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Proportion of North American and European Atlantic Salmon off  
West Greenland in 1980

by

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ABSTRACT

The proportion of salmon of North American origin in samples from commercial catches at West Greenland in 1980 was 48% and in the research vessel catch was 58%. The exploited stock at West Greenland in 1980 consisted of 59.0% North American origin salmon. The relative abundance of North American salmon at West Greenland has increased from 1978 to 1980. The proportion of salmon of North American origin decreased in the commercial samples from south to north.

RESUME

La proportion des saumons d'origine nord-américaine au Groenland occidental en 1980 était de 48 % dans les échantillons commerciaux et de 58 % dans les prises par navire de recherche. Le stock exploité dans cette région cette année-là comprenait 59,0 % de saumons d'origine nord-américaine. L'abondance relative des saumons d'origine nord-américaine au Groenland occidental augmenta entre 1978 et 1980. Dans les échantillons commerciaux, la proportion des saumons nords-américains diminua du sud au nord.

## INTRODUCTION

The development and subsequent expansion of the West Greenland salmon (*Salmo salar* L.) fishery has been well documented (Gulland 1967; Parrish 1968, 1970 and 1974; Anon. 1979 and 1980). Equally well documented have been catches of salmon at West Greenland (Parrish 1976, 1978 and Anon. 1979 and 1980).

The West Greenland fishery exploits salmon that would return to home waters as multi-sea-winter salmon (Anon. 1980) from stocks originating in most of the salmon producing countries of North America and Europe. Concern for these stocks and homewater fisheries based on them led in 1965 to the establishment of the ICES/ICNAF Joint Working Party on North Atlantic salmon. This Working Group assessed the West Greenland fishery in terms of losses to homewater stocks and catches of salmon that if not caught at West Greenland would return to homewaters.

Lear and Sandeman (1980) utilized a discriminant function based on scale characters to separate salmon caught at Greenland into their continent of origin. The proportions of these populations at West Greenland have been reported by Reddin and Burfitt (1980) for 1969-1979 (exclusive of 1977). The discriminant function developed by Lear and Sandeman was used in this paper to analyze samples from research vessel and commercial catches made in 1980 at West Greenland.

## MATERIALS AND METHODS

The 1980 samples were collected from the R. V. "A. T. Cameron" which operated in Greenland coastal waters from August 10 until August 27, 1980 (Fig. 1). The samples were collected from the areas of greatest commercial fishing concentration and where salmon were assumed to be most abundant. A fleet of drift nets (monofilament gillnets) 3700 m long was fished at each station, alternating 126 and 142 mm mesh nets (size of mesh opening) in the fleet.

During the research vessel cruise, salmon were also sampled in fish plants at Holsteinsborg and Godthaab. Prior to the cruise a sample was obtained from the Godthaab fish plant by the Greenland Fisheries Investigations of the Danish Ministry for Greenland (O. Christensen and K. Leeman). The first Godthaab sample and the Holsteinsborg sample are the catch of one fisherman over a five day period. The second Godthaab sample was from the small boat fishery that begins after the main fishery ends and is the catch of several boats.

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 at 30X. Counts of the circuli in the second river zone (CR<sub>2</sub>) and first sea zone (CS<sub>1</sub>) were made. Only those circuli were

counted that continued intact within an angle of 10 degrees on each side of a line drawn through the longest axis of the scale. As with Lear (1972) and Lear and Sandeman (1980), 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 (1980), 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 both wild and hatchery). A few fish classified by discriminant function as North American hatchery were reclassified as North American wild ( $CS_1$  less than 35) or European ( $CS_1$  greater than 35) because growth in the river zone did not typify the hatchery type. 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 of European origin.

