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Relationship Between West Greenland and Canadian 1-Sea-Winter Salmon Catches

by

D. G. Reddin
Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

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Abstract

Relationships were tested to explain annual variability in abundance of salmon between 1-sea-winter (1SW) landings of Atlantic salmon (Salmo salar L.) at West Greenland and 1SW landings of the same smolt class in home water Canadian fisheries. As there was no systematic pattern to the 3 significant (out of 92) correlations found, it was concluded that there were no statistical relationships between West Greenland and Canadian catches of 1SW salmon.

Résumé

Nous avons vérifié diverses relations qui pourraient expliquer la variabilité annuelle d'abondance de saumons atlantiques (Salmo salar L.) unibermarins (1 hiver en mer) dans les débarquements du Groenland occidental et ceux de la même classe de smolts capturés par les Canadiens dans les eaux d'origine de ces saumons. Comme aucun patron systématique n'est apparu dans les trois corrélations (sur un total de 92) significatives trouvées, nous avons conclu à l'absence de relations statistiques entre les prises de saumons unibermarins au Groenland occidental et dans les eaux canadiennes.

Introduction

The objective of this paper is to determine if there is a relationship between 1-sea-winter (1SW) landings of Atlantic salmon (*Salmo salar* L.) at West Greenland and 1SW salmon landings in home water Canadian fisheries in the same year. These fish came from the same smolt class although Canadian catches of 1SW salmon are mainly maturing fish, i.e. grilse; while catches of 1SW salmon at West Greenland are non-maturing fish that would have returned home as multi-sea-winter (MSW) salmon. However, as they came from salmon that smoltified in the same year any relationships between these two catches may be useful for explaining annual variability in abundance of salmon in these two fisheries.

Methods

Catch records for Newfoundland were obtained from O'Connell et al. (1983); for West Greenland from Anon. (1982) for 1960-81, 1982 from W. G. Doubleday (pers. comm.), 1983 from the author's observations while in Greenland in 1983 (Table 1); and Canadian catches for 1969-77 from Anon. (1979a) and for 1978-82 from Anon. (1982). Catches reported in Anon. (1979a) were used for 1969-77 as Canadian catches reported to ICES for these years did not include recreational catches (Table 2).

These catch records were used to investigate the relationship between the salmon fishery at West Greenland and that for 1SW salmon in Canadian fisheries of the same smolt class i.e. catches at West Greenland in 1970 related to 1SW catches in home waters in 1970. Catches at West Greenland were divided into North American and European origin on the basis of discriminant analysis of scale characters reported in Anon. (1981).

Regression analysis was used to test the relationships between:

- (1) total salmon catch at West Greenland and catch of North American salmon at West Greenland (Y) on Canadian 1SW catch (X) of the same smolt class for all years of available data and for those years prior to quota control at West Greenland (Table 2). The rationale for using only those catches prior to quota control is that a quota limits the catch so that it no longer reflects abundance;
- (2) total salmon catch at West Greenland and catch of North American salmon at West Greenland (Y) on Newfoundland-Labrador 1SW catches (X) from the same smolt class for all years of available data and for those years prior to quota control (Table 3);
- (3) total salmon catch at West Greenland and catch of North American origin salmon at West Greenland (X) on Newfoundland-Labrador 1SW catches (Y) by Statistical Area (Newfoundland) and Section (Labrador) for all years of available data and for those years prior to quota control (Table 4; Fig. 1 and 2).

The assumptions that these relationships are based on are:

1. Catches reflect abundance of salmon at sea and differences in effort and catchability between West Greenland and Canada do not vary greatly from year to year.

2. Reported catches are accurate.
3. The proportions of other sea ages in these catches are similar from year to year. No adjustments were made for grilse error in Canadian landings (Reddin 1982) or to West Greenland catches for presence of other sea ages (West Greenland catches were 97% 1SW salmon in 1981, Anon. 1982) and 90% in 1969 (Anon 1979b).
4. The variance in the proportion of fish that develop into grilse versus MSW salmon from a given smolt run is small.

Results and Discussion

The catches at West Greenland after the instigation of quota control in 1976 show considerable variability for a controlled fishery. The quota was 1190 t from 1976 to 1980, 1265 t in 1981, 1253 t in 1982, and 1190 t in 1983. The catches reported in excess of or below the quota were 1420 t in 1977, 984 t in 1978, 1395 t in 1979, 1077 t in 1982, and 310 t in 1983. Thus, except in 1976, 1980, and 1981, the catch either exceeded or was less than the quota (Table 1).

