NOT TO BE CITED WITHOUT
AUTHORS' PERMISSION

Research Document 79/3
ACFF Subcommittee

The Stock Composition of Atlantic Salmon off West Greenland and in the Labrador Sea in 1978 and a Comparison to Other Years

by

D.G. Reddin, R.F. Burfitt and W.H. Lear

Abstract

The yearly proportions of North American origin salmon caught in research vessel catches at West Greenland were 1969-51%, 1970-35%, 1971-34%, 1972-36%, 1973-49%, 1974-43%, 1975-44%, 1976-43% and 1978-38%. The salmon landings at West Greenland are presented by continent of origin for 1969-1978. The continental proportion was positively correlated with latitude in 1972 at West Greenland and with time at West Greenland in 1974. The continental proportion was negatively correlated with time in the Labrador Sea. Individual fish movement is random but fish from a particular continent or even individual stocks tend to be grouped together in time and space at West Greenland.

Introduction

The development and subsequent expansion of the West Greenland salmon fishery has been well documented (Gulland 1967; Parrish 1968, 1970 and 1974). Equally well documented have been the catches of salmon at West Greenland (Parrish 1976, 1978). Unfortunately, detailed information on the effort expended in the fishery is not known for all years and, what information there is, tends to be unreliable.

The West Greenland fishery exploits salmon from stocks originating in most of the salmon-producing countries of North America and Europe; and concern for these stocks and for the homewater fisheries based on them, led in 1965 to the establishment of the ICES/ICNAF Joint Working Party on North Atlantic Salmon. The principal questions asked by the Working Party were:

(1) What is the proportion of the original population that visits Greenland?

(2) What is the proportion of these that are caught at Greenland?

(3) What is the proportion of those fish which avoid capture at Greenland and survive to return to home waters?

(4) What is the growth of the fish between the times of the Greenland and home fisheries?

(5) What is the proportion of the returning fish caught in home waters?

Thus, it is important to know the proportion of North American and European salmon, the relative contributions from different regions of each continent, the stock composition changes during the fishing period, and the stock composition changes from year to year.

Payne (1973) developed a method based on serum transferrin electrophoresis to estimate the contributions of North American and European salmon. Unfortunately, it was not useful for separating fish into their different North American stocks or stock complexes. Lear and Sandeman (1974) utilized a discriminant function based on scale characters to separate salmon caught at Greenland into their continent of origin. The function developed by Lear and Sandeman is used in this paper to analyze research vessel catches made in 1978 at West Greenland and the Labrador Sea. These results are then compared to the analyses of W.H. Lear (unpublished data) in 1969-77.

Materials and Methods

The 1978 samples were collected from the M.V. "Atkinson" which operated in Greenland coastal waters and the Labrador Sea (Fig. 1) from August 22 until September 6, 1978 (Table 1). The samples were collected in the areas of greatest fishing concentrations except those from 1E and 1F (Fig. 2) where the availability of salmon decreased later in August due to the presence of heavy ice and low water temperatures. Up to 3000 fath of drift nets (monofilament gillnets) were used at each set, and were arranged in basic units of 30 nets as follows: 10 monofilament, 127 mm (5 inch); 10 monofilament, 140 mm (5 1/2 inch); and 10 monofilament, 155 mm (6 inch).

Scales were taken from the left side of the fish between 3-6 scale rows above the lateral line, and on a line extending from the posterior edge of the dorsal fin to the anterior edge of the anal fin. The right side above the lateral line or general body area was used as an alternative area. Impressions of these scales were made on plastic slides and then examined on the ground glass screen of a microprojector under 30X. Counts of the circuli in the 2nd river zone (CR_2) and 1st sea zone (CS_1) were made. Only those circuli were counted that continued intact within an angle of 10° on each side of a line drawn through the longest axis of the scale. As with Lear (1972) and Lear and Sandeman (1974) the criteria used for exclusion or inclusion of circuli were similar to those used by Tanaka et al. (1969).

The discriminant function used was that of Lear and Sandeman (1974), and is based on CR_2 and CS_1 involving two linear discriminant functions to solve three unknowns (those fish of North American origin either wild or hatchery and European origin). Those scales lacking CR_2

were separated by hand utilizing CS_1 where a count of 35 or less circuli characterize those fish of North American origin and greater than 35 are European origin fish.

Results

The continent of origin, sampling dates, sizes, and positions are presented in Table 1. Unfortunately, only set numbers 1, 2, 3, 5 and 10 had reasonable sample sizes (Table 1). It was necessary to combine samples in the same divisions as the reported catches in spite of significant differences between the North American proportions in samples within divisions. For example, samples 1 and 2 are significantly different at less than the 5% level of significance and thus should not be combined whereas samples 3 and 5 were not significantly different at 5% and can be combined. The sample from the Labrador Sea (Table 2a) was significantly different from the total West Greenland sample at less than the 1% level; thus, the proportion of North American origin salmon caught at West Greenland in 1978 was 37.5% (41.3, 33.6) and in the Labrador Sea was 60.7% (73.5, 47.9).

The landings of North American origin salmon at West Greenland during the 1978 fishing season are derived from the North American proportion and the salmon landings (Table 2b). Whether the proportion by ICNAF area is applied to the landings by area or whether the average West Greenland proportion is applied to the total West Greenland landings makes very little difference, 386 metric tons as opposed to 372 by the latter method. However, as certain North American stocks tend to be caught in larger numbers in one area than another, these area landings can be important (Ruggles and Ritter 1979). As well, if samples were available from those areas poorly sampled or not at all, then the total could change significantly.

The comparability of the research vessel catches and the commercial catches during 1978 is unknown. In 1972, Lear and Sandeman (1974) demonstrated that the North American proportion in the research vessel catches did not differ significantly from that of the commercial drift net catch. However, little information is available on the inshore gillnet fishery. But as the mesh sizes are similar to those in the drift net fishery it was assumed that the continental proportions would be similar.

