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Length, weight, sex and age characteristics of Atlantic salmon (Salmo salar) of North American and European origin caught at West Greenland in 1979

by

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Abstract

Atlantic salmon (Salmo salar L.) from research vessel catches and samples of commercial catches at West Greenland in 1979 were analyzed for fork length, weight and smolt age differences among fish identified to continent of origin (either North American wild or hatchery, or European origin). There were no significant differences in the fork lengths, weights and smolt ages of male and female salmon, of salmon caught in NAFO Div. 1AB and 1CD, and of salmon caught by research vessel and by commercial fishery. However, North American wild origin salmon were shorter, weighed less, and had a higher mean smolt age than did salmon of European origin. The sex ratio was 1: 2.69 (males:females) in the research vessel catches. The sea-age composition in the West Greenland commercial catches was sea-age 1-96.6%, sea-age 2-2.1% and previous spawners-1.3%.

Résumé

Nous avons analysé les données sur des saumons atlantiques (Salmo salar L.) capturés par navire de recherche et dans les échantillons commerciaux au Groenland occidental en 1979 afin de détecter des différences possibles de longueur à la fourche, de poids et d'âge des smolts entre sujets dont le continent d'origine avait été identifié (soit d'origine nord-américaine, sauvage ou d'élevage, soit européenne). La longueur à la fourche, le poids et l'âge des smolts ne diffèrent pas de façon significative entre les mâles et le femelles chez les saumons capturés dans les divisions 1AB et 1CD de l'OPANO, et chez les saumons capturés par navire de recherche et dans la pêche commerciale. Cependant, les saumons nords-américains d'origine sauvage sont plus courts, pèsent moins et ont un âge moyen de smolts plus élevés que les saumons d'origine européenne. La proportion des sexes est de 1:2,69 (mâles:femelles) dans les prises par navire de recherche. La composition par âge en mer des prises commerciales au Groenland occidental est la suivante : âge en mer 1-96,6 %; âge en mer 2-2,1 %; reproducteurs récidivistes - 1,3 %.

Introduction

Research vessel catches since the late 1960's have been used to define the biological characteristics of Atlantic salmon exploited at West Greenland (Munro and Swain 1980). Recent analyses have used this information in a mathematical model analyzing losses to homewater stocks (Ritter et al. 1980). This paper reports and analyzes biological characteristics of catches from both commercial samples taken at fish plants and research vessel catches by drift gillnets at sea.

Methods

Samples were collected from "M.V. Zagreb" which operated in Greenland coastal waters from August 8, 1979 to September 7, 1979 (Reddin and Burfitt 1979). Research vessel samples were collected using 5000 m of monofilament driftnets (gillnets). They were arrayed in basic units of 3 nets as follows: 1 monofilament, 126 mm; 1 monofilament, 142 mm; and 1 monofilament, 154 mm so that equivalent amounts of each mesh size were fished in a single array at each set. Mesh size is length of mesh opening. Commercial catches were examined randomly at fish plants at Frederikshaab, Godthaab, Holsteinsborg and Egesdesminde. The fish were sampled for fork length (FL) to the nearest centimetre, gutted weight head-on (GW) to the nearest 1/10th of a kilogram, sex and then a scale sample was taken from the left side of the fish between 3 to 6 scale rows above the lateral line, on a line extending from the posterior edge of the dorsal fin to the anterior edge of the anal fin. The smolt age, sea age, spawning marks and reliability (on a scale of 1-4) were then interpreted from these scales after impressions were made on plastic slides. In addition, the salmon from research vessel catches were weighed for gutted weight (GW) and round weight (RW) to the nearest 1/10th of a kilogram. The linear relationship of GW on RW from research catches was used to convert the gutted weights of the commercial plant samples to round weights.

Individual specimens were categorized, using scale analysis techniques of Lear and Sandeman (1980) and Reddin et al. (1979) as (1) North American wild, (2) North American hatchery, or (3) European origin including wild and hatchery.

Computer programs used to calculate analysis of variance (ANOVA) and analysis of covariance (ANCOVA) were Biomedical Computer Programs - BMDP7D and BMDP1V (Dixon and Brown 1979). The ANOVA program included Levene's test for homogeneity of variance and where this proved significant, the Brown-Forsythe statistic which does not assume equality of variances was used (Brown and Forsythe 1974).