Of the relationships tested in Methods it was found that:

- (1) there were no significant correlations between catches at West Greenland, either the total or North American portion, and Canadian catches of 1SW salmon for either all years of data or for those years prior to quota control (Table 2).
- (2) there were no significant correlations between catches at West Greenland, either total or catches of North American origin salmon on Newfoundland, Labrador, or Newfoundland-Labrador total catches for all years or for those years prior to quota control (Table 3).
- (3) there were three out of 76 relationships significantly correlated between Newfoundland-Labrador 1SW catches by Statistical Area (Newfoundland) and Section (Labrador) for all years of available data and for those years prior to quota control (Table 4). Two of the three were between catches in Statistical Areas F and M and total catch at West Greenland for all years, while the other was between catch in Statistical Area G and catch of North American salmon at West Greenland.

For the following reasons these three significant correlations are probably spurious: (1) there is no apparent biological rationale for a statistical relationship between 1SW catches in Statistical Areas G and M since stocks in these areas primarily mature as grilse and have no MSW component; although Statistical Area F does harvest MSW salmon that could be returning from Greenland; (2) there were no systematic patterns to the significant correlations; (3) if one attempts 100 correlations then it can be expected that 5% of them would be significant by chance occurrence. Thus, for these reasons, while a relationship is implied they are, in the author's opinion, meaningless

and were due to the large numbers of relationships attempted rather than a true relationship.

In conclusion, there was no statistical relationship found between catches at West Greenland and Canadian or Newfoundland catches of 1SW salmon in homewaters from the same smolt class.

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Table 1. Reported nominal salmon catches at West Greenland, 1960-83 (in tonnes, round fresh weight) taken from Anon. (1982).

	Drift-net				Gill-net and drift-net	Total
	Norway	Faroese	Sweden	Denmark	Greenland ^d	
1960	0	0	0	0	60	60
1961	0	0	0	0	127	127
1962	0	0	0	0	244	244
1963	0	0	0	0	466	466
1964	0	0	0	0	1539	1539
1965	^a	36	0	0	825	861
1966	32	87	0	0	1251	1370
1967	78	155	0	85	1283	1601
1968	138	134	4	272	579	1127
1969	250	215	30	355	1360(385) ^d	2210
1970	270	259	8	358	1244	2146 ^c
1971	340	255	0	645	1449	2689
1972	158	144	0	401	1410	2113
1973	200	171	0	385	1585	2341
1974	140	110	0	505	1162	1917
1975	217	260	0	382	1171	2030
1976	0	0	0	0	1175	1175
1977	0	0	0	0	1420	1420
1978	0	0	0	0	984	984
1979	0	0	0	0	1395	1395
1980	0	0	0	0	1194	1194
1981	0	0	0	0	1264	1264
1982	0	0	0	0	1077	1077 ^b
1983	0	0	0	0	310	310

^aFigures not available, but catch is known to be less than the Faroes

^bProvisional (pers. comm. W. G. Doubleday)

^cIncluding 7 metric tons caught on long-line by one of two Greenland vessels in the Labrador Sea early in 1970

^dUp to 1968, gill-net only, after 1968 gill-net and drift-net. The figures in brackets for the 1969 catch are an estimate of the minimum drift-net catch

Factor used for converting landed catch to round fresh weight in fishery by Greenland vessels = 1.11. Factor for Norwegian, Danish, and Faroese drift-net vessels = 1.10.

Table 2. Landings (commercial plus recreational) of Atlantic salmon for 1969-81 smolt classes (tonnes).

Smolt class	Canadian ^{1,2}			West Greenland ²		Total catches of Canadian salmon
	1-sea-winter	Multi-sea-winter	Total	North American origin ³	Total	
1969	756	1453	2209	751	2146	2960
1970	505	1142	1647	914	2689	2561
1971	554	1589	2143	761	2113	2904
1972	778	1509	2287	1147	2341	3434
1973	945	1509	2454	824	1917	3278
1974	905	1665	2570	893	2030	3463
1975	777	1798	2575	505 ⁴	1175	3080
1976	655	1225	1880	582	1420	2462
1977	320	705	1025	374	984	1399
1978	582	1763	2345	656	1395	3001
1979	917	1619	2536	693	1194	3229
1980	818	1082	1900	-	1264	-
1981	716	-	-	-	1077	-

1 from Anon. (1979a)

2 from Anon. (1982)

3 derived using proportions reported in Anon. (1981)

4 W. Greenland catches under quota control beginning with the 1975 smolt class

Regressions

A) All years of data.

