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Biological Update for 4Vn Herring, 1981-82

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Abstract

The purse seine catch during the 1982 winter fishery was 3,552 t against a TAC of 3,000 t. The catch rate from purse seine log records has shown a general downward trend since 1972 even though effort has increased in recent years. In 1982 a substantial portion of the catch was taken near the northern tip of Cape Breton and over 76% of the catch was of 4, 5, and 6-year old fish.

Tagging experiment results indicate that the winter fishery exploits herring which have a strong affinity for Gulf of St. Lawrence stocks, local Cape Breton stocks including that in Bras d'Or Lakes, and a lesser but consistent mixing with 4X groups. Thus it would appear that 4Vn is an overwintering area for components of various east coast stocks which, if not exploited in 4Vn during winter, would be available to the various fisheries during their summer distribution.

Résumé

Les prises des sennes coulissantes pendant l'hiver 1982 ont été de 3 552 t contre un TPA de 3 000 t. D'après les journaux de bord, le taux de capture de ces engins montre une tendance à la baisse, en dépit d'une augmentation de l'effort de pêche en ces dernières années. En 1982, une importante portion des prises a été effectuée près de l'extrémité septentrionale du Cap-Breton, et les poissons de 4, 5 et 6 ans constituaient plus de 76 % des prises.

Des expériences de marquage indiquent que la pêche d'hiver exploite des harengs qui se rapprochent beaucoup des stocks du golfe du Saint-Laurent et des stocks locaux du Cap-Breton, y compris celui des lacs Bras d'Or, ainsi qu'un mélange moindre mais uniforme, avec les groupes de 4X. Il semble donc que 4Vn est un lieu d'hivernage pour les composantes des divers stocks de la côte est qui, s'ils n'étaient pas exploités dans 4Vn en hiver, pourraient l'être par diverses pêches dans leur distribution estivale.

Introduction

The Sydney Bight (4Vn) herring fishery has two components; a relatively small fixed gear (trap and gillnet) fishery in the spring and summer and a larger mobile gear fishery (purse seine) during the winter. The recorded catch from the fixed gear fishery has always been small (500 t) and includes catches made in the Bras d'Or Lakes. The winter fishery prosecutes the overwintering components of east coast stocks, but the stock identity is difficult to ascertain due to mixing of several stocks on the overwintering grounds. These overwintering fish are predominately fall spawners. The origin and movements of fish exploited in the summer fishery has not been well studied and the fishery has not been well sampled. Although the relationship between the summer and overwintering groups of herring has not been well established, the results of tagging experiments are helping to clarify this question.

Catch and CPUE Trends

The exploitation of herring in 4Vn was intensified in 1968 with the development of a foreign fishery in the summer; the Canadian purse seine fishery developed in the winter of 1968-69. For the first two years (1968 and 69) the foreign fleets took the majority of the catch (Table 1), but by the winter of 1970-71 the 4Vn herring fishery was predominantly Canadian. Catches peaked in the 1972-73 winter fishery at 17,500 t and have been declining since that time. The average catch, since the 1978-79 season has been less than 3,500 t, partly due to quota limitations, but largely due to weather conditions and herring abundance. The fixed gear fishery is almost exclusively a summer fishery and catches have remained relatively stable since 1977 at about 300 t annually.

The fishing year in this area, is considered to extend from 1 November of one year to 31 October of the next year. The monthly breakdown of catch during the 1981 fishing year (1 November, 1980 - 31 October 1981) and the 1982 winter fishery (November/December, 1981) are given in Table 2. The catch during the 1982 fishing year winter fishery occurred entirely in November and December with 3,552 t being taken against a 3,000 t TAC. Over 95% of the fixed gear catch was taken in the March-July period.

Several catch per unit effort indices have been produced from the purse seine logs (Table 3). The proportion of the total catch accounted for by the log records is relatively high, thus the CPUE indices shown can be considered representative of the overall fishery. Although continuing disagreement exists on the value of purse seine CPUE as an indicator of stock abundance, all the indices derived from log records continue to show a downward trend (Figure 1). It is notable that since the 1979-80 winter fishery, effort has increased although the catch has remained relatively stable (Figure 1).

Geographic Distribution of Catch

The geographic distribution of the fishery in 4Vn has changed dramatically over the history of the fishery. In the early 1970's about half of the catch was taken in the southern part of 4Vn, between Scatarie and Cape Fourchu, while most of the remainder was taken in the area between Bird Islands (near St. Ann's Bay) and Scatarie (Sinclair et al, 1981). By the mid-1970's the fishery was concentrated in the Bird Islands-Scatarie area with a continuing decline in the proportion of the catch being taken in the southern portion. Until the late 1970's only small quantities of herring were taken in the area between Bird Islands and Cape North. But since the 1979-80 winter fishery, the majority of the catch has been taken in this northern portion of 4Vn; the 1981-82 season further illustrates the northward movement of the fishery (Figures 2a, b) with a substantial portion of the catch occurring near the northern tip of Cape Breton.

Age Composition

Biological sampling of the winter purse seine fishery has generally been good in 4Vn. During the 1981-82 season however, sampling was poor, with only 3 biological samples taken for the landed catch of 3,552 t. As a result the data on length frequency of the catch, weights-at-age, and age composition may not be as representative of the fishery as in the past. The age composition of the catch during the 1981-82 purse seine fishery is given in Table 4. The catch was largely comprised of 4, 5, and 6 year olds (1978, 1977, and 1976 year-classes respectively; birthdate arbitrarily set at 1st November) which represented 76.2% of the total catch, in weight.

The numbers and weights-at-age for previous years are given in Tables 5 (catch-at-age matrix) and 6 (weights-at-age) and Figure 3. The derived weights-at-age are generally higher for the 1981-82 fishery, but this may be due to the limited data available for calculating the length-weight relationship. As observed in the 1979-80 and 1980-81 seasons, the 1976 and 1977 year-classes appeared strong in the fishery. Prior to these year-classes only the 1970 year-class was strong (Figure 3). The largest proportion of the catch represented by any year-class in the latter 1970's has been at age 5 thus supporting the suggestion (Sinclair et al, 1981) that recruitment is not complete until age 5.

Results of Tagging Experiments

In an attempt to elucidate the relationships of herring in the 4Vn summer and winter fisheries with adjacent stocks, a number of tagging experiments have been conducted since 1977. A total of 21,132 fish have been tagged between 1977-81. The results have been summarized previously (Sinclair et al, 1980, 1981) and only an update in numbers recovered and general conclusions will be present here.