## RESULTS AND DISCUSSION

It was estimated from analysis of scale characters of Atlantic salmon collected in fish plants at Godthaab and Holsteinsborg in 1980 that 467 of the 978 specimens sampled were of North American origin (47.7% North American, 95% confidence intervals 50.9% and 44.6%) (Table 1). The same scale characteristics from research vessel samples indicated that 358 of 617 specimens caught were of North American origin (58.0% North American, 95% confidence interval 61.9% and 54.1%) (Table 2). The difference of 10.3% between the North American proportion in research and commercial samples is significant at the 5% level of significance. This indicates that the commercial fishery was exploiting a different component of the population than research vessel catches were. Research vessel fishing in conjunction with commercial samples showed similar proportions of North American stocks in these catches in 1972 and 1979. The influence of gear selectivity on the size of fish caught (Doubleday and Reddin 1980) and the fact that North American salmon at West Greenland are significantly shorter than their European counterparts effects the proportions caught at West Greenland (Reddin 1979). In 1979, 126, 142 and 154 mm mesh sizes were fished by research vessel at West Greenland; in 1980, the larger mesh was dropped because the commercial fishery was reported to be using mainly 120 to 140 mm gear (Anon. 1980). The difference between the North American proportion in the research and commercial landings suggests that gear larger than 140 mm is fished. A fishing vessel landing catch at Godthaab was fishing gear with a mean mesh size of 159 mm. The Manager of a fish plant in Holsteinsborg reported that most of the gear in use by fishermen from that harbour ranged from 146 to 150 mm. Better information on effort and mesh size fished at West Greenland by commercial fishermen is essential.

In 1980, the North American proportion in commercial samples from Area 1D was 50.5% and 43.5% in 1B; a significant decrease from south to north ( $P < 0.05$ ). The North American proportion in research samples increased from south to north but the increase was not significant (Table 3). The North American proportion in samples collected by research vessel decreased significantly from south to north in 1972 (Reddin et al. 1979) and increased in 1979 in commercial samples (Reddin and Burfitt 1980).

Doubleday and Reddin (1981) state that due to gear selectivity samples collected in 1969-71 and in 1980 overestimate the proportions of North American salmon in the exploited population at West Greenland. The most unbiased mesh sizes would be 127, 140 and 152 mm (size of mesh opening) or 140 mm to measure the proportion in the exploited population. Thus, in 1980 the best estimate of the North American proportion of 1-sea-winter salmon in the exploited population is represented by the catch in the 142 mm nets; which was 58.8% (64.3%, 53.3%) (Table 4). Comparisons of the continental proportions of either North American or European origin salmon on a yearly basis are very difficult due to variations in sample sizes, times, locations and mesh sizes of the gear fished. However, the yearly proportions of North American origin salmon in the exploited population at West Greenland have varied from a high of 59% in 1980 to a low of 34% in 1971 (Table 5). The changes in proportion over these years probably reflects relative changes in abundance of North American and/or European origin salmon in the West Greenland area due to changes in migration routes or variations in annual production. It is evident using the best estimates for continental proportions in the exploited population that the North American proportion has increased from 38% in 1978, to 47% in 1979 to 59% in 1980. This may reflect greater abundance of North American multi-sea-winter salmon at West Greenland in response to stock rebuilding efforts on these stocks.

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Table 1. The stock composition from samples of commercial catches caught at West Greenland in 1980.

Sampling location	Sampling dates (dates caught)	NAFO division	Numbers					Percentage of		
			NA	NAH	E	Total	Not Determined	NA	NAH	E
Godthaab	7/8/80	1D	102	23	172	297	4	34.4 (40,29)	7.7 (11,5)	57.9 (64,52)
Holsteinsborg	16/8/80 (9-14/8/80)	1B	146	20	216	382	1	38.2 (43,33)	5.3 (7,3)	56.5 (62,52)
Godthaab	25/8/80 (17-23/8/80)	1D	165	11	123	299	2	55.2 (61,50)	3.7 (6,2)	41.1 (47,36)
Total			413	54	511	978	7	42.2 (45,39)	5.5 (7,4)	52.3 (55,49)

NA - North American wild, NAH - North American hatchery, E - European wild and hatchery

North American Origin - 47.7% (50.9, 44.6)  
 European Origin - 52.3% (55.4, 49.1)  
 (upper limit, lower limit) of 95% confidence limit

Table 2. The stock composition of Atlantic salmon caught by research vessel at West Greenland in 1980.

NAFO	Number					Percentage of		
	NA	NAH	E	Total	Not determined	NA	NAH	E
1A-1B	17	1	5	23	0	73.9 (93,55)	04.4 (13,0)	21.7 (40,4)
1C-1D	315	25	254	594	6	53.0 (57,49)	04.2 (6,3)	42.8 (47,39)
Total	332	26	259	617	6	53.8 (58,50)	04.2 (6,3)	42.0 (46,38)

North American Origin	-	58.0% (61.9, 54.1)
European Origin	-	42.0% (45.9, 38.1)
(upper limit, lower limit) of 95% confidence interval		

Table 3. The stock composition of Atlantic salmon caught by research vessel at West Greenland in 1980.