Results and Discussion

The linear relationship between whole weight and gutted weight was significant ($F_{1,322} = 9135.97$, $P < 0.0001$, $r^2 = 0.98$) and the relationship of $Y = -0.06439 + 1.1824X$ was used to convert gutted weights to round weight (Figure 1). Comparisons of the research samples showed that within the population from each continent male and female salmon had similar fork lengths ($F = 0.138$, $P = 0.711$), whole weights ($F = 1.446$, $P = 0.230$) and smolt ages ($F = 3.079$, $P = 0.080$). Thus in further analyses male and female fish were combined.

Table 1a and 1b shows fork length distributions of North American wild, North American hatchery and European origin salmon sampled from research net catches and commercial catches respectively. Comparisons of these frequency distributions by Kolmogorov-Smirnov test showed that there was no difference between samples caught by research nets or commercial nets.

In both research and commercial samples (1SW only) mean fork lengths of North American wild were significantly shorter than European origin salmon (Tables 2a and 2c, $F = 7.501$, $P < 0.001$ and $F = 90.68$, $P < 0.0001$) when tested by analysis of variance (ANOVA). Tables 2b and 2d show the mean fork lengths of salmon that had previously spawned and were caught in research and commercial nets. In both research and commercial samples (1SW only) mean whole weights of North American wild were significantly less than those for European origin salmon (Tables 3a and c, $F = 6.959$, $P = 0.001$ and $F = 32.479$, $P < 0.0001$). Tables 3b and d show mean weights of salmon that had previously spawned and were caught in research and commercial nets. In both research and commercial samples mean smolt ages (1SW only) of North American origin salmon were significantly higher than those of European origin (Tables 4a and b, $F = 46.219$, $P < 0.0001$ and $F = 270.02$ and $P < 0.00001$).

The effect of sample type, that is commerical or research was examined using 2 way ANOVAs of continent of origin and sample type comparing fork lengths, gutted weights and smolt ages of 1SW fish. For fork lengths there was no significant differences between either sample type ($F = 1.01$, $P = 0.32$) and there was no interaction effect between continent of origin and sample type ($F = 0.30$, $P = 0.74$). For gutted weights there was no significant difference between either sample type ($F = 0.02$, $P = 0.88$) and there was no significant interaction effect between continent of origin and sample type ($F = 1.43$, $P = 0.24$). For smolt age there was no significant difference between either sample type ($F = 0.47$, $P = 0.49$) and there was no significant interaction effect between continent of origin and sample type ($F = 1.13$, $P = 0.32$).

For combined commercial and research samples (1SW only) ANOVAs comparing mean fork lengths ($F = 69.852$, $P < 0.0001$), mean whole weights ($F = 39.351$, $P < 0.0001$) and mean smolt age ($F = 317.914$, $P < 0.0001$) showed that North American wild salmon were shorter, lighter and had a higher mean smolt age than European origin salmon. Because the Levene's test for homogeneity of variance proved significant for fork length ($F = 7.22$, $P = 0.0008$) and mean smolt age ($F = 18.86$, $P < 0.0000$), further analysis was carried out. The fork lengths and mean smolt ages of North American wild, North Amercan hatchery and European origin salmon were significantly different for the Brown-Forsythe statistic ($F = 164.79$, $P < 0.0000$ and $F = 161.21$, $P < 0.0000$) respectively. It was shown after correcting for unequal variance that North American wild salmon were shorter and had a higher mean smolt age than their European counterparts.

The effect of area was analyzed by ANOVA for the combined research and commercial sample types. There was no significant difference between mean fork lengths of salmon in NAFO Div. 1AB and 1CD. ($F = 0.954$, $P = 0.329$). The 2 way interactions between mean fork lengths of salmon of North American wild and hatchery and European origin in NAFO Div. 1AB and 1CD was also not significant ($F = .146$, $P = 0.864$). There was no significant difference between mean whole weights of salmon in NAFO Div. 1AB and 1CD ($F = 3.335$, $P = 0.068$). The 2-way interactions between mean whole weights of salmon of North American wild and hatchery and European origin was also not significant ($F = 0.669$, $P = 0.414$).

There was no significant difference between mean smolt age of salmon in NAFO Div. 1AB and 1CD ($F = 2.374$, $P = 0.124$). The 2-way interactions between mean smolt age of salmon of North American wild and hatchery and European origin was also not significantly different ($F = 0.708$, $P = 0.493$).