Excluding the returns in 4Vn during the first two weeks after release, there have been 454 recoveries from the tagging experiment in Dec./Jan., 1979-80 in the Bird Islands to Ingonish area (Table 7; Figure 4). Of this total, there have been a number of recoveries (20) from the 1980 and 1981 spring and summer fisheries in 4Vn, including 3 from the Bras d'Or Lakes, and 48 recoveries from the 1980-81 and 1981-82 winter fisheries in 4Vn. The other recoveries substantiate that the overwintering group is an admixture of east coast stocks. A total of 18 were taken in the 4W winter and spring fisheries and 8 during the 4X summer fishery. A greater number, 45, have been recovered from the various Gulf herring fisheries (Figure 4), a significant proportion being taken in the inshore fisheries. These data suggest a strong affinity with the Gulf of St. Lawrence and local Cape Breton stocks, and a lesser but consistent mixing with 4X groups.

The results of previous tagging experiments in 4Vn in 1977 and 1978 (Table 8 and 9; Figures 5 and 6) exhibited different patterns of distribution and movement than those in 1979-80. It has been postulated (Sinclair et al, 1981) that these different patterns of recoveries are a result of the dramatic change in geographical distribution of the fishery (ie. The change in geographic location of the fishery resulted in different populations ("stocks") of fish being exploited in the 3 fishery years, and since the tagging experiments were conducted on commercially operating vessels, resulted in different populations of fish being tagged). The 1977, 1978, and 1979-80 tagging experiments were conducted successively further north in 4Vn. The results of these tagging experiments show a coincident change in the proportion of tags recovered from 4X and 4T. It would appear that fish tagged in the northern part of 4Vn tend to go into the Gulf while those tagged in the southern part tend to move south. Tag recoveries in 4Vn from tagging experiments conducted in other NAFO areas also suggest that 4Vn is an overwintering area for components of several east coast herring stocks. The recoveries in 4Vn from those tagging experiments are summarized below:

	Release Areas*				
	<u>4Xa</u>	<u>4Xb</u>	<u>4W</u>	<u>4Tmn</u>	<u>4Tg</u>
Recoveries in 4Vn	22	5	20	6	3

- * Areas defined: 4Xa - N.S. side of Bay of Fundy and southwest N.S.
4Xb - N.B. side of Bay of Fundy
4W - off Chedabucto Bay, N.S.
4Tmn - Chaleur Bay
4Tg - off Souris, P.E.I.

The recoveries from the most recent tagging experiment conducted in St. Ann's Bay in April-May, 1981 (Table 10, Figure 7) suggest that some of the fish in 4Vn in spring subsequently move into the southern Gulf, some into Bras d'Or Lakes, and are definitely exploited during the winter fishery in 4Vn.

Management Considerations

The available biological information indicates that the winter 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. It appears certain that the winter fishery exploits both overwintering components of 4T and 4WX as well as local "stocks" in 4Vn and 4W. It has been suggested (Sinclair et al, 1981; Anon. 81/7) that "based on biological considerations it would be preferable that there be no 'overwintering' fishery in 4Vn; the spring and summer fixed gear fishery is believed to prosecute the local stocks. Elimination of the 'overwintering' fishery should result in no loss of yield to the overall east coast herring fishery since the components of other herring populations which only overwintering in 4Vn would still be available to various fisheries during their summer distribution." This report adds to the validity of that recommendation.

References

- Anon. 1981. Advice on Pelagic Stocks. CAFSAC Advisory Document 81/7.
- Sinclair, M., W.T. Stobo, and J. Simon. 1980. 1979-1980 4Vn herring assessment. CAFSAC Research Document 80/50.
- Sinclair, M., W.T. Stobo, and J. Simon. 1981. 4Vn herring assessment. CAFSAC Research Document 81/44.

Table 1. Annual (Oct-Oct) herring landings (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	81-82
Can. Fixed Gear	492	407	252	91	296	235	225	74	142	162	116	212	226	74	120	310	327	261	328	-
Can. Mobile Gear	-	-	-	-	-	2	2044	5335	2917	10681	17537	16285	14297	5546	12831	7078	3332	2865	3952	3552
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	3552
TAC																11000	8000	3000	4500*	3000

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

1
2
1

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

	1980		1981											
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Purse Seine	1154	2410	338										2623	929
Traps						16.7	68.1	6.1						
Drift Gillnets	3.4				22.3	55.1	76.6	50.4	13.6			1.1	1.6	
Set Gillnets						4.3	9.4	0.5						0.1
Misc.							0.2							

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

YEAR	Catch (t) per successful night	Catch (t) per night	Catch (t) per set
71-72	115 ¹	-	-
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
81-82	31.3	27.1	17.4

¹ From previous assessments

Table 4. 4Vn herring catch-at-age (numbers x 10⁻³) for the 1981-82 purse seine fishery.*

	2	3	4	5	6	7	8	9	10	11+	TOTAL
November & December	104	945	1965	7192	2982	844	0	77	77	893	15,079
% Number	.6	6.3	13.0	47.7	19.8	5.6	-	1	1	5.9	
% Weight	1	3	10	44	22.2	7.4	-	1	1	11.4	

* 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	81-82
2	43	116	1	0	0	0	0	43	104
3	3798	5116	671	16	7	26	3172	518	945
4	43737	4156	1544	2986	110	441	3437	3791	1965
5	14264	33189	1848	5103	2377	1413	1671	3946	7192
6	4435	6430	7846	4136	2800	1443	741	1060	2982
7	2955	2417	2571	17602	1442	878	1004	645	844
8	3176	2304	1123	8379	7622	847	607	614	-
9	2841	2242	892	3401	4056	1701	873	717	77
10	3842	2842	1006	2431	1202	1838	879	1192	77
11+	4969	5401	3461	5451	3098	1915	750	2688	893
TOTAL	84060	64213	20963	49505	22714	10502	13134	15214	15,079
TONNES	16863	14354	5734	12831	7078	3332	2865	3952	3,552

* 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	81-82
2	34	52	41	-	-	-	-	36	16
3	85	102	93	105	110	120	103	104	113
4	162	145	157	141	175	189	152	146	182
5	182	203	203	187	220	211	207	201	217
6	218	235	249	219	245	258	255	252	264
7	251	256	273	256	272	289	289	267	310
8	302	287	292	275	308	302	324	332	-
9	325	314	332	295	346	338	366	361	375
10	350	334	361	319	377	376	400	395	375
11+	367	362	382	333	383	397	417	431	453

Table 7. Tag return update (to April 14, 1982) for 11,101 fish tagged in 4Vn, Dec. 10/79-Jan 7, 1980.

