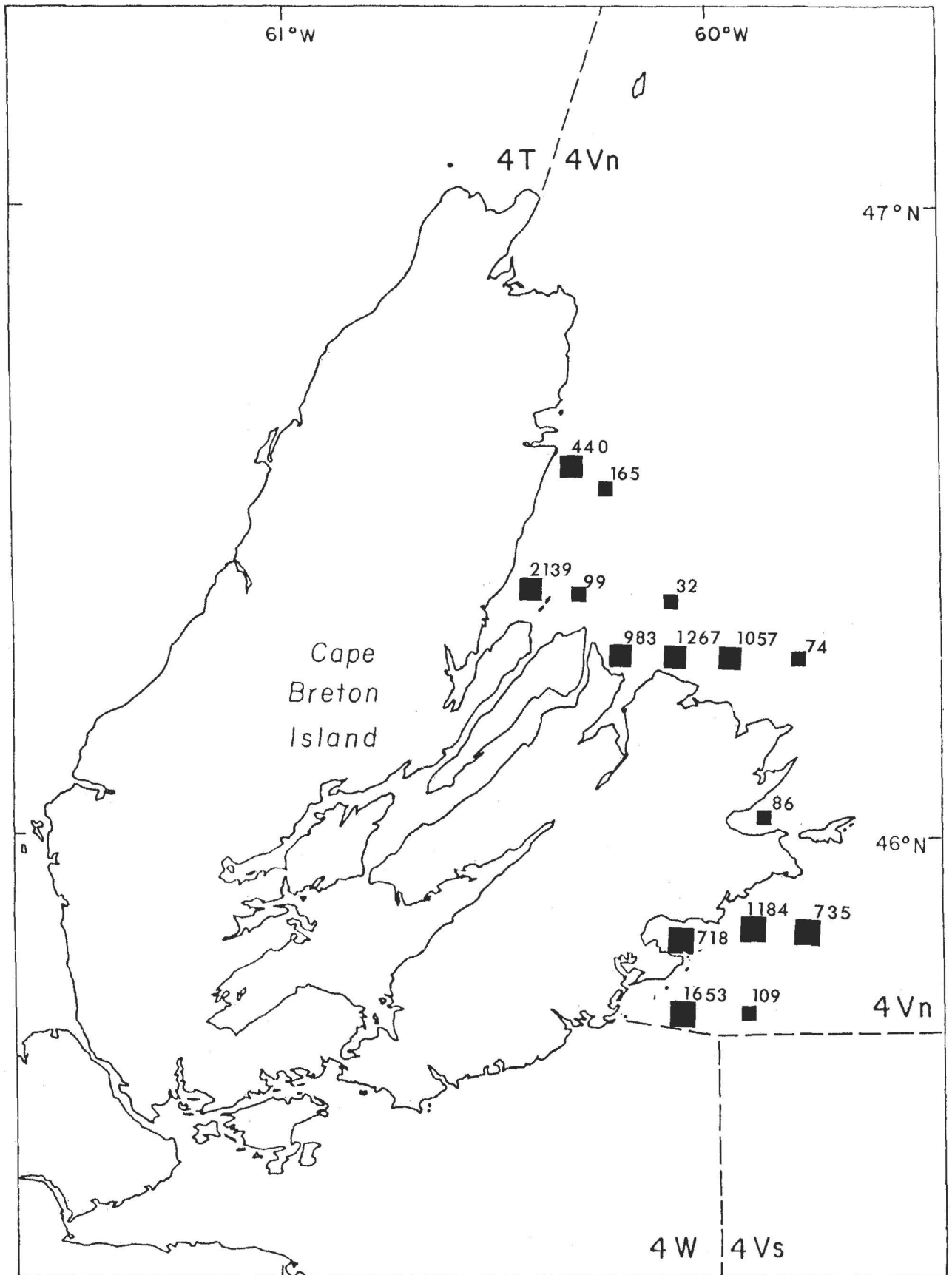


Figure 10. 1973/74 Catch distribution (from log records).