Total catch at West Greenland on Canadian 1SW catches. Years 1969-81.

$$R^2 = 0.0021 \quad \text{N.S.}$$

$$Y = 1574.0 + 0.1390 X \quad N = 13$$

Catch of North American salmon at West Greenland on Canadian 1SW catches. Years 1969-79.

$$R^2 = 0.18 \quad \text{N.S.}$$

$$Y = 417.4 + 0.4560 X \quad N = 11$$

B) Years before quota only.

Total catch at West Greenland on Canadian 1SW catches. Years 1964-74.

$$R^2 = 0.53 \quad \text{N.S.}$$

$$Y = 3036.6 - 1.1216 X \quad N = 6$$

Catch of North American salmon at West Greenland on Canadian 1SW catches. Years 1969-74.

$$R^2 = 0.0097 \quad \text{N.S.}$$

$$Y = 822.3 - 0.0802 X \quad N = 6$$

Table 3. Commercial catches of Atlantic salmon for Newfoundland-Labrador and West Greenland fisheries from 1969-1983 from O'Connell et al. 1983.

Year	Commercial catches (tonnes)								
	Newfoundland		Labrador		Total		West Greenland		Total
	Grilse	Salmon	Grilse	Salmon	Grilse	Salmon	N.A.	Total	
1969	403	577	74	388	477	965	1442	1127	2210
1970	541	596	94	364	635	960	1595	751	2146
1971	292	643	125	517	417	1160	1577	914	2689
1972	367	490	93	444	460	934	1394	761	2113
1973	640	729	116	522	756	1251	2007	1147	2341
1974	731	566	109	605	840	1171	2011	824	1917
1975	590	749	213	492	803	1241	2044	893	2030
1976	484	772	163	594	647	1366	2013	505	1175
1977	396	830	138	574	534	1404	1938	582	1420
1978	184	491	54	381	238	872	1110	374	984
1979	391	270	97	229	488	499	987	656	1395
1980	580	669	228	625	808	1294	2102	693	1194
1981	440	654	238	576	678	1230	1908	-	1264
1982	421	350	158	389	579	739	1318	-	1077
1983	292	303	88	257	380	560	940	-	310 estimated

R ²	Regression line	N	Year	Significance
West Greenland (total) on Newfoundland grilse catches				
0.11	$Y = 954.48 + 1.4718X$	15	1969-83	N.S.
0.41	$Y = 2722.92 - 1.0142X$	7	1969-75	N.S.
North American catches at West Greenland on Newfoundland grilse catch.				
0.18	$Y = 479.30 + 0.6207X$	12	1969-80	N.S.
0.0003	$Y = 907.46 + 0.0182X$	7	1969-75	N.S.
West Greenland (total) on Labrador grilse catches				
0.01	$Y = 1788.17 - 1.2915X$	15	1969-83	N.S.
0.01	$Y = 2277.59 - 0.6033X$	7	1969-75	N.S.
North American salmon catches at West Greenland on Labrador grilse.				
0.00	$Y = 768.49 - 0.0034X$	12	1969-80	N.S.
0.01	$Y = 948.12 - 0.2668X$	7	1969-75	N.S.
West Greenland (total) on Newfoundland-Labrador total grilse catches.				
0.06	$Y = 1108.94 + 0.8720X$	15	1969-83	N.S.
0.37	$Y = 2748.39 - 0.8643X$	7	1969-75	N.S.
North American salmon catches at West Greenland on Newfoundland-Labrador total grilse catches.				
0.12	$Y = 512.27 + 0.4336X$	12	1969-80	N.S.
0.0001	$Y = 918.42 - 0.0027X$	7	1969-75	N.S.

Table 4. Relationships between West Greenland catches and catches in Newfoundland Statistical Areas and Labrador Statistical Sections.