Discussion

Comparisons on a yearly basis are very difficult due to the variations in sample sizes, times and locations. However, the yearly proportions (%) of North American origin salmon are presented in Table 3a. In spite of the sampling problems, it is evident that the proportion and hence stocks of North American salmon both wild and hatchery have fluctuated from year to year. The yearly proportions can be grouped as follows on the basis of the 5% level of significance: 1969, 1970-72, 1973, 1974-76 and 1978. Thus, as the proportion changes for these years or groups of years the relative abundance of North American salmon, European salmon or both must also fluctuate yearly. The Labrador Sea samples show similar fluctuations if the spring and autumn collections are examined separately (Table 3b). It is obvious that the stocks of North American salmon are concentrated in greater proportion in the Labrador Sea than at West Greenland; that the proportions of North American salmon are greater in the Labrador Sea during the spring than in the autumn; and that the autumn proportions vary more than the spring. In the autumn, salmon can be found at West Greenland as well as the Labrador Sea and the abundance probably relates to hydrographic conditions as well as food abundance. May (1972) has indirectly related the movements of salmon to Greenland and the Labrador Sea via ocean currents in the North Atlantic. Templeman (1967) has pointed out that the large anti-clockwise eddy in the south Labrador Sea offers favourable conditions for the concentration of salmon because of the abundant food present there.

The daily variation in the North American proportion in catches at West Greenland (unpublished data, W.H. Lear, and Table 1) indicates the aggregations of individual stocks of fish at West Greenland. In 1974, in approximately the same position, research vessel catches showed proportions of 52% North American on one day and 21% the next; while later in the year, in October, the catches were much more stable (W.H. Lear, unpublished data). Thus, to provide a reliable estimate, as many samples as possible should be made throughout the fishing season in each of the fishing divisions. The homewater tag returns, both European and Canadian, indicate that salmon from one country or river system may be more abundant in particular ICNAF Divisions at certain times of the season (Ruggles and Ritter 1979; Swain 1979). Obviously, it can be concluded that mixing rates of fish vary considerably at West Greenland. The tagging studies at West Greenland support this, in that there would appear to be very little mixing of stocks north and south. Those fish tagged in 1C appeared to be caught randomly throughout 1C with a few fish being caught in 1B and 1D (Møller Jensen, 1979).

The distribution from inshore to offshore of North American and European fish appears to be random especially within 60 miles of the coast. This is logical if examined in the light of the feeding patterns (Lear 1979). However, as the catches and hence abundance can vary considerably from east to west (Christensen and Lear 1979) so can the total catches of both European or North American origin fish.

Thus, the following hypothesis for fish movement in the coastal waters of West Greenland is presented:

> Individual fish movement is random, but fish from a particular continent and fish from a particular stock tend to be grouped in certain areas at certain times at West Greenland so that more fish of a particular stock or stocks are concentrated in one area than another.

Thus the proportion of North American or European salmon can be reduced simply to one of time and space depending on the distance these fish have to travel and when they depart from home rivers. Fig. 3 shows the variation with time of the North American proportion using ungrouped data from samples taken in 1974. The r^2 equals 0.58 and the regression was significant when analyzed by Anova ($F = 13.85$) at less than the .01 level of significance. Therefore, in 1974 the proportion of North

(

American fish increased with time at West Greenland, but how this relates to abundance is not known, as the catches by month are not available for 1974. Other years' data were examined but did not show any statistically significant results when analyzed with time as the independent variable.

Fig. 4 depicts the variation with time of the proportion of North American salmon in the Labrador Sea using ungrouped data but combining 4 years in the same regression. The correlation between time and proportion of North American fish is negative which is the opposite of that shown by Fig. 3. When Fig. 3 is overlaid on Fig. 4 so that the times coincide, it is obvious that as the North American proportion decreases in the Labrador Sea, it increases at West Greenland. Unfortunately, there is very little, if any, information on abundance in the Labrador Sea, as there is not a commercial fishery there, so this may only be a relative increase in European stocks or decrease in North American as they move into the West Greenland area.

Previous analyses (Lear and Sandeman 1974) have shown that the proportion of North American salmon varies inversely with latitude in both the Labrador Sea and at West Greenland. As reported by Lear and Sandeman (1974), there is a discontinuity occurring at approximately the Cape Farewell area in southern Greenland (Fig. 5). The regression of Labrador Sea data was calculated using individual samples over 4 years while the one for West Greenland is with grouped data from August in 1972 only. When samples from individual years or for all years were combined, the correlation was not significant because of the variations between samples and years. Thus, as this relationship was only significant for combined samples and given the wide fluctuation in the confidence intervals, it undoubtedly did exist in 1972 although it may have been rather weak. But the 1972 data were collected from all the areas of the fishery throughout the season and the lack of significance of this relationship in other years may only be due to the small sample sizes and short periods of sampling. However, this is only an index of relative abundance and should not be examined in isolation to catch but, unfortunately, the total catches by month and area are not available for 1972.

The data contained in Table 4 is an attempt to establish a grid system of North American proportions at West Greenland. It cannot be used for yearly predictions on a monthly by area basis because of the yearly variations and lack of data in some areas and times.

Summary

1. A hypothesis is presented: individual fish movement is random, but fish from a particular stock tend to be grouped in certain areas at certain times at West Greenland so that more of a particular stock or stocks are concentrated in one area than another.

2. The distribution of salmon (of European or North American origin) from inshore to offshore is random.

3. The relationship of proportion on latitude that existed for the 1972 samples did not exist in any other year, although this may be due to poor sample sizes and distribution of the sampling sites.

4. The linear relationship of proportion on time at both West Greenland and in the Labrador Sea proved to be significant, and was negatively correlated with time in the Labrador Sea and positive at West Greenland.