To test the hypothesis that the weights of fish weighed on shore were similar to those on the research vessel and verify the conversion factor of gutted to whole weight calculated from research vessel samples; analysis of covariance (ANCOVA) between research and commercial samples of gutted weight on fork length for North American wild, North American hatchery and European origin salmon from commerical samples showed that slopes were significantly different ($F = 8.33$, $P < 0.003$) as were adjusted mean weights ($F = 5.30$, $P < 0.005$). Therefore, all comparisons between sample types were done separately for North American wild, North American hatchery and European origin salmon. For North American wild origin salmon, ANCOVA showed that the slopes of gutted weight on fork length relationships were similar ($F = 0.36$, $P = 0.55$) for both commercial and research samples but that adjusted mean gutted weights of research samples were about 4% heavier than those of commercial samples. For North American hatchery origin salmon ANCOVA showed that the slopes of gutted or fork length relationships were similar ($F = 0.002$, $P = 0.97$) as were adjusted mean gutted weights ($F = 0.10$, $P = 0.76$). For European origin salmon, ANCOVA showed that the slopes of gutted weight on fork length relationships were similar ($F = 1.39$, $P = 0.24$) for both research and commercial samples but that the adjusted mean gutted weights of research samples were about 5% heavier than commercial samples ($F = 37.23$, $P < 0.0001$). Thus, the weights of fish sampled by research vessel are about 4.52% heavier than those sampled in commercial fish plants. This difference is attributed to the difficulty of weighing fish on research vessels. It does not however affect the reliability of conversion factors calculated from research vessel samples as both the gutted and whole weights would be equally effected.

In 1979, the research samples consisted of 96.7%, 1-sea-winter salmon; 1.8%, 2-sea-winter salmon; and 1.5% previous spawners (Table 5a). The commercial samples consisted of 96.6%, 1-sea-winter fish; 2.1%, 2-sea-winter fish and 1.3% previous spawners (Table 5b). Munro and Swain (1980) reported that during the 1972 International Salmon Tagging Experiment the research vessels underestimated the two-sea-winter fish caught by the commercial fishery. They reported that 92.0% of the fish caught by the research vessels were one-sea-winter fish, 6.4% were 2-sea-winter fish, and less than 1% had previously spawned. Munro and Swain (1980) also reported a significant increase in 1-sea-winter fish and subsequent decrease in 2-sea-winter fish southwards. In 1978, 97.9% were 1-sea-winter, 1.0% were 2-sea-winter, and 1.1% previous spawners (Reddin and Burfitt 1979). Comparison of the 1978 samples with 1972 and 1979 is difficult because the majority of the samples in 1978 were from 1B and 1C whereas Munro and Swain's data came from the whole coast. However, it is evident from comparing 1972 and 1979 that the stocks currently at West Greenland consists of less 2-sea-winter fish than was previously the case.

Salmon of European, North American wild and North American hatchery origin have been compared for fork lengths, whole weights and smolt ages from samples collected in 1978 (Reddin and Burfitt 1979) and 1979. In all cases fish of North American wild origin were significantly shorter, lighter and of higher mean smolt ages than European origin salmon.

Salmon of smolt ages from 1 to 7 years were found in the catches at West Greenland. The North American wild origin salmon smoltified predominantly after 2 and 3 years spent in the river while fish of European origin smoltified predominantly after 1 and 2 (Tables 6a and b). If the samples in NAFO Div. 1B, 1C and 1D were compared, it can be seen that salmon of higher river age composition are found further north. This compares favourably with data collected between 1965 and 1972 (Munro and Swain 1980) and in 1978 (Reddin and Burfitt 1979). Templeman (1967), Lear (1972) and Lear and Misra (1978) have shown that smolt age increases from south to north along the east coast of North America. Thus, salmon from a northerly latitude are found further north at West Greenland.

The overall sex ratio at West Greenland was approximately 1: 2.7 (males and females, Table 7). Previously Reddin and Burfitt (1979) reported it was approximately 1:3 in 1978 and Munro and Swain (1980) reported it was 1:2.8 in 1972 and higher in previous years (1: between 3 and 4). If the fish are separated by continent of origin, it is apparent that the sex ratio of the North American wild fish of 1:2.83 is similar to 1:2.84 for European origin salmon (Table 7); although variations from area to area are apparent.

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Table 1a. The fork length frequency distribution by continent of origin and mesh size of Atlantic salmon caught at West Greenland in 1979 by research vessel.