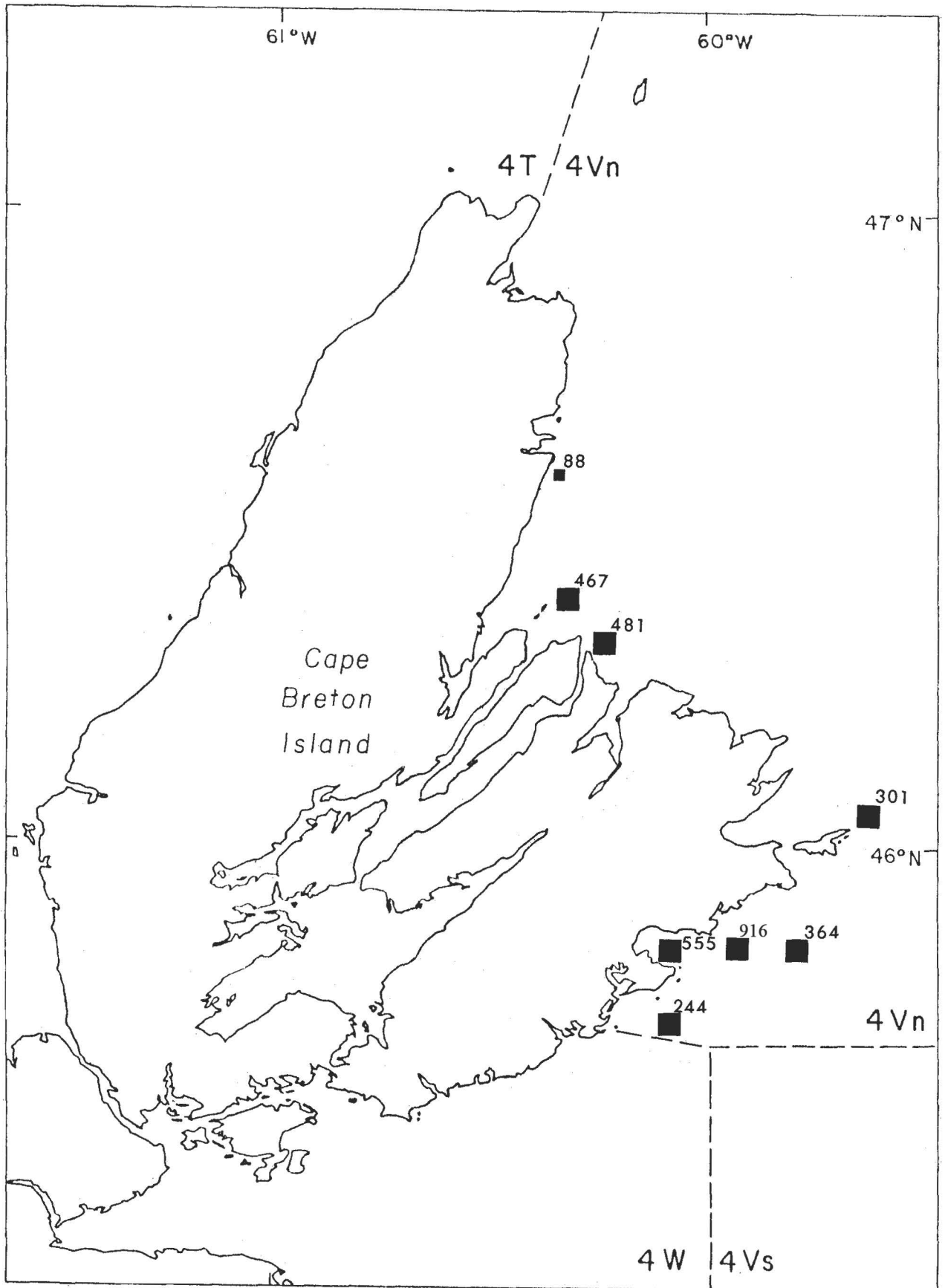


Figure 11. 1972/73 Catch distribution (from log records).