Acknowledgements

The authors' kindly acknowledge the assistance of T. R. Porter, J. D. Pratt and Y. Coté who reviewed the manuscript. Mrs. J. Lannon typed the manuscript while K. Hiller did the calculations for the tables.

References

Christensen, O., and W.H. Lear. 1979. Distribution and abundance of Atlantic salmon at West Greenland. Rapport et Proces Verbaux on North Atlantic salmon (in press).

Gulland, J.A. 1967. Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, 1966. ICES Co-op. Res. Rep., Ser. A, No. 8, 27 p.

Lear, W.H. 1972. Scale characteristics of Atlantic salmon from various areas in the North Atlantic. ICES, Anacat Committee, C.M. 1972/M:10, 9 p.

Lear, W.H., and E.J. Sandeman. 1974. Use of scale characters and a discriminant function for identifying continental origin of Atlantic salmon. ICNAF Res. Doc. 74/40, Ser. No. 3226, 12 p.

Lear, W.H., and R.H. Payne. 1975. A comparison of scale analysis and serum electrophoresis as methods of determining the stock composition of Atlantic salmon off West Greenland in 1974. ICES, Anacat Committee, C.M. 1975/M:5, 7 p.

Lear, W.H. 1979. Food of Atlantic salmon in the West Greenland-Labrador Sea area. Rapport et Proces Verbaux on North Atlantic salmon (in press).

May, A.W. 1972. Distribution and migration of salmon in the Northeast Atlantic. Int. Atlantic Salmon Symposium. Special Publication Series, Vol. 4, No. 1, 373-396.

Møller Jensen, J. 1979. Recaptures from international tagging experiments at West Greenland. Rapport et Proces Verbaux on North Atlantic salmon (in press).

Parrish, B.B. 1968. Second Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, May 1968, ICES Co-op. Res. Rep. Ser. A, No. 12, 18 p.

1970. Third Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, December 1970, ICES Co-op. Res. Rep. Ser. A, No. 24, 36 p.

1974. Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, March 1974, ICES, Anacat Committee, C.M. 1974/M: 2, 38 p.

1976. Salmon catches in 1975. ICES, Anacat Committee, C.M. 1976/M:18, 2 p.

1978. West Greenland, Norwegian Sea and Home Waters Salmon Catches in the North Atlantic in 1976 and 1977. ICES, Anacat Committee, C.M. 1978/M:22, 7 p.

Payne, R.H. 1973. The use of serum transferrin polymorphism to determine the stock composition of Atlantic salmon in the West Greenland fishery. ICES, Anacat Committee, C.M. 1973/M:8, 7 p.

Payne, R.H., W.H. Lear, and J. Møller Jensen. 1976. The stock composition off West Greenland in 1976. ICES, Anacat Committee, C.M. 1976/M:8, 5 p.

Ruggles, C.P., and J.A. Ritter. 1979. Review of North Atlantic salmon tagging to assess the Atlantic salmon fishery off West Greenland. Rapport et Proces Verbaux on North Atlantic salmon (in press).

Swain, A. 1979. Tagging of salmon smolts in European rivers with special reference to recapture off West Greenland in 1972 and earlier years. Rapport et Proces Verbaux on North Atlantic salmon (in press).

Tanaka, S., M.P. Shepard, and H.T. Bilton. 1969. Origin of chum salmon (Oncorhynchus keta) in offshore waters of the North Pacific in 1956-1958 as determined from scale studies. Int. North. Pac. Fish. Comm. Bull. 26: 57-155.

Templeman, W. 1967. Atlantic salmon from the Labrador Sea and off West Greenland, taken during A.T. Cameron cruise, July-August, 1965. ICNAF Res. Bull. No. 4: 5-40.

Table 7 Sampling sites and continent of origin of Atlantic salmon caught at West Greenland during 1978.

Set number	Dates	Position	ICNAF area	Sample size	Number *NA	Number NAH	Number E	% NA	% NAH	% E
1	Aug. 22-23	65°02'N 52°57'W	1C	15	1	0	14	06.7	00	93.3
2	Aug. 23-24	66°08'N 54°04'W	1C	419	127	20	272	30.3	4.8	64.9
3	Aug. 25	67°12'N 54°18'W	1B	43	21	2	20	48.8	4.7	46.5
4	Aug. 27	66°51'N 54°21'W	1B	3	2	0	1	66.7	0	33.3
5	Aug. 27-28	67°14'N 54°14'W	1B	116	44	7	65	37.9	6.0	56.0
6	Aug. 31	63°13'N 51°23'W	1D	5	1	0	4	20.0	0	80.0
7	Sept. 1	61°24'N 49°14'W	1E	2	1	1	0	50.0	50.0	0
8	Sept. 2	60°49'N 48°44'W	1E	3	0	0	3	0	0	100.0
9	Sept. 3-4	56°21'N 47°33'W	1F Labrador Sea	1	1	0	0	100.0	0	0
10	Sept. 5-6	55°11'N 54°09'W	Labrador Sea	55	31	2	22	56.4	3.6	40.0

* NA - North American
NAH - North American hatchery
E - European

Tabl(2a. A breakdown, from scales, of the probable continent of origin of Atlantic salmon caught at W. Greenland and the Labrador Sea by the M.V. "Atkinson" in the autumn of 1978 (by ICNAF areas).

Area	Number Examined	% N.A.	% N.A.H.	% E	% N.A. & N.A.H.	% E
1B	162	41.4	05.5	53.1	46.9	53.1
1C	434	29.5	04.6	65.9	34.1	65.9
1D	5	20.0	00.0	80.0	20.0	80.0
1E	5	20.0	20.0	60.0	40.0	60.0
Labrador Sea East (1F)	1	100.0	00.0	00.0	100.0	00.0
Labrador Sea West	55	56.4	03.6	40.0	60.0	40.0

NA = North American
NAH = North American Hatchery
E = European

Greenland	606	32.5	05.0	62.5	37.5	62.5
Labrador Sea	56	57.1	03.6	39.3	60.7	39.3

Table 2b. The landings of salmon at West Greenland in 1978 of North American origin.