Length Interval (cm)	North American			North American Hatch			European			Not Determined			Total
	126 mm mesh	142 mm mesh	154 mm mesh	126 mm mesh	142 mm mesh	154 mm mesh	126 mm mesh	142 mm mesh	154 mm mesh	126 mm mesh	142 mm mesh	154 mm mesh	
51	0	0	0	0	0	0	0	0	0	0	0	1	1
54	1	0	0	0	0	0	0	0	0	0	0	1	2
55	0	0	0	1	0	0	0	0	0	0	0	0	1
56	4	0	0	0	0	0	0	0	0	0	0	0	4
57	3	0	0	0	0	0	1	0	0	0	0	0	4
58	2	2	0	0	0	0	0	0	0	0	0	1	5
59	4	1	0	1	0	0	0	0	0	0	0	0	6
60	5	2	0	0	0	0	1	2	0	0	0	0	10
61	10	2	0	0	0	0	2	3	0	0	0	0	17
62	9	7	2	0	1	0	4	3	2	2	0	0	30
63	6	6	1	1	1	0	6	4	0	1	0	0	26
64	6	7	1	1	0	0	8	8	3	0	0	0	34
65	9	5	3	1	0	0	9	7	7	0	0	0	41
66	4	2	1	0	1	0	5	11	5	2	0	0	31
67	4	2	1	1	0	0	9	6	6	0	0	0	29
68	1	2	1	0	3	1	4	5	4	1	0	0	22
69	0	0	3	0	0	1	4	4	5	0	0	0	17
70	2	2	0	1	0	0	1	8	2	0	0	0	16
71	1	0	1	0	0	0	5	1	1	0	0	1	10
72	0	0	0	0	0	1	2	2	3	0	0	0	8
73	0	0	0	0	0	0	2	2	0	0	0	0	4
74	0	0	0	0	0	0	0	1	0	0	0	0	1
76	0	0	0	0	0	0	1	0	0	0	0	0	1
77	1	0	0	0	0	0	1	0	1	0	0	0	3
79	0	0	0	1	0	0	0	0	0	0	0	0	1
83	0	0	0	0	0	0	0	1	0	0	0	0	1
84	1	0	0	0	0	0	0	0	0	0	0	0	1
88	0	0	2	0	0	0	0	0	1	0	0	0	3
Total	73	40	16	8	6	3	65	68	40	6	0	4	329

Table 1b. The fork length frequency distribution by continent of origin of Atlantic salmon samples taken from commercial fishery at West Greenland in 1979.

Length Interval (cm)	North American	North American Hatchery	European	Origin not Determined	Total
52	1	0	0	0	1
53	2	0	0	0	2
54	3	1	0	0	4
55	4	0	0	1	5
56	12	0	0	0	12
57	18	0	1	0	19
58	27	0	1	0	28
59	38	3	4	0	45
60	69	2	11	0	82
61	76	5	18	0	99
62	67	4	45	0	116
63	81	3	64	0	148
64	77	6	58	0	141
65	55	10	81	0	146
66	62	5	97	0	164
67	43	6	109	0	158
68	39	4	93	0	136
69	27	5	70	0	102
70	17	5	63	0	85
71	13	2	47	1	63
72	3	0	20	0	23
73	4	0	13	0	17
74	0	2	2	0	4
75	0	0	8	0	8
76	2	0	2	0	4
77	3	0	1	0	4
78	3	0	1	0	4
79	0	0	1	0	1
80	3	0	2	0	5
81	4	0	0	0	4
82	4	0	1	0	5
83	1	0	0	0	1
84	2	0	0	0	2
85	1	0	1	0	2
86	2	0	1	0	3
87	3	0	0	0	3
88	0	0	2	0	2
90	1	0	0	0	1
91	0	0	3	0	3
92	1	0	0	0	1
93	1	0	1	0	2
Total	769	63	821	2	1655

Table 2 a. Comparison of mean fork length (cm) of each sea age class of Atlantic salmon by area and continent of origin (exclusive of previous spawners) caught by research vessel sampling in 1979.

Area	Sea age class 1 length	1 number	2 length	2 number	3 length	3 number	Total length	Total number
			North American (wild & hatchery) & European					
1B	64.7	102	73.5	2	-	0	64.9	104
1C	64.6	92	-	0	-	0	64.6	92
1D	65.3	95	85.0	3	-	0	65.9	98
1E	66.2	25	88.0	1	-	0	67.0	26
West Greenland	65.0	314	81.7	6	-	0	65.3	320
			North American Wild					
1B	62.7	46	70.0	1	-	0	62.9	47
1C	62.6	35	-	0	-	0	62.6	35
1D	63.3	38	86.0	2	-	0	64.4	40
1E	64.1	8	-	0	-	0	64.1	8
West Greenland	63.0	127	80.7	3	-	0	63.4	130
			North American Hatchery					
1B	65.4	5	-	0	-	0	65.4	5
1C	64.2	5	-	0	-	0	64.2	5
1D	66.6	5	-	0	-	0	66.6	5
1E	66.0	1	-	0	-	0	66.0	1
West Greenland	65.4	16	-	0	-	0	65.4	16
			European					
1B	66.4	51	77.0	1	-	0	66.6	52
1C	66.0	52	-	0	-	0	66.0	52
1D	66.7	52	83.0	1	-	0	67.0	53
1E	67.3	16	88.0	1	-	0	68.5	17
West Greenland	66.5	171	82.7	3	-	0	66.8	174