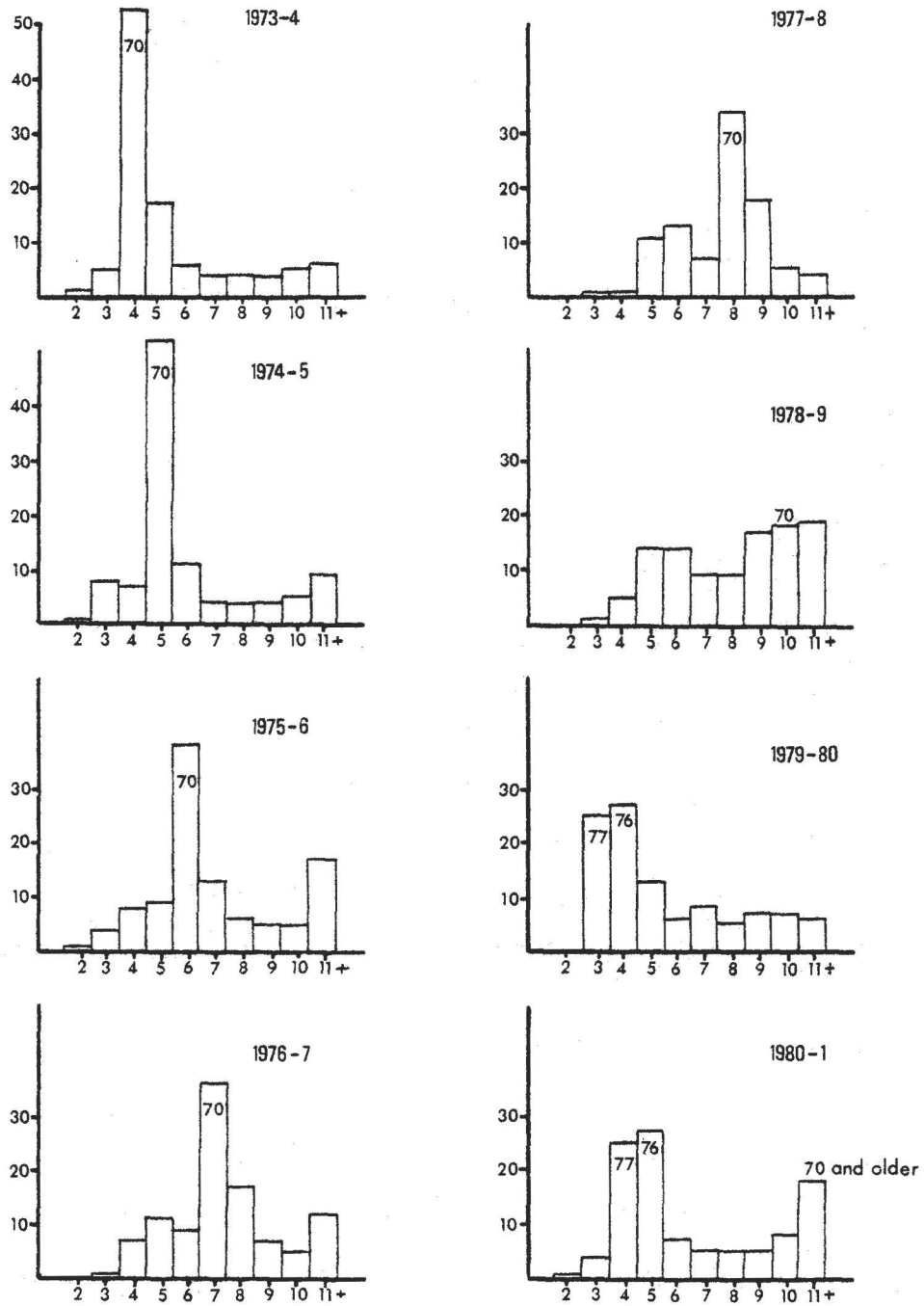


Figure 12. Historical age composition by percent for the 4Vn herring fishery 1973-74 to 1980-81.