ICNAF Area	North American Proportion (%)	*West Greenland Landings kg	N. American Origin kg	95% from confidence intervals		Catch	
				Upper	Lower	Upper kg	Lower kg
**1A	37.5	186,000	69,750	.413	.336	76,818	62,496
1B	46.9	238,000	111,622	.546	.392	129,948	93,296
1C	34.1	245,000	83,545	.386	.296	94,570	72,520
**1D	37.5	186,000	69,750	.413	.336	76,818	62,496
**1E	37.5	127,000	47,625	.413	.336	52,451	42,672
**1F	37.5	10,000	3,750	.413	.336	4,130	3,360
Total	-	992,000	386,042	-	-	434,735	336,840
% Total	37.5	992,000	372,000	.413	.336	409,696	333,312

*data provided by Sv.Aa. Horsted

**In view of the poor sample sizes from these areas the average for West Greenland is used.

Table 3a. The proportion and landings by continent of origin of Atlantic salmon caught at West Greenland, 1969-78.

Date	Proportion North Amer. Wild & Hatchery (%)	95% Confidence Intervals Upper (%)	95% Confidence Intervals Lower (%)	North American Hatchery (%)	West Greenland Landings (tonnes)	North American Component (tonnes)	Range Upper (tonnes)	Range Lower (tonnes)	North American Hatchery Component (tonnes)	European Component (tonnes)
1969	51	57	44	8	2210	1127	1260	972	177	1083
1970	35	43	26	14	2146	751	922	558	300	1395
1971	34	40	28	5	2689	914	1076	753	134	1775
1972	36	37	34	7	2113	761	782	718	148	1352
1973	49	59	39	1	2341	1147	1381	913	23	1194
1974	43	46	39	6	1917	824	882	748	115	1093
1975	44	48	40	4	2030	893	974	812	81	1137
1976	43	48	38	6	1175	505	564	447	71	670
*1977	41	-	-	6	1420	582	-	-	85	838
1978	38	41	34	5	992**	377	407	337	50	615

* Unweighted average 1969-1976, 1978.
**Data provided by Sv.Aa. Horsted

Table 3b. The proportions by continent of origin of Atlantic salmon caught in the Labrador Sea in the spring and autumn.

Autumn					Spring				
Year	North American Wild & Hatchery	95% Confidence Intervals	Hatchery Only	Europe	Year	North American Wild & Hatchery	95% Confidence Intervals	Hatchery Only	Europe
1969	50	15-85	13	50	-				
1970	67	56-78	6	33	1970	87	77-97	7	13
1971	82	76-87	6	18	1971	93	88-97	7	7
1972	75	68-82	2	25	1972	90	80-99	0	10
1977	58	52-65	4	42	-				
1978	61	48-73	4	39	-				

Table 4. A breakdown, from scales, of the probable continent of origin of Atlantic salmon caught at West Greenland and the Labrador Sea for 1969-78.

1969

ICNAF Area	April	August	September	October	November	December	Totals
1A			51.5, 8.3 169	38.5, 15.4 13			50.6, 8.8 182
1B			45.0, 5.0 20				45.0, 5.0 20
1C			66.7, 0.0 6				66.7, 0.0 6
1D							
1E							
1F			50.0 0.0 4				50.0 0.0 4
Totals			51.3, 7.5 199	38.5, 15.4 13			50.5, 8.0 212
Labrador Sea			50.0, 12.5 8				50.0, 12.5 8

North American wild & hatchery %, N.A. hatchery %
Sample size
e.g. 51.5, 8.3
169

Table 4. (Cont'd)

1970 ICNAF Area	April	August	September	October	November	December	Totals
1A			62.5, 12.5 8				62.5, 12.5 8
1B			32.4, 14.7 102				32.4, 14.7 102
1C			33.3, 11.1 9				33.3, 11.1 9
1D			40.0, 20.0 5				40.0, 20.0 5
1E			33.3, 0.0 3				33.3, 0.0 3
1F							
Totals			34.7, 14.2 127				34.7, 14.2 127
Labrador Sea	86.7, 6.7 45			35.7, 3.6 28			67.1, 5.5 73

North American wild & hatchery %, N.A. hatchery %   e.g.   51.5, 8.3
Sample size   169

Table 4. (Cont'd)

1971

ICNAF Area	May	August	September	October	November	December	Totals
1A			28.6, 0.0 7				28.6, 0.0 7
1B			37.1, 4.8 210				37.1, 4.8 210
1C			12.0, 0.0 25				12.0, 0.0 25
1D			40.0, 20.0 5				40.0, 20.0 5
1E							
1F							
Totals			34.4, 4.5 247				34.4, 4.5 247
Labrador Sea	92.7, 6.6 137		43.9, 2.4 41				81.5, 5.6 178

North American wild & hatchery %, N.A. hatchery % / Sample size   e.g. 51.5, 8.3 / 169

Table 4. (Cont'd)

1972

ICNAF Area	April	August	September	October	November	December	Totals
1A		33.3, 0.0 3	23.1, 7.7 13				25.0, 6.3 16
1B		35.2, 7.4 162	31.8, 8.2 110				33.8, 7.7 272
1C		37.8, 8.9 548	26.1, 5.8 138				35.4, 8.3 686
1D		38.1, 5.8 226	43.3 6.7 30	38.2, 5.9 34			38.6, 5.9 290
1E		45.6, 5.9 239	33.3, 4.8 21	51.9, 22.2 27			45.3, 7.3 287
1F		47.5, 2.5 40					47.5, 2.5 40
Totals		39.3, 7.3 1218	30.1, 6.7 312	44.3, 13.1 61			*37.7, 7.4 1591
Labrador Sea	89.5, 0.0 38	74.8, 2.0 151					77.8, 1.6 189