Table 2b. Comparison of mean fork length (cm) of Atlantic salmon that had previously spawned, caught by research vessel sampling in 1979.

Area	Sea age class 2 Mean	2 Number	3 Mean	3 Number	Total Previous Spawners Mean	Total Previous Spawners Number	*Total Salmon Mean	*Total Salmon Number
North American (wild and hatchery) and European								
West Greenland	65.5	2	81.3	3	75.0	5	65.5	325
North American Wild								
West Greenland	65.5	2	82.5	2	74.0	4	63.7	134
North American Hatchery								
West Greenland	-	0	79.0	1	79.0	1	66.2	17
European								
West Greenland	-	0	-	0	-	0	66.8	174

* Total number of previous spawners plus non-spawners from Table 2a.

Table 2c. Comparison of mean fork length (cm) of each sea age class of Atlantic salmon by area and continent origin (exclusive of previous spawners) taken from commercial fishery at West Greenland in 1979.

Area	Sea age class 1 mean	1 number	2 mean	2 number	3 mean	3 number	Total mean	Total number
			North American (wild & hatchery) & European					
1A	64.1	205	76.0	1	-	0	64.2	206
1B	65.7	528	80.5	10	-	0	65.9	538
1D	64.7	655	84.9	19	-	0	65.3	674
1E	65.7	210	81.7	6	-	0	66.1	216
West Greenland	65.1	1598	82.9	36	-	0	65.5	1634
			North American Wild					
1A	62.7	92	76.0	1	-	0	62.8	93
1B	63.4	244	80.0	9	-	0	64.0	253
1D	63.1	310	83.4	11	-	0	63.8	321
1E	64.0	79	82.0	5	-	0	65.0	84
West Greenland	63.2	725	81.7	26	-	0	63.9	751
			North American Hatchery					
1A	64.5	13	-	0	-	0	64.5	13
1B	65.8	22	-	0	-	0	65.8	22
1D	64.5	22	-	0	-	0	64.5	22
1E	68.5	6	-	0	-	0	68.5	6
West Greenland	65.3	63	-	0	-	0	65.3	63
			European					
1A	65.4	100	-	0	-	0	65.4	100
1B	67.8	261	85.0	1	-	0	67.8	262
1D	66.3	323	87.0	8	-	0	66.8	331
1E	66.5	124	80.0	1	-	0	66.7	125
West Greenland	66.7	808	86.1	10	-	0	66.9	818

Table 2d. Comparison of mean fork length (cm) of Atlantic salmon that had previously spawned, taken from commercial fishery at West Greenland in 1979.

Area	Sea age class: 2 mean	2 Number	3 mean	3 Number	Total Previous Spawners mean	Total Previous Spawners Number	*Total Salmon mean	*Total Salmon Number
			North American (wild and hatchery) and European					
West Greenland	64.3	10	78.9	11	72.0	21	65.6	1655
			North American Wild					
West Greenland	64.3	10	77.8	8	70.3	18	64.9	769
			North American Hatchery					
West Greenland	-	-	-	0	-	0	65.3	63
			European					
West Greenland	-	0	82.0	3	82.0	3	67.0	821

* Total number of previous spawners plus non-spawners from Table 2c.

Table 3a. Comparison of mean round weights (kg) of each sea age class of Atlantic salmon by area and continent of origin (exclusive of previous spawners) caught by research vessel sampling in 1979.