Dependent Variable	INDEPENDENT VARIABLE							
	1969-1983		1969-75		1969-80		1969-75	
	Catch at W. Greenland		Catch at W. Greenland		Catch of N.A. salmon at W. Greenland		Catch of N.A. salmon at W. Greenland	
Area	R ²	Significance	R ²	Significance	R ²	Significance	R ²	Significance
A	0.03	NS	0.01	NS	0.00	NS	0.17	NS
B	0.00	NS	0.14	NS	0.03	NS	0.01	NS
C	0.01	NS	0.39	NS	0.10	NS	0.04	NS
D	0.14	NS	0.54	NS	0.04	NS	0.11	NS
E	0.08	NS	0.18	NS	0.08	NS	0.02	NS
F	0.32	<0.05	0.24	NS	0.11	NS	0.27	NS
G	0.02	NS	0.16	NS	0.34	<0.05	0.14	NS
H	0.22	NS	0.17	NS	0.27	NS	0.02	NS
I	0.10	NS	0.00	NS	0.27	NS	0.10	NS
J1	0.05	NS	0.46	NS	0.05	NS	0.01	NS
J2	0.11	NS	0.18	NS	0.11	NS	0.00	NS
K	0.01	NS	0.01	NS	0.16	NS	0.54	NS
L	0.03	NS	0.31	NS	0.01	NS	0.04	NS
M	0.48	<0.01	0.00	NS	0.28	NS	0.01	NS
N	0.04	NS	0.01	NS	0.02	NS	0.11	NS
50	0.01	NS	0.31	NS	0.04	NS	0.18	NS
51	0.00	NS	0.16	NS	0.00	NS	0.30	NS
52	0.01	NS	0.42	NS	0.03	NS	0.14	NS
53	0.06	NS	0.01	NS	0.00	NS	0.14	NS

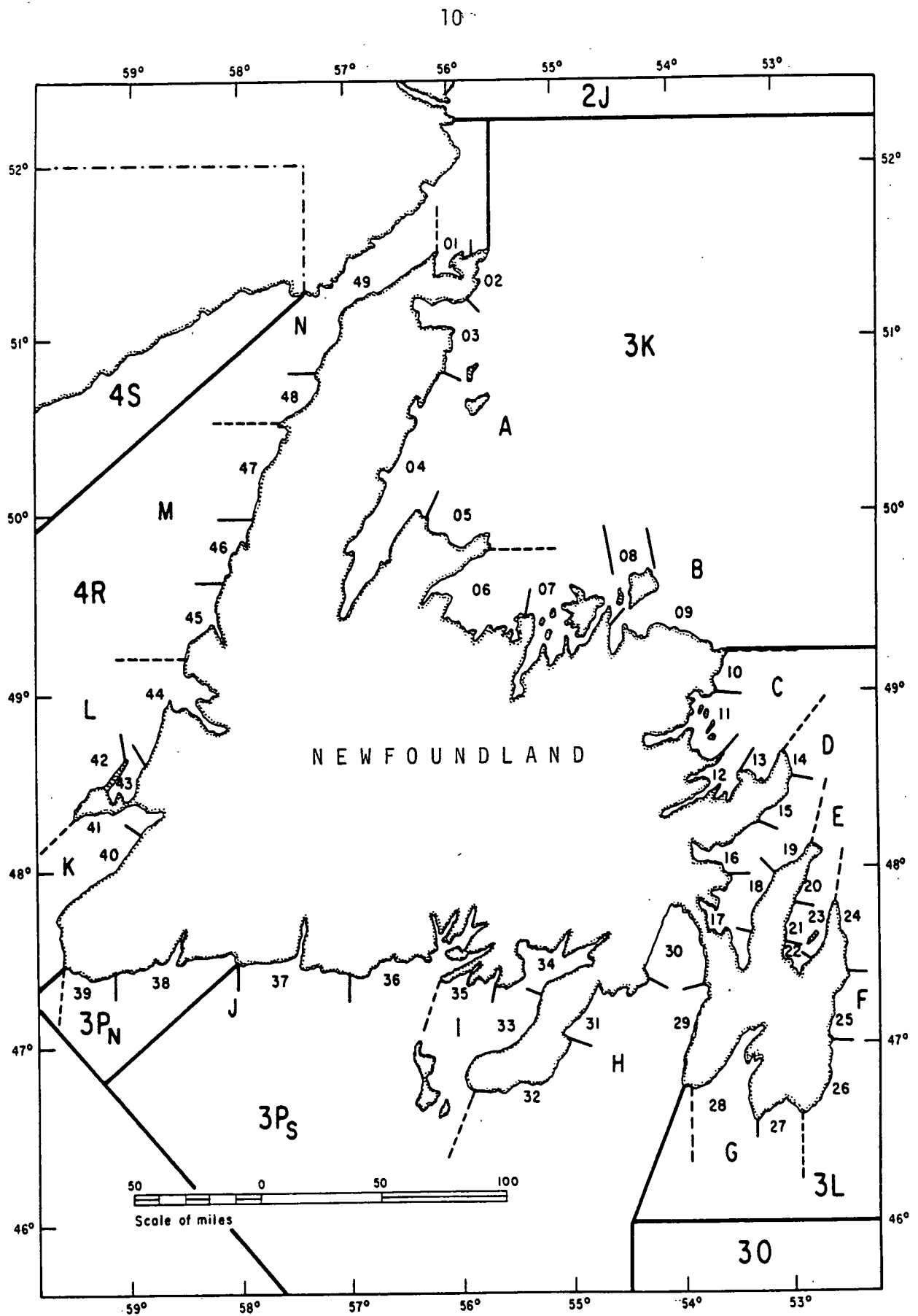


Fig. 1. The relationship between Statistical Areas (dotted lines), Sections (solid lines) and ICNAF Divisions (double solid lines and blocked-in letters) for coastal Newfoundland.