North American wild & hatchery %, N.A. hatchery % e.g. 51.5, 8.3
Sample size 169

*37.7, 7.4 (research vessels) + 34.1, 6.2 (commercial vessels) = 35.7, 6.7
1591 1892 3488

Table 4. (Cont'd)

1973 ICNAF Area	April	August	September	October	November	December	Totals
1A							
1B							
1C							
1D		60.0, 0.0 15	43.3, 3.3 30	44.4, 0.0 27	46.2, 0.0 26	100.0, 0.0 1	47.5, 1.0 99
1E							
1F			100.0, 0.0 3				100.0, 0.0 3
Totals		60.0, 0.0 15	48.5, 3.0 33	44.4, 0.0 27	46.2, 0.0 26	100.0, 0.0 1	49.0, 1.0 102
Labrador Sea							

North American wild & hatchery %, N.A. hatchery %
Sample size
e.g. 51.5, 8.3
169

Table 4. (Cont'd)

<u>1974</u>

ICNAF Area	April	August	September	October	November	December	Totals
1A							
1B							
1C							
1D		34.0, 7.0 417	47.2, 1.9 53	57.8, 5.7 263			43.5, 6.1 733
1E		34.7, 6.9 101					34.7, 6.9 101
1F							
Totals		34.2, 7.0 518	47.2, 1.9 53	57.8, 5.7 263			42.5, 6.2 834
Labrador Sea							

North American wild & hatchery %, N.A. hatchery % e.g. 51.5, 8.3
Sample size 169

Table 4. (Cont'd)

1975 ICNAF Area	April	August	September	October	November	December	Totals
1A							
1B							
1C							
1D		43.8, 4.4 528					43.8, 4.4 528
1E							
1F							
Totals		43.8, 4.4 528					43.8, 4.4 528
Labrador Sea							

North American wild & hatchery %, N.A. hatchery % e.g. 51.5, 8.3
Sample size 169

Table 4. (Cont'd)

1976

ICNAF Area	April	August	September	October	November	December	Totals
1A							
1B							
1C							
1D		38.1, 6.1 278	61.5, 3.9 26	46.7, 6.7 15	44.4, 0.0 9	100.0, 0.0 1	40.7, 5.8 329
1E		50.6, 6.6 91					50.6, 6.6 91
1F							
Totals		47.4, 6.2 369	61.5, 3.9 26	46.7, 6.7 15	44.4, 0.0 9	100.0, 0.0 1	42.9, 6.0 420
Labrador Sea							

North American wild & hatchery %, N.A. hatchery % e.g. 51.5, 8.3
Sample size 169

Table 4. (Cont'd)

1977

ICNAF Area	April	August	September	October	November	December	Totals
Labrador Sea				58.3, 3.5 228			58.3, 3.5 228

North American wild & hatchery %, N.A. hatchery % e.g. 51.5, 8.3
Sample size 169

Table 4. (Cont'd)

1978

ICNAF Area	April	August	September	October	November	December	Totals
1A							
1B		46.9, 5.6 162					46.9, 5.6 162
1C		34.1, 4.6 434					34.1, 4.6 434
1D		20.0, 0.0 5					20.0, 0.0 5
1E			40.0, 20.0 5				40.0, 20.0 5
1F							
Totals		37.4, 4.8 601	40.0, 20.0 5				37.5, 5.0 606
Labrador Sea			60.7, 3.6 56				60.7, 3.6 56