Recovery location	Jan 1- Mar 31/80	Apr 1- June 30	July 1 Sept 30	Oct 1- Dec 31/80	Jan 1- Mar 31/81	Apr 1- June 30	July 1- Sept 30	Oct 1- Dec 31/81
4Vn								
Sydney Bight	315	17	-	44	3	-	-	1
Bras d'Or Lakes	-	1	-	-	-	2	-	-
4W	2	2	-	7	7	-	-	-
4X								
S.W. Nova Scotia	-	-	4	-	-	2	2	-
4T Edge	-	23	-	-	-	-	-	-
Southern Gulf	-	2	3	-	-	1	5	-
Western Gulf	-	-	1	5	-	2	1	1
4R	-	1	-	-	-	-	-	-

Table 8. Tag return update (to April 14, 1982) for 3063 fish tagged in 4Vn, November 26-December 15, 1977

Recovery location	Oct 1- Oct 31/77	Jan 1- Mar 31/78	Apr 1- June 30	July 1- Sept 30	Oct 1- Dec 31/78	Jan 1- Mar 31/79	Apr 1- June 30	July 1- Sept 30	Oct 1- Dec 31/79	Jan 1- Mar 31/80	Apr 2- June 30/80
4Vn Sydney Bight	3	2	-	-	13	-	-	-	1	2	-
4W	1	77	-	1	2	2	-	-	-	-	-
4X South Shore	-	-	3	1	-	-	-	-	-	-	-
S.W. Nova Scotia	-	-	2	5	-	-	-	-	-	-	-
Bay of Fundy	-	-	-	2	-	-	-	-	-	-	-
4T Edge	-	-	-	-	-	-	1	-	-	-	1
Northumberland Strait	-	-	-	-	1	-	-	-	-	-	-

Table 9. Tag return update (to Apr 14, 1982) for 3993 fish tagged in 4Vn, November 9 - December 2, 1978.

<u>Recovery Location</u>	<u>Oct 1 Dec 31/78</u>	<u>Jan 1 Mar 31/79</u>	<u>Apr 1 June 30</u>	<u>July 1 Sept 30</u>	<u>Oct 1 Dec 31/79</u>	<u>Jan 1 Mar 31/80</u>	<u>Apr 1 June 30</u>	<u>July 1- Sept 30/80</u>	<u>Oct 1 Dec 31</u>	<u>Jan 1 Mar 31/81</u>
4Vn Sydney Bight	28	-	2	-	-	68	1	-	7	-
4W	2	5	5	-	-	3	-	-	-	2
4X S.W. Nova Scotia	-	-	-	1	-	-	-	2	-	-
South Shore	-	-	-	-	-	1	-	3	-	-
Scott's Bay	-	-	-	1	-	-	-	1	-	-
4T Edge	-	-	9	-	-	-	3	-	-	-
Western Gulf	-	-	-	1	1	-	-	-	-	-
Southern Gulf	-	-	-	1	-	-	-	-	-	-
4R	-	-	1	-	-	-	-	-	-	-

Table 10. Tag returns from 2975 fish tagged in St. Ann's Bay, 4Vn, April 14-May 1, 1981.

<u>Recovery location</u>	<u>Apr 1- June 30/81</u>	<u>July 1- Sept 30/81</u>	<u>Oct 1- Dec 31/81</u>
4Vn Sydney Bight	1	-	23
Bras d'Or Lakes	1	-	-
4T Pictou Is.	1	1	-
Northumberland Strait	1	-	-