Area	Sea age class 1 mean	1 number	2 mean	2 number	3 mean	3 number	Total mean	Total number
North American (wild & hatchery) & European								
1B	3.37	101	6.20	2	-	0	3.42	103
1C	3.20	91	-	0	-	0	3.20	91
1D	3.34	94	8.67	3	-	0	3.50	97
1E	3.43	25	7.40	1	-	0	3.58	26
West Greenland	3.31	311	7.63	6	-	0	3.40	317
North American Wild								
1B	3.02	45	6.60	1	-	0	3.10	46
1C	2.88	35	-	0	-	0	2.88	35
1D	2.97	38	9.25	2	-	0	3.28	40
1E	3.10	8	-	0	-	0	3.10	8
West Greenland	2.97	126	8.37	3	-	0	3.09	129
North American Hatchery								
1B	3.46	5	-	0	-	0	3.46	5
1C	3.12	5	-	0	-	0	3.12	5
1D	3.54	5	-	0	-	0	3.54	5
1E	3.50	1	-	0	-	0	3.50	1
West Greenland	3.38	16	-	0	-	0	3.38	16
European								
1B	3.67	51	5.80	1	-	0	3.71	52
1C	3.42	51	-	0	-	0	3.42	51
1D	3.59	51	7.50	1	-	0	3.67	52
1E	3.59	16	7.50	1	-	0	3.82	17
West Greenland	3.56	169	6.90	3	-	0	3.62	172

Table 3b. Comparison of mean round weights (kg) of Atlantic salmon that had previously spawned, caught by research vessel sampling in 1979.

Area	Sea age class 2 mean	2 Number	3 mean	3 Number	Total Previous Spawners mean	Total Previous Spawners Number	* Total Salmon mean	* Total Salmon Number
			North American (wild and hatchery) and European					
West Greenland	3.50	2	5.60	3	4.76	5	3.42	322
			North American Wild					
West Greenland	3.50	2	5.75	2	4.63	4	3.14	133
			North American Hatchery					
West Greenland	-	0	5.30	1	5.30	1	3.49	17
			European					
West Greenland	-	0	-	0	-	0	3.62	172

* Total number of previous spawners plus non-spawners from Table 3a.

Table 3c. Comparison of mean round weights (kg) of each sea age class of Atlantic salmon by area and continent of origin (exclusive of previous spawners) taken from commercial fishery at West Greenland in 1979.

Area	Sea age class 1 mean	1 number	2 mean	2 number	3 mean	3 number	Total mean	Total number
				North American (wild & hatchery) & European				
1A	3.08	205	5.40	1	-	0	3.09	206
1B	3.26	486	6.63	10	-	0	3.33	496
1D	3.25	655	7.60	19	-	0	3.37	674
1E	3.28	210	6.95	6	-	0	3.38	216
West Greenland	3.23	1556	7.16	36	-	0	3.32	1592
				North American wild				
1A	2.86	92	5.40	1	-	0	2.89	93
1B	2.89	227	6.51	9	-	0	3.03	236
1D	2.99	310	7.27	11	-	0	3.14	321
1E	2.99	79	7.14	5	-	0	3.24	84
West Greenland	2.94	708	6.91	26	-	0	3.08	734
				North American hatchery				
1A	3.25	13	-	0	-	0	3.25	13
1B	3.43	22	-	0	-	0	3.43	22
1D	3.23	22	-	0	-	0	3.23	22
1E	3.78	6	-	0	-	0	3.78	6
West Greenland	3.36	63	-	0	-	0	3.36	63
				European				
1A	3.25	100	-	0	-	0	3.25	100
1B	3.60	236	7.70	1	-	0	3.62	237
1D	3.50	323	8.05	8	-	0	3.61	331
1E	3.44	124	6.00	1	-	0	3.46	125
West Greenland	3.49	783	7.81	10	-	0	3.54	793

Table 3d. Comparison of mean round weights (kg) of Atlantic salmon that had previously spawned, taken from commercial fishery at West Greenland in 1979

Area	Sea age class 2 mean	2 Number	3 mean	3 Number	Total Previous Spawners mean	Total Previous Spawners Number	* Total Salmon mean	* Total Salmon Number
			North American (wild and hatchery) and European					
West Greenland	2.86	10	5.29	10	4.07	20	3.33	1612
			North American Wild					
West Greenland	2.86	10	4.84	7	3.68	17	3.09	751
			North American Hatchery					
West Greenland	-	0	-	0	-	0	3.36	63
			European					
West Greenland	-	0	6.33	3	6.33	3	3.55	796

* Total number of previous spawners plus non-spawners from Table 3c.

Table 4a. Comparison of the mean smolt age (years) of each sea age class of Atlantic salmon by area and continent of origin caught by research vessel sampling in 1979.