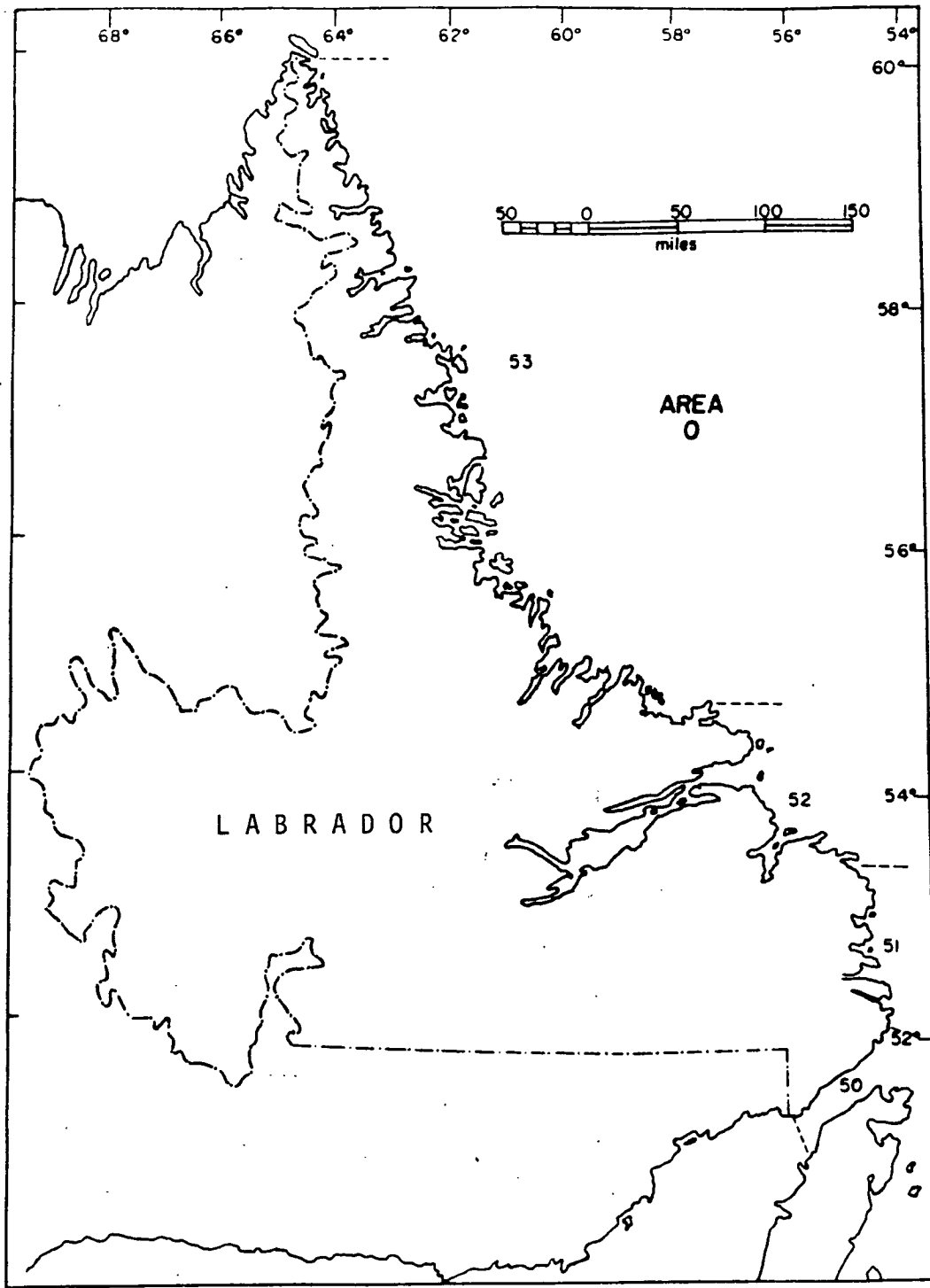


Fig. 2. The relationship between Statistical Areas and Sections (dotted lines) for coastal Labrador.