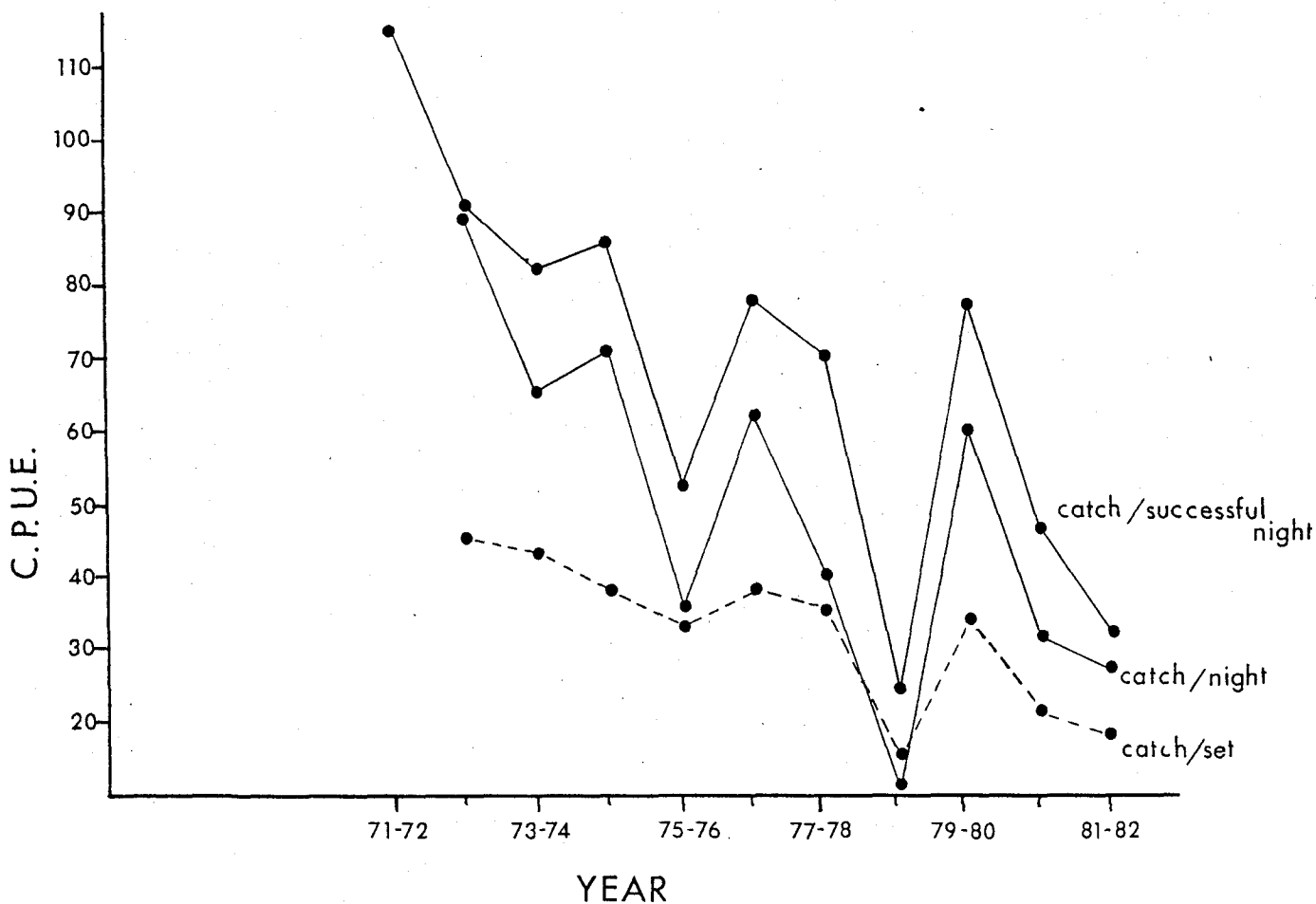
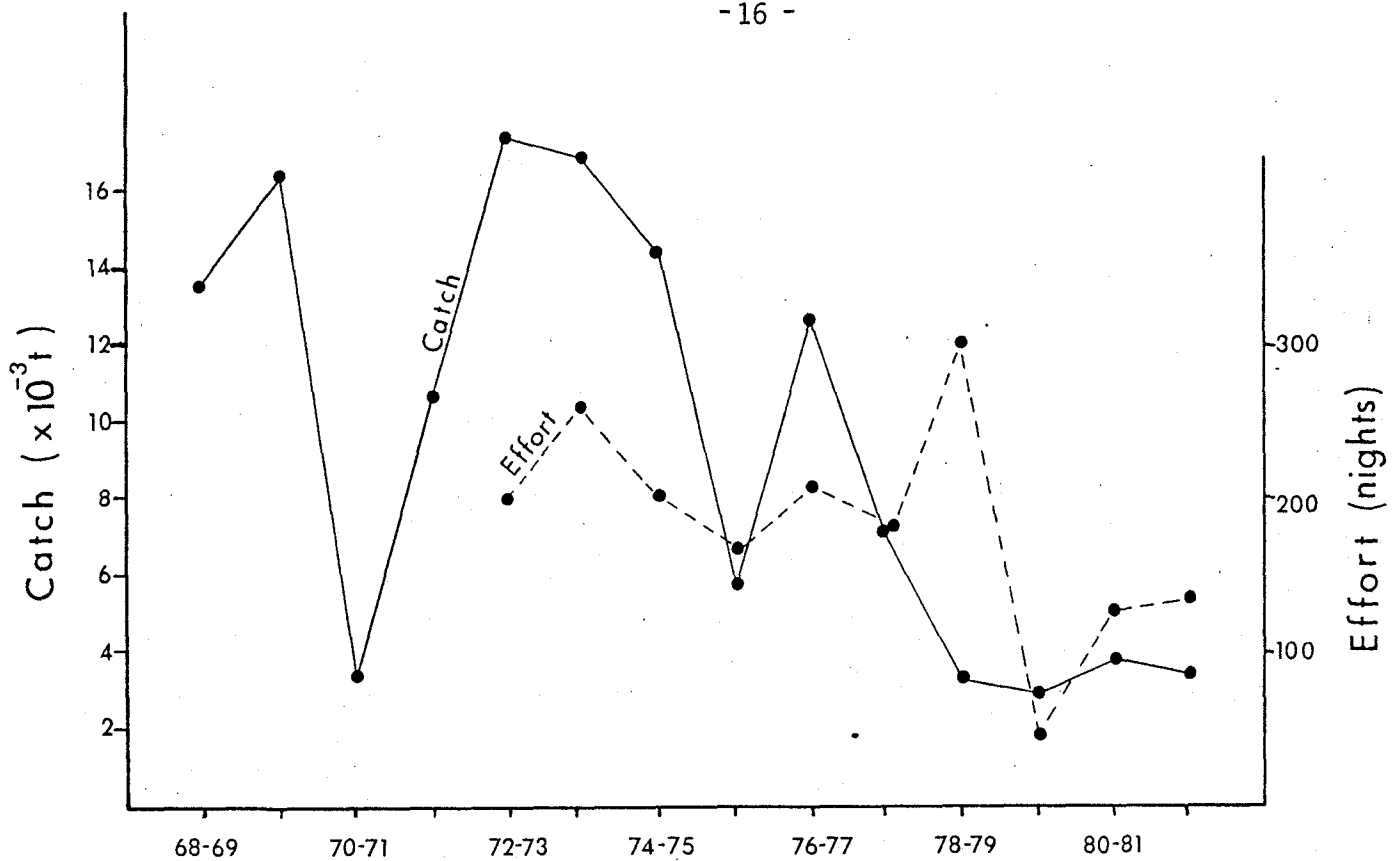


Figure 1. Distribution of catch, effort and CPUE for the 4Vn purse seine fishery. Effort is the catch divided by catch/night.