Area		Sea Age				Number	
		1SW	2SW	3SW	Previous Spawners	Origin Not Determined	Sample[1]
1B	NA	2.8	2.0	-	4.3	0	51
	NAH	2.0	-	-	-	0	5
	E	1.8	3.0	-	-	0	52
	Total	2.3	2.5	-	4.3	11	119
1C	NA	2.6	-	-	-	0	35
	NAH	2.0	-	-	2.0	0	6
	E	1.8	-	-	-	0	52
	Total	2.1	-	-	2.0	0	93
1D	NA	2.7	2.0	-	-	0	40
	NAH	2.0	-	-	-	0	3
	E	1.9	1.0	-	-	0	53
	Total	2.2	1.7	-	-	0	96
1E	NA	2.3	-	-	-	0	8
	NAH	2.0	-	-	-	0	1
	E	1.9	1.0	-	-	0	16
	Total	2.0	1.0	-	-	1	26
West Green-land	NA	2.7	2.0	-	4.3	0	134
	NAH	2.0	-	-	2.0	0	15
	E	1.8	1.7	-	-	0	173
	Total	2.2	1.8	-	3.8	12	334

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

[1]Totals include fish where origin was not determined.

Table 4b. Comparison of the mean smolt age (years) of each sea age class of Atlantic salmon by area and continent of origin taken from commercial fishery at West Greenland in 1979.

Area		Sea age				Number	
		1SW	2SW	3SW	Previous Spawners	Origin not Determined	Sample
1A	NA	2.9	2.0	-	3.8	0	98
	NAH	1.8	-	-	0	0	12
	E	1.9	-	-	0	0	98
	Total	2.3	2.0	-	3.8	0	208
1B	NA	2.8	2.6	-	3.9	0	255
	NAH	1.5	-	-	0	0	22
	E	1.9	1.0	-	2.0	0	258
	Total	2.3	2.4	-	3.6	0	535
1D	NA	2.8	3.0	-	4.3	0	321
	NAH	1.4	-	-	0	0	21
	E	1.9	1.3	-	1.0	0	325
	Total	2.3	2.4	-	3.5	0	667
1E	NA	2.8	3.2	-	0	0	81
	NAH	1.2	-	-	0	0	5
	E	1.9	2.0	-	0	0	117
	Total	2.2	3.0	-	0	0	203
West Green-land	NA	2.8	2.9	-	3.9	0	755
	NAH	1.5	-	-	0	0	60
	E	1.9	1.4	-	1.7	0	798
	Total	2.3	2.5	-	3.6	0	1613

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

Table 5a. The sea age composition of Atlantic salmon caught at West Greenland in 1979 from research vessel samples.

Area		Sea Age Composition (%) 1SW	2SW	3SW	Previous Spawners	Number Origin Not Determined	Sample[1]
1B	NA	90.2	2.0	0	7.8	0	51
	NAH	100.2	0	0	0	0	5
	E	98.1	1.9	0	0	0	52
	Total	94.4	1.9	0	3.7	11	119
1C	NA	100.0	0	0	0	0	37
	NAH	83.3	0	0	16.7	0	6
	E	100.0	0	0	0	0	53
	Total	99.0	0	0	1.0	0	96
1D	NA	95.0	5.0	0	0	0	40
	NAH	100.0	0	0	0	0	5
	E	98.1	1.9	0	0	0	53
	Total	96.9	3.1	0	0	0	98
1E	NA	100.0	0	0	0	0	8
	NAH	100.0	0	0	0	0	1
	E	94.1	5.9	0	0	0	17
	Total	96.2	3.8	0	0	1	27
West Green- land	NA	94.9	2.2	0	2.9	0	136
	NAH	94.1	0	0	5.9	0	17
	E	98.3	1.7	0	0	0	175
	Total	96.7	1.8	0	1.5	12	340

[1]Totals include fish where origin was not determined.

Table 5b. The sea age composition of Atlantic salmon samples taken from commercial fishery at West Greenland in 1979.

Area		Sea age composition (%)				Number	
		1SW	2SW	3SW	Previous Spawners	Origin not Determined	Sample[1]
1A	NA	93.9	1.0	0	5.1	0	98
	NAH	100.0	0	0	0	0	13
	E	100.0	0	0	0	0	100
	Total	97.2	0.5	0	2.3	0	211
1B	NA	92.8	3.4	0	3.8	0	263
	NAH	100.0	0	0	0	0	22
	E	98.9	0.4	0	0.7	0	264
	Total	96.0	1.8	0	2.2	1	550
1D	NA	95.7	3.4	0	0.9	0	324
	NAH	100.0	0	0	0	0	22
	E	97.3	2.4	0	0.3	0	332
	Total	96.6	2.8	0	0.6	0	678
1E	NA	94.0	6.0	0	0	0	84
	NAH	100.0	0	0	0	0	6
	E	99.2	0.8	0	0	0	125
	Total	97.2	2.8	0	0	1	216
West Green-land	NA	94.3	3.4	0	2.3	0	769
	NAH	100.0	0	0	0	0	63
	E	98.4	1.2	0	0.4	0	821
	Total	96.6	2.1	0	1.3	2	1655

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

[1]Totals include fish where origin was not determined.