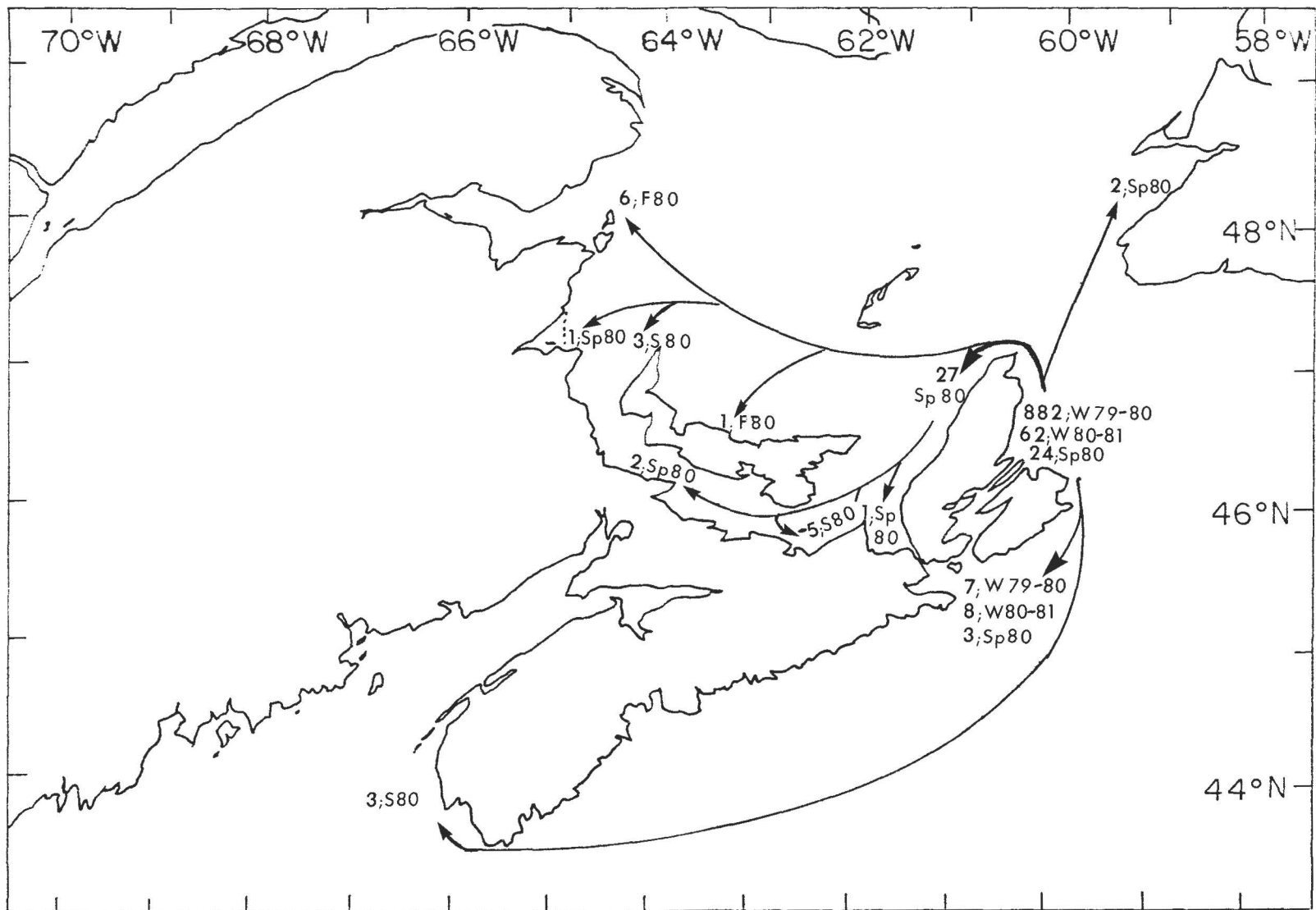


Figure 13. Recoveries from 11,101 herring tagged in 4Vn, December 10, 1979-January 7, 1980 (tagging area Ingonish-Bird Island).