North American wild & hatchery %, N.A. hatchery % e.g. 51.5, 8.3
Sample size 169

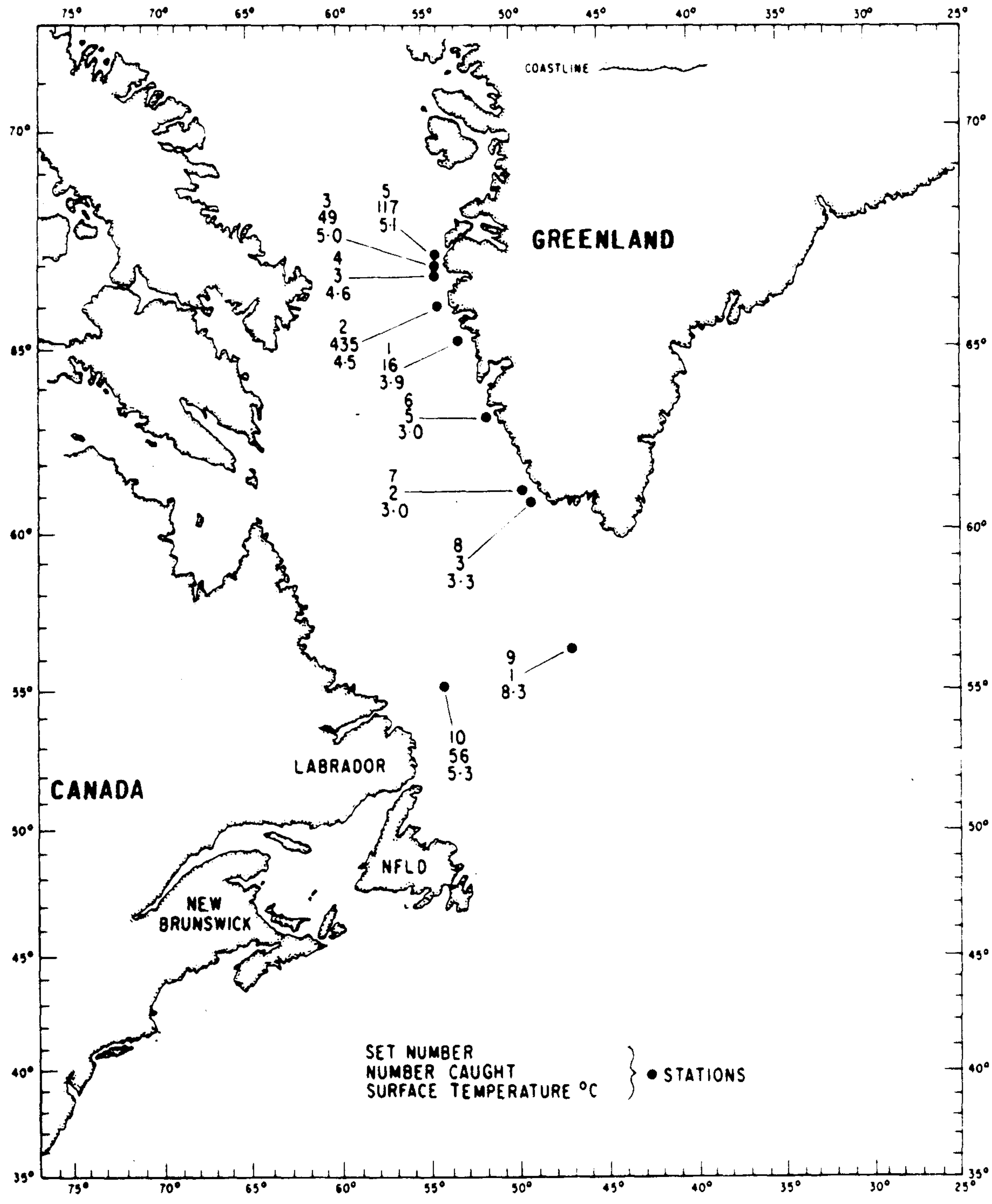

Fig. 1. The fishing stations occupied by M. V. Atkinson, August 22-September 6, 1978.

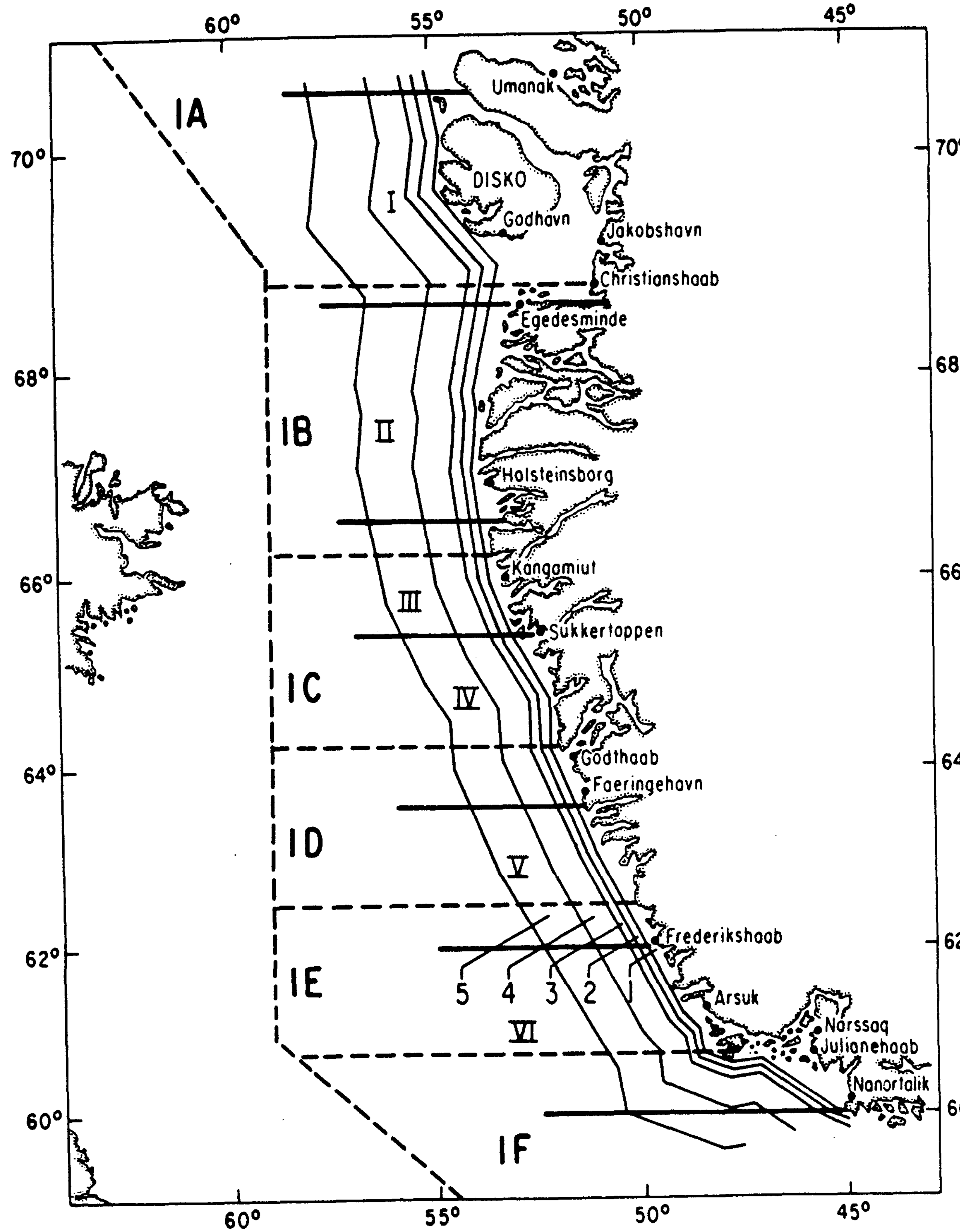

Fig. 2. Map of West Greenland with ICNAF Divisions (1A - 1F), fishing areas (I - VI) and subareas (1 - 5).