Set Number	Date	NAFO division	Number					Percentage of		
			NA	NAH	E	Total	Not determined	NA	NAH	E
1	12/8/80	1C	17	3	18	38	0	44.7 (61,28)	07.9 (17,0)	47.4 (64,30)
2	13/8/80	1C	38	5	40	83	0	45.8 (57,35)	06.0 (11,1)	48.2 (59,37)
3	13/8/80	1C	36	3	12	51	0	70.6 (83,58)	05.9 (12,0)	23.5 (36,12)
4	14/8/80	1C	34	2	31	67	0	50.7 (63,38)	03.0 (7,0)	46.3 (59,34)
5	14/8/80	1C	6	0	3	9	0	66.7 (100,30)	0	33.3 (70,0)
6	15/8/80	1B	1	0	0	1	0	100.0	0	0
7	16/8/80	1B	2	0	0	2	0	100.0	0	0
8	17/8/80	1B	14	1	5	20	0	70.0 (92,48)	05.0 (15,0)	25.0 (45,5)
9	19/8/80	1C	40	5	37	82	0	48.8 (60,38)	06.1 (11,1)	45.1 (56,34)
10	20/8/80	1C	32	1	17	50	0	64.0 (78,50)	2.0 (6,0)	34.0 (48,21)



Table 3. (Cont'd).

Set Number	Date	NAFO division	Number					Percentage of		
			NA	NAH	E	Total	Not determined	NA	NAH	E
11	20/8/80	1C	10	0	18	28	1	35.7 (54,19)	0	64.3 (83,46)
12	21/8/80	1C	39	1	28	68	1	57.3 (69,45)	01.5 (4,0)	41.2 (53,29)
13	21/8/80	1C	4	0	11	15	1	26.7 (51,2)	0	73.3 (98,49)
14	22/8/80	1C	52	5	32	89	3	58.4 (69,48)	05.6 (10,1)	36.0 (46,26)
15	22/8/80	1C	1	0	3	4	0	25.0 (94,0)	0	75.0 (100,6)
16	23/8/80	1D	6	0	4	10	0	60.0 (95,25)	0	40.0 (75,5)
Total			332	26	259	617	6	53.8 (58,50)	04.2 (6,3)	42.0 (46,38)

North American Origin-58.0% (61.9, 54.1)

European Origin-42.0% (45.9, 38.1)

(upper limit, lower limit) at 95% confidence limit

Table 4. Percentage (by number) of North American and European salmon caught by research vessel in 142 and 126 mm mesh nets.

Mesh (mm)	North American			95% confidence interval		Percentage European	95% confidence interval		Sample size	Not determined
	Wild	Hatchery	Total	Upper	Lower		Upper	Lower		
126	52.4	4.9	57.3	63.1	51.6	42.7	48.4	36.9	286	3
142	55.1	3.9	59.0	64.4	53.5	41.0	46.5	35.6	312	3
Unknown	52.6	0	52.6			47.4			19	0
1SW Only										
126	51.7	5.0	56.7	62.5	51.0	43.3	49.0	37.5	282	
142	54.9	3.9	58.8	64.3	53.3	41.2	46.7	35.7	306	

Table 5. Percentage (by number) of North American and European salmon in research vessel catches at West Greenland 1969-1980 and from commercial samples 1979-80.

Year	Percentage North American wild plus hatchery	95% confidence interval		Percentage North American hatchery fish	Percentage European	95% confidence interval	
		Upper	Lower			Upper	Lower
RESEARCH							
1969	51	57	44	8	49	56	43
1970	35	43	26	14	65	74	57
1971	34	40	28	5	66	72	50
1972	36	37	34	7	64	66	63
1973	49	59	39	1	51	61	41
1974	43	46	39	6	57	61	54
1975	44	48	40	4	56	60	52
1976	43	48	38	6	57	62	52
1977	-	-	-	-	-	-	-
1978(a)	38	41	34	5	62	66	59
1978(b)	44	47	41	4	56	59	53
1979	47	52	41	5	53	59	48
1980	58	62	54	4	42	46	38
COMMERCIAL							
1979	50	52	48	4	50	52	48
1980	48	51	45	6	52	55	49