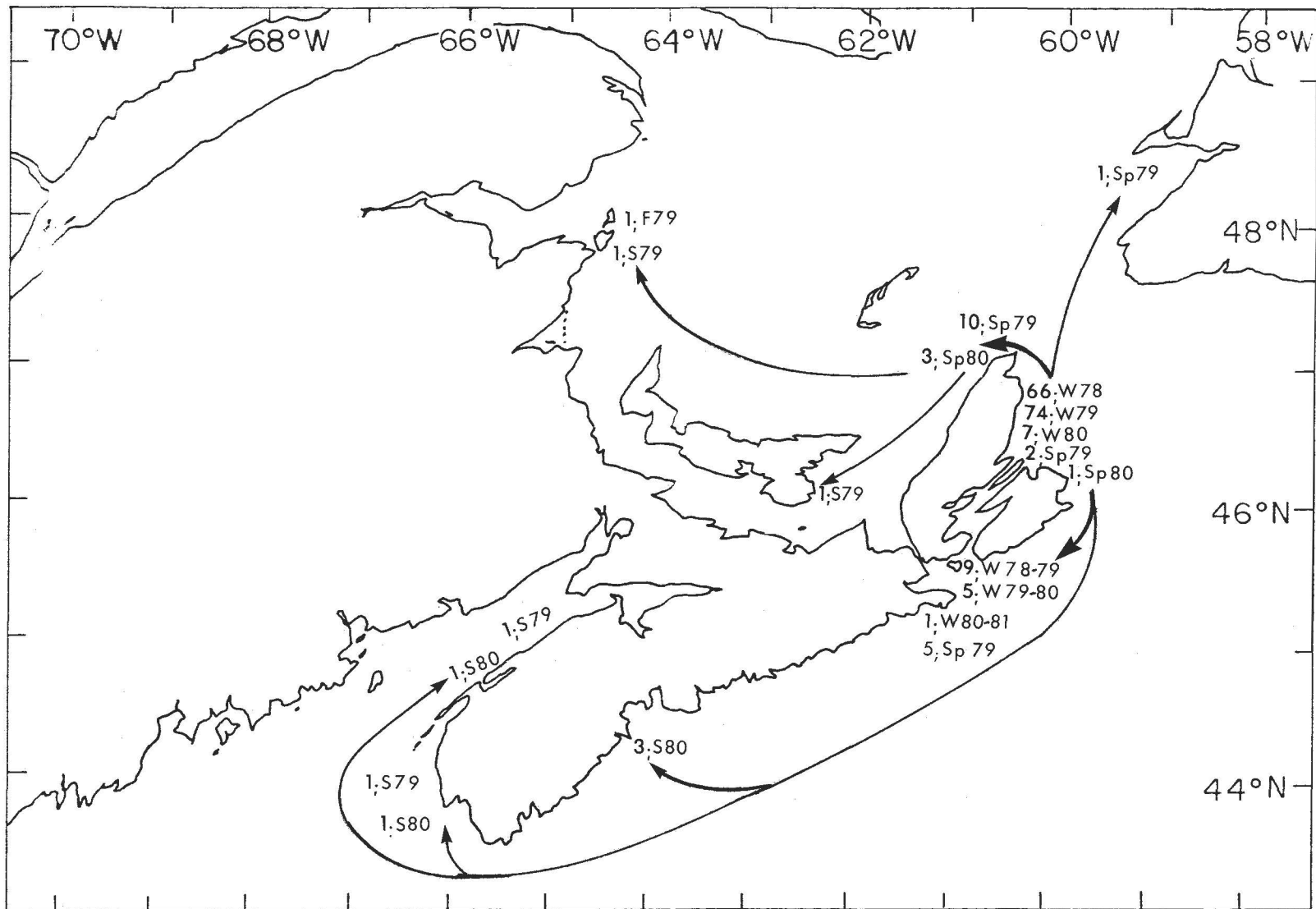


Figure 14. Recoveries from 3993 herring tagged in 4Vn November-December 1978. (Tagging area Bird Island-New Waterford).