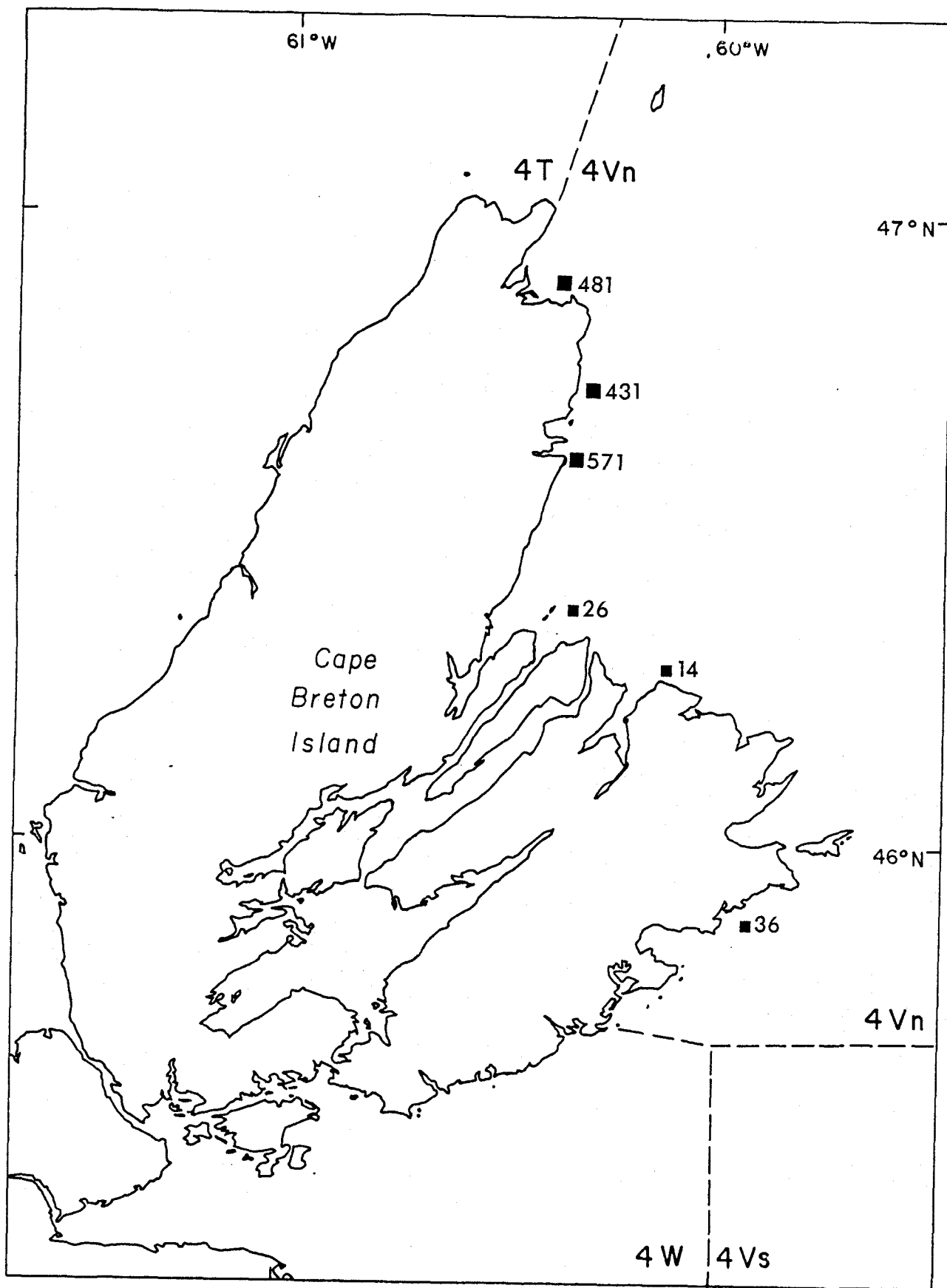


Figure 2a. Purse-seine catch (t) distribution from logbooks November 1981.

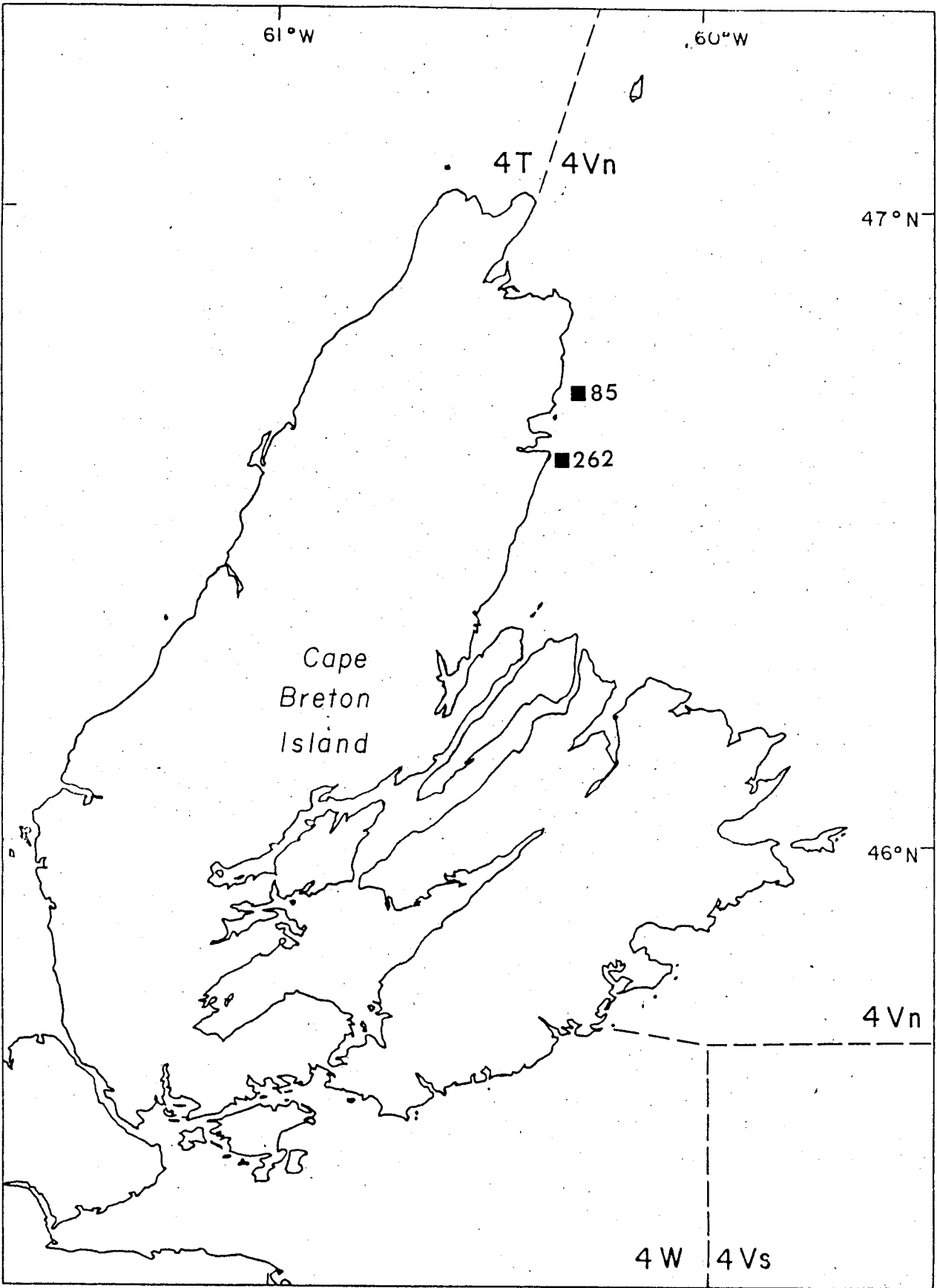


Figure 2b. Purse-seine catch (t) distribution from logbooks December 1981.