(a) during fishery

(b) includes research samples after fishery closed

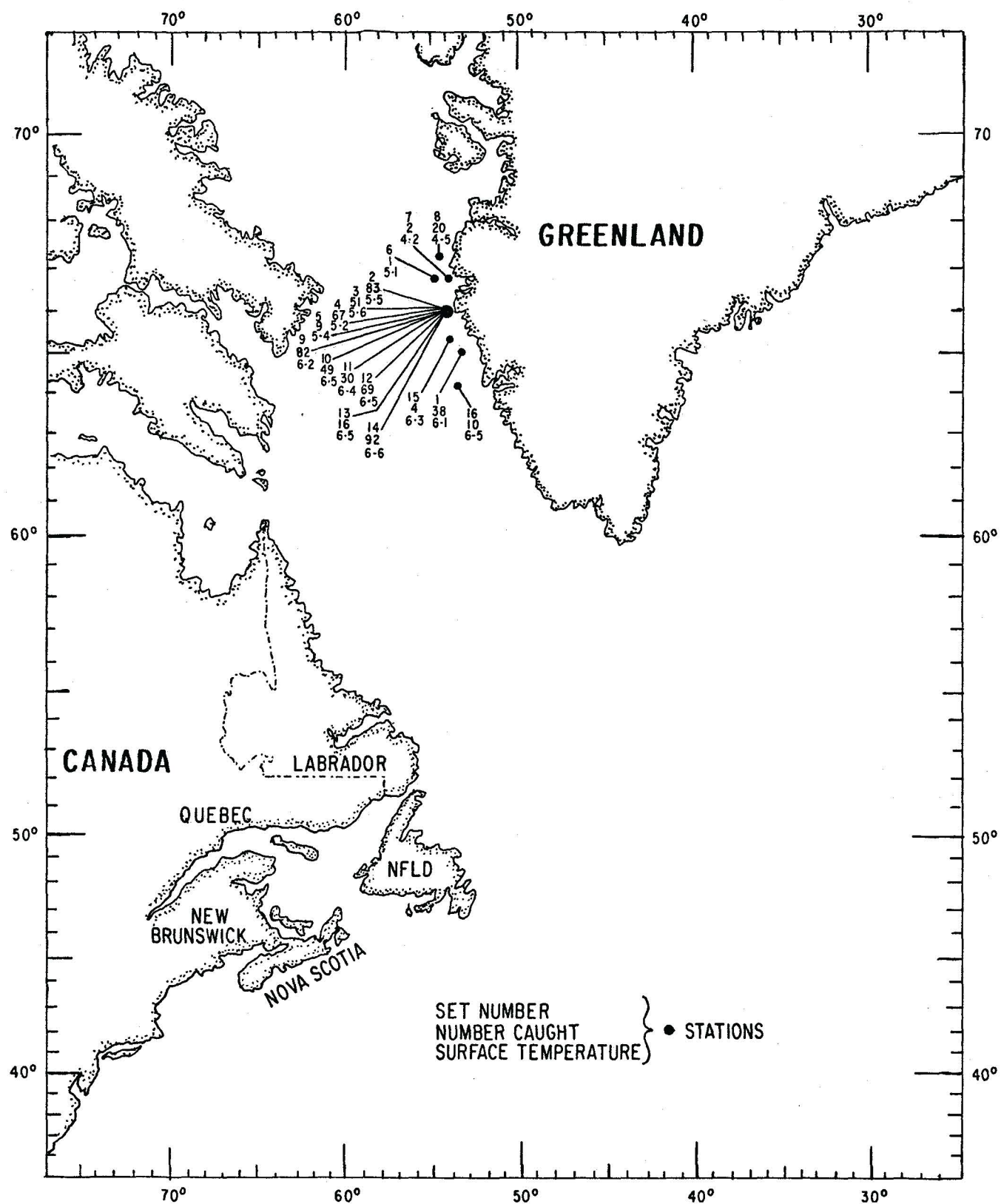


Fig. 1. The stations, catch, set numbers and water temperatures from research drift netting at West Greenland in 1980.