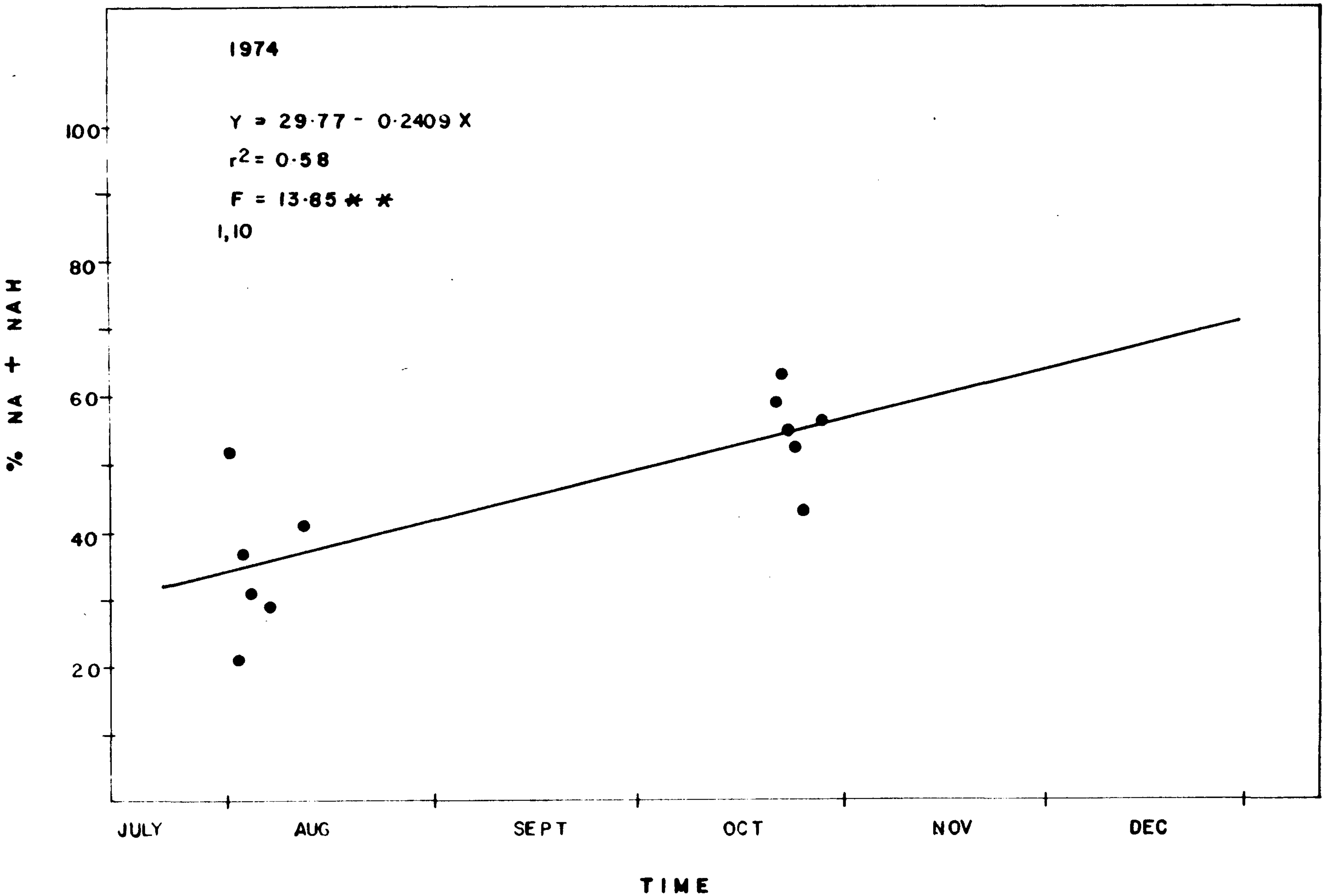

Fig. 3.. The variation with time of North American stock of salmon at West Greenland.