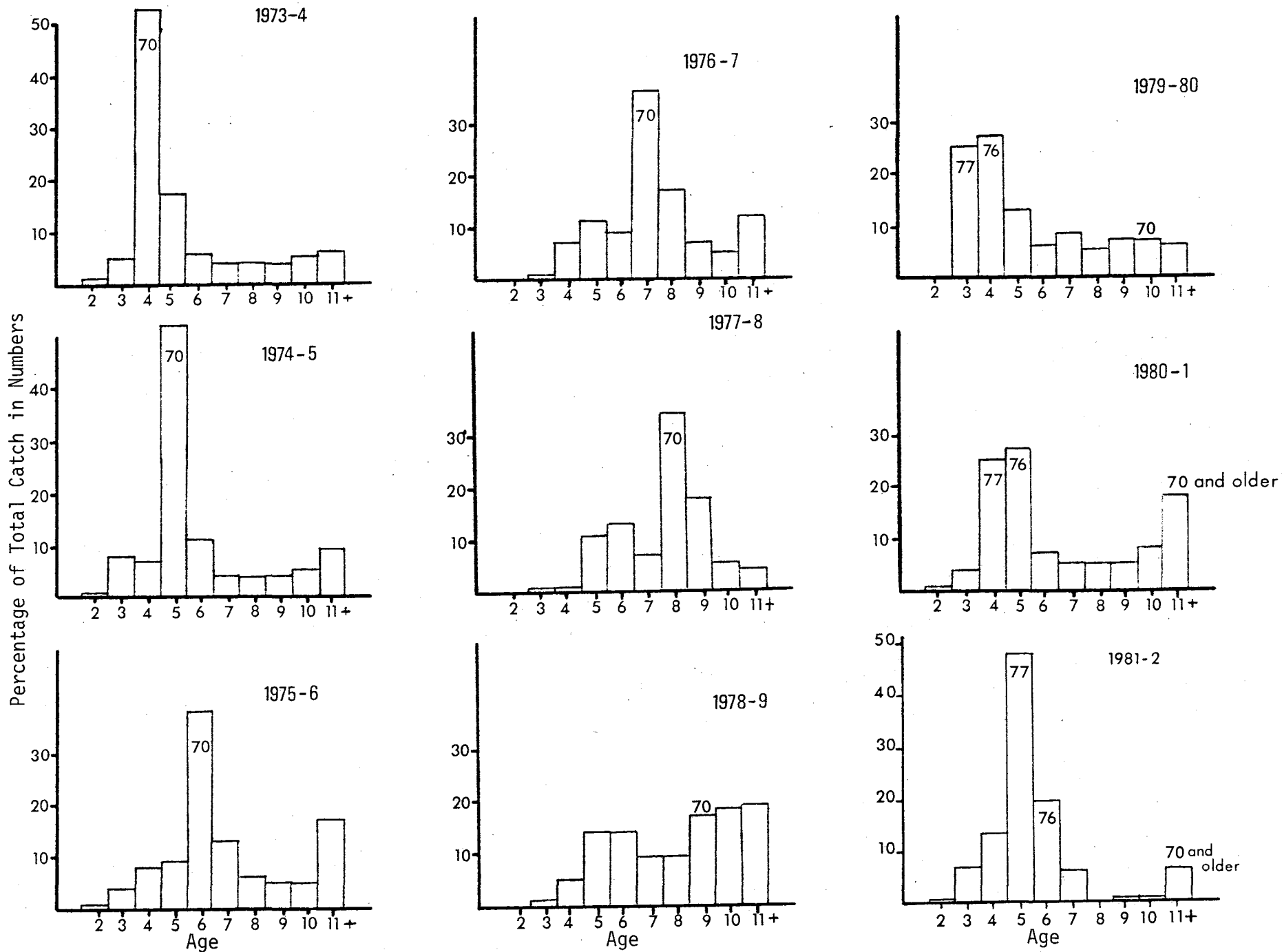


Figure 3. Historical age composition by percent for the 4Vn herring fishery 1973-74 to 1981-82.

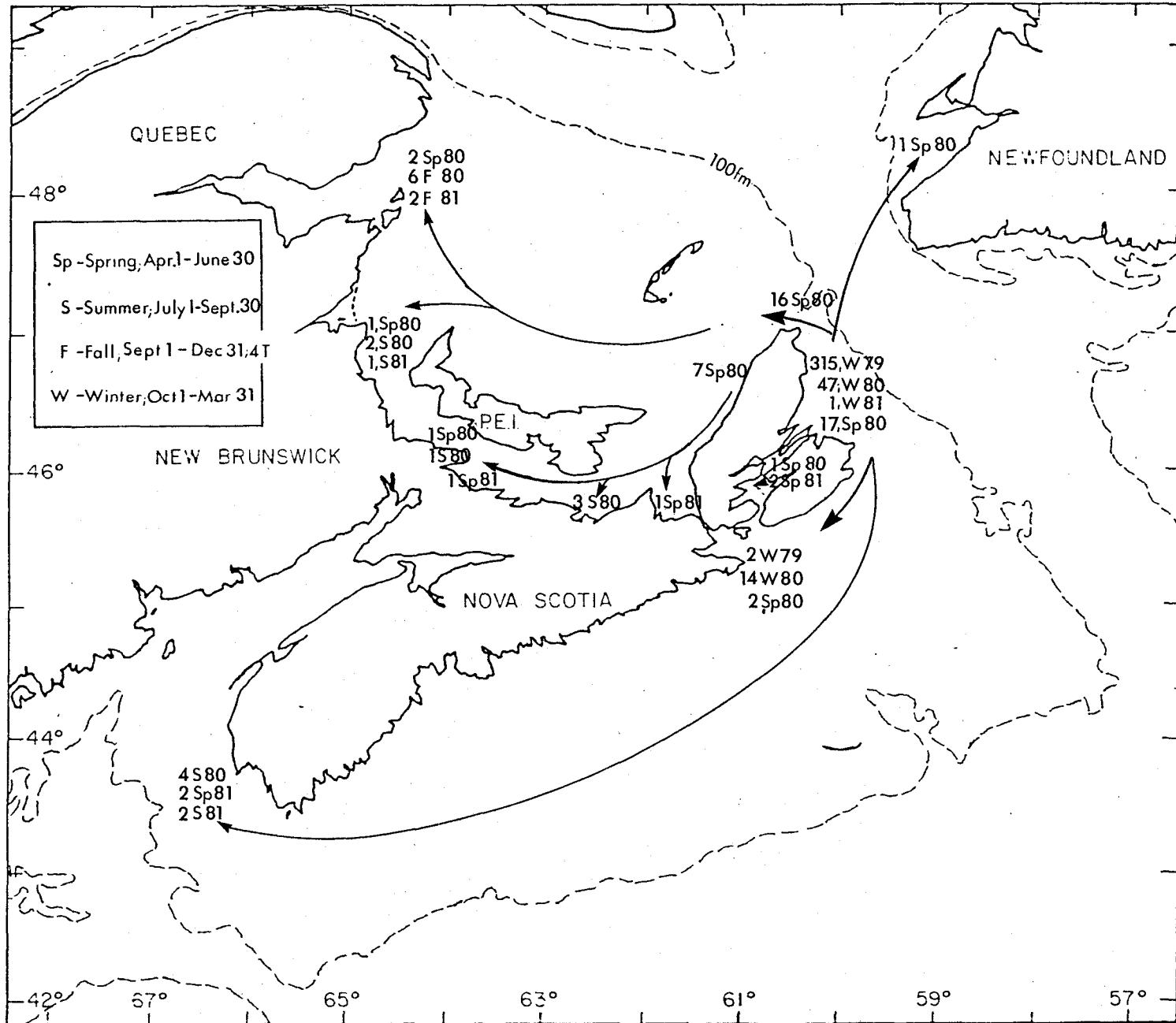


Figure 4. Recoveries from 11,101 herring tagged in 4Vn, December 10, 1979-January 7, 1980 (tagging area Ingonish-Bird Island). The total number of recoveries in various geographical areas are broken down by season, by year.