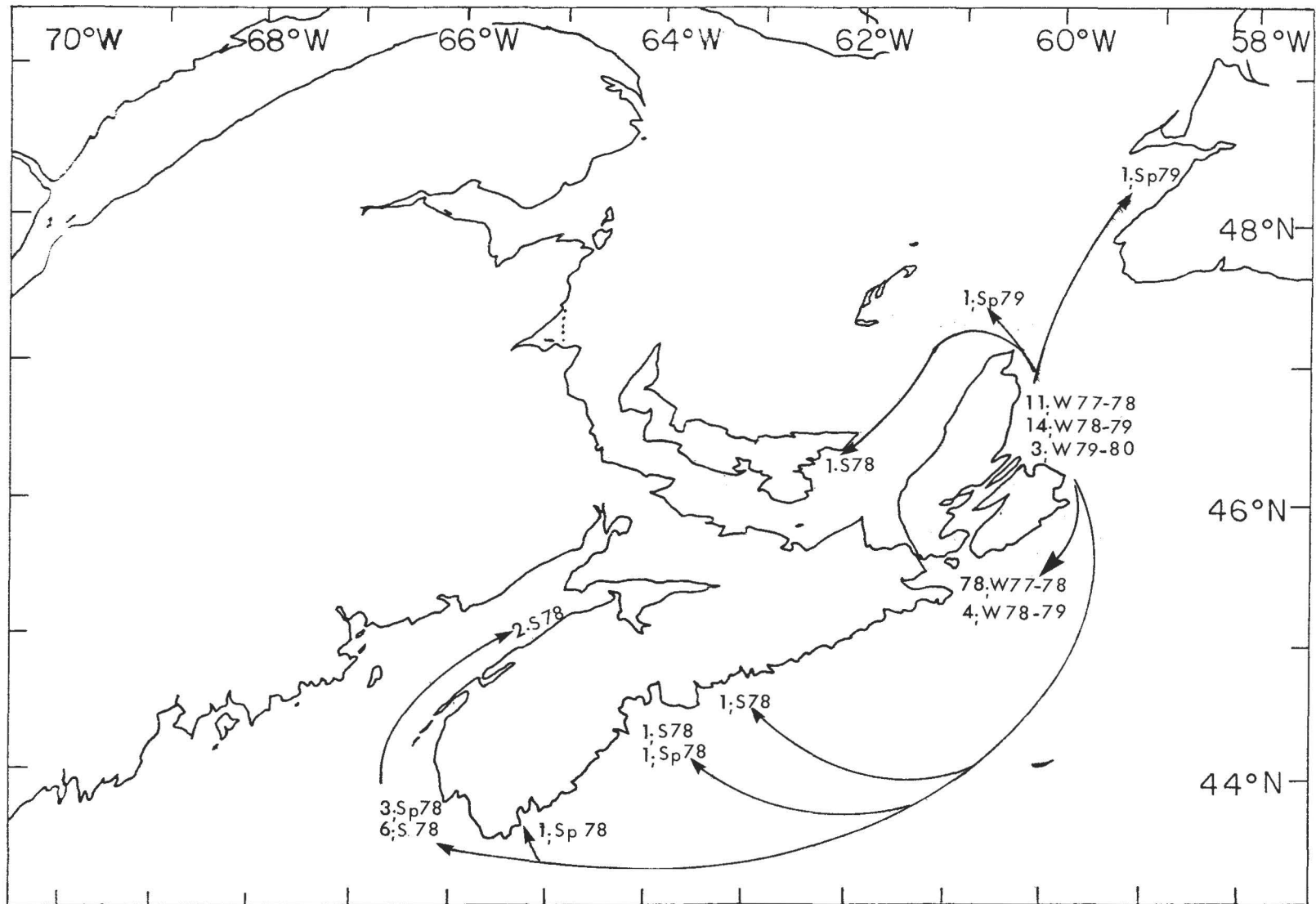


Figure 15. Recoveries from 3063 herring tagged in 4Vn - November-December 1977. (Tagging area Low Point - Little Lorraine).