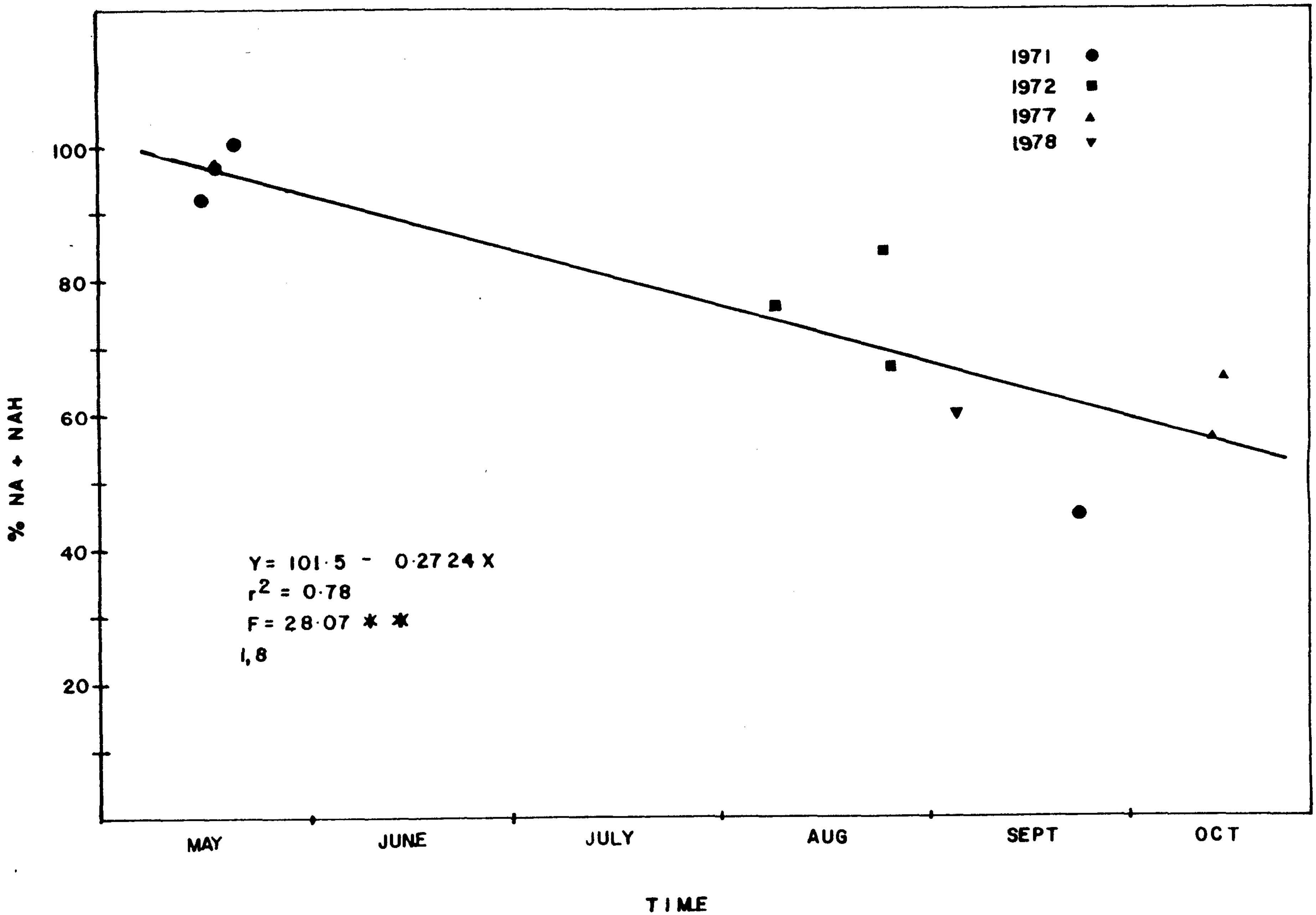

Fig. 4. The variation with time of North American stocks of salmon in the Labrador Sea.

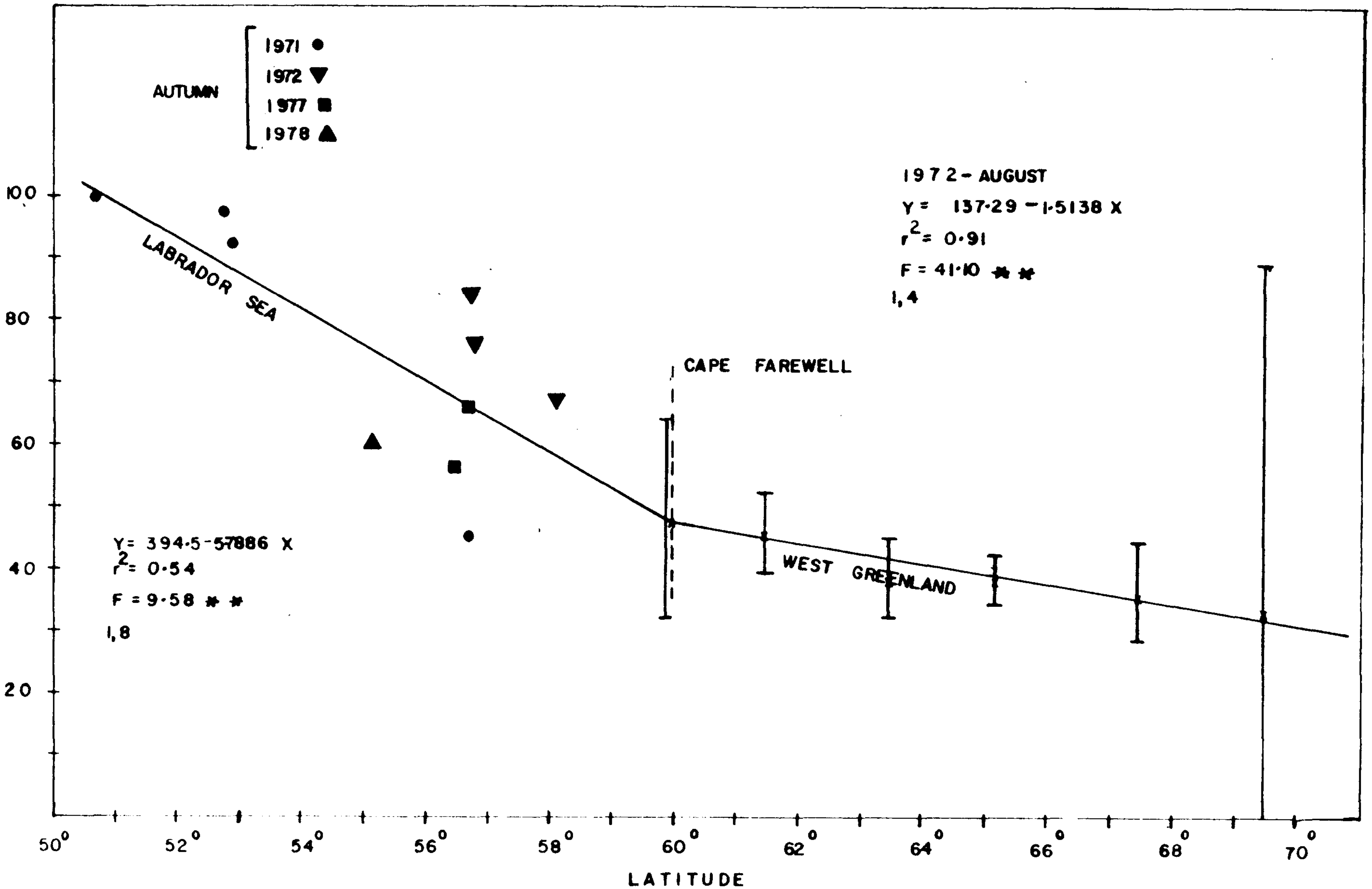

Fig. 5. The variation with latitude of North American stocks of salmon in the Labrador Sea and at West Greenland.