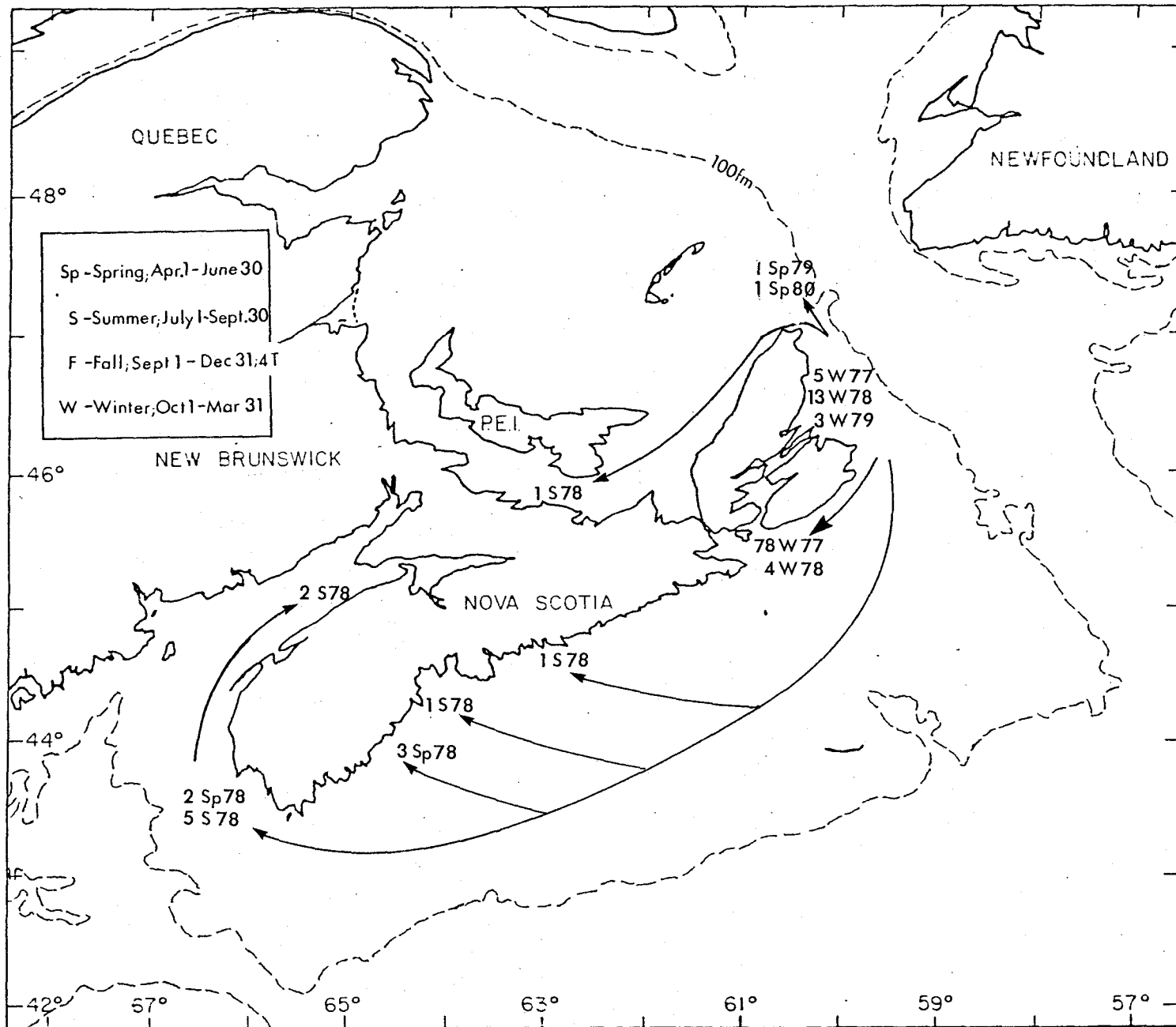


Figure 5. Recoveries from 3,063 herring tagged in 4Vn - November-December 1977. (Tagging area Low Point - Little Lorraine). The total number of recoveries in various geographical areas are broken down by season by year.

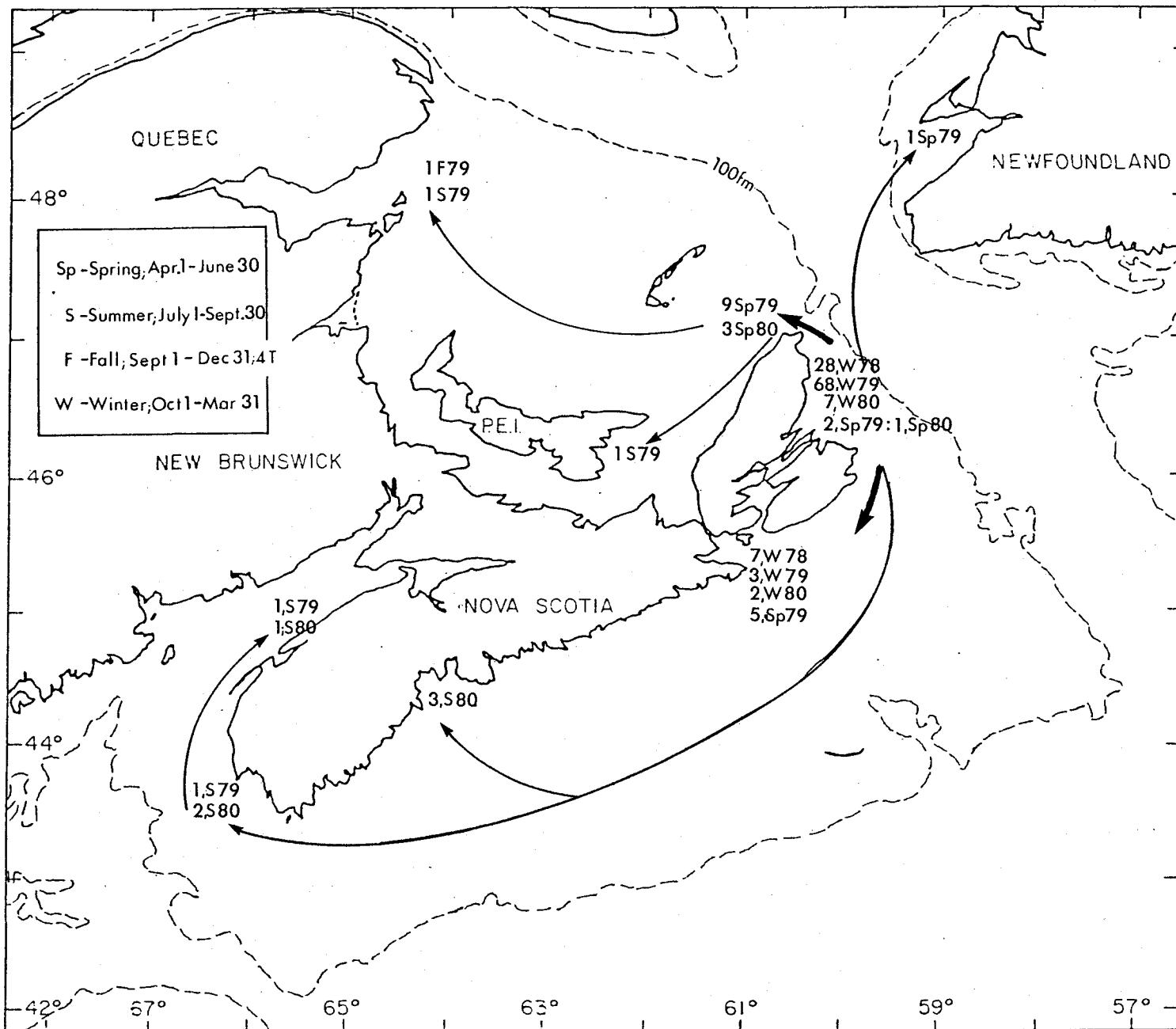


Figure 6. Recoveries from 3,993 herring tagged in 4Vn - November-December 1978. (Tagging area Bird Island - New Waterford). The total number of recoveries in various geographical areas are broken down by season by year.

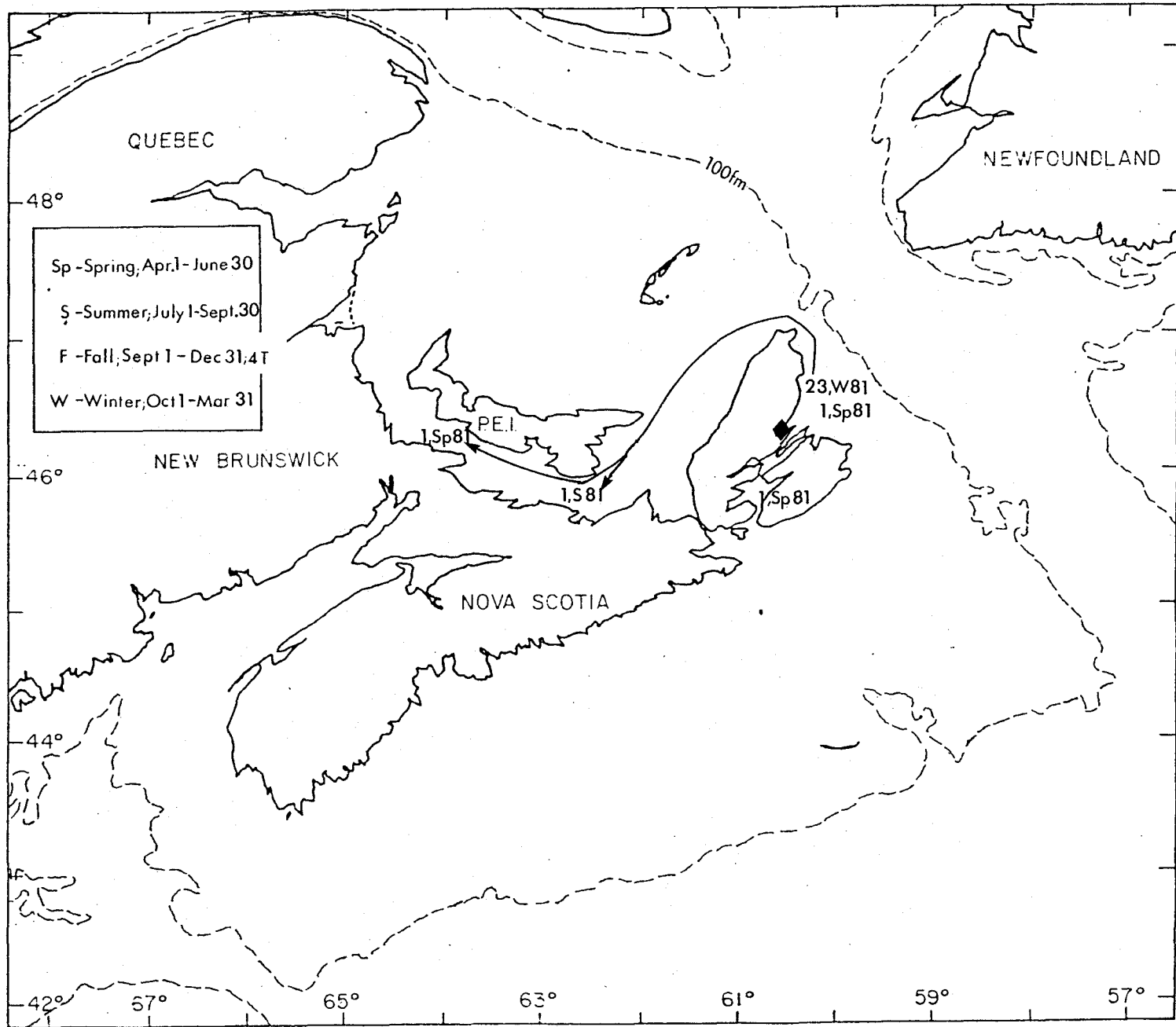


Figure 7. Recoveries from 2975 herring in 4Vn, April 14, - May 1, 1981 (tagging area \blacklozenge St. Ann's Bay). The total number of recoveries in various geographical areas are broken down by season by year.