Table 6a. The smolt age composition at West Greenland in 1979 from research vessel samples.

Area		Smolt Age Composition (%)							Number	
		1	2	3	4	5	6	7	Origin Not Determined	Sample[1]
1B	NA	0	33.3	49.0	13.7	2.0	2.0	0	0	51
	NAH	0	100.0	0	0	0	0	0	0	5
	E	30.8	55.8	13.4	0	0	0	0	0	52
	Total	14.8	47.2	29.7	6.5	0.9	0.9	0	11	119
1C	NA	0	57.1	28.6	11.4	2.9	0	0	0	35
	NAH	0	100.0	0	0	0	0	0	0	6
	E	30.8	63.5	3.8	1.9	0	0	0	0	52
	Total	17.2	63.4	12.9	5.4	1.1	0	0	0	93
1D	NA	0	50.0	40.0	5.0	5.0	0	0	0	40
	NAH	0	100.0	0	0	0	0	0	0	3
	E	26.4	62.3	9.4	1.9	0	0	0	0	53
	Total	14.6	58.3	21.9	3.1	2.1	0	0	0	96
1E	NA	12.5	50.0	37.5	0	0	0	0	0	8
	NAH	0	100.0	0	0	0	0	0	0	1
	E	31.3	50.0	18.7	0	0	0	0	0	16
	Total	24.0	52.0	24.0	0	0	0	0	1	26
West Green- land	NA	0.7	45.5	40.3	9.7	3.0	0.8	0	0	134
	NAH	0	100.0	0	0	0	0	0	0	15
	E	29.5	59.5	9.8	1.2	0	0	0	0	173
	Total	16.1	55.6	22.1	4.7	1.2	0.3	0	12	334

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

[1]Totals include fish where origin was not determined.

Table 6b. The smolt age composition of Atlantic salmon samples taken from commercial fishery at West Greenland in 1979.

Area		Smolt age composition (%)							Number	
		1	2	3	4	5	6	7	origin not determined	sample
1A	NA	0	30.6	55.1	9.2	4.1	1.0	0	0	98
	NAH	41.7	50.0	0	8.3	0	0	0	0	12
	E	22.4	65.3	11.2	1.0	0	0	0	0	98
	Total	13.0	48.1	31.2	5.3	1.9	0.5	0	0	208
1B	NA	0.4	41.2	38.4	15.3	3.9	0.8	0	0	255
	NAH	50.0	50.0	0	0	0	0	0	0	22
	E	25.2	63.9	9.3	1.6	0	0	0	0	258
	Total	14.4	52.5	22.8	8.0	1.9	0.4	0	0	535
1D	NA	0.3	38.3	46.7	9.7	2.5	2.2	0.3	0	321
	NAH	57.1	42.9	0	0	0	0	0	0	21
	E	24.9	64.3	10.5	0.3	0	0	0	0	325
	Total	14.1	51.1	27.6	4.8	1.2	1.0	0.2	0	667
1E	NA	1.2	40.7	42.0	11.1	2.5	2.5	0	0	81
	NAH	80.0	20.0	0	0	0	0	0	0	5
	E	19.7	67.5	12.8	0	0	0	0	0	117
	Total	13.8	55.7	24.1	4.4	1.0	1.0	0	0	203
West Green-land	NA	0.4	38.5	44.5	11.7	3.2	1.6	0.1	0	755
	NAH	53.3	45.0	1.7	0	0	0	0	0	60
	E	23.9	64.8	10.5	0.8	0	0	0	0	798
	Total	14.0	51.8	26.0	5.9	1.5	0.7	0.1	0	1613

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

Table 7. The sex ratio of salmon caught at West Greenland in 1979.

Area	Ratio male:female	No. in sample	North American wild	North American hatchery	European
1B	1:1.95	118	1:1.78	1:1.50	1:2.47
1C	1:3.70	94	1:3.00	1:2.00	1:4.78
1D	1:3.62	97	1:7.00	0:5	1:2.25
1E	1:1.70	27	1:1.67	1:0	1:2.40
West Greenland	1:2.69	336	1:2.83	1:2.40	1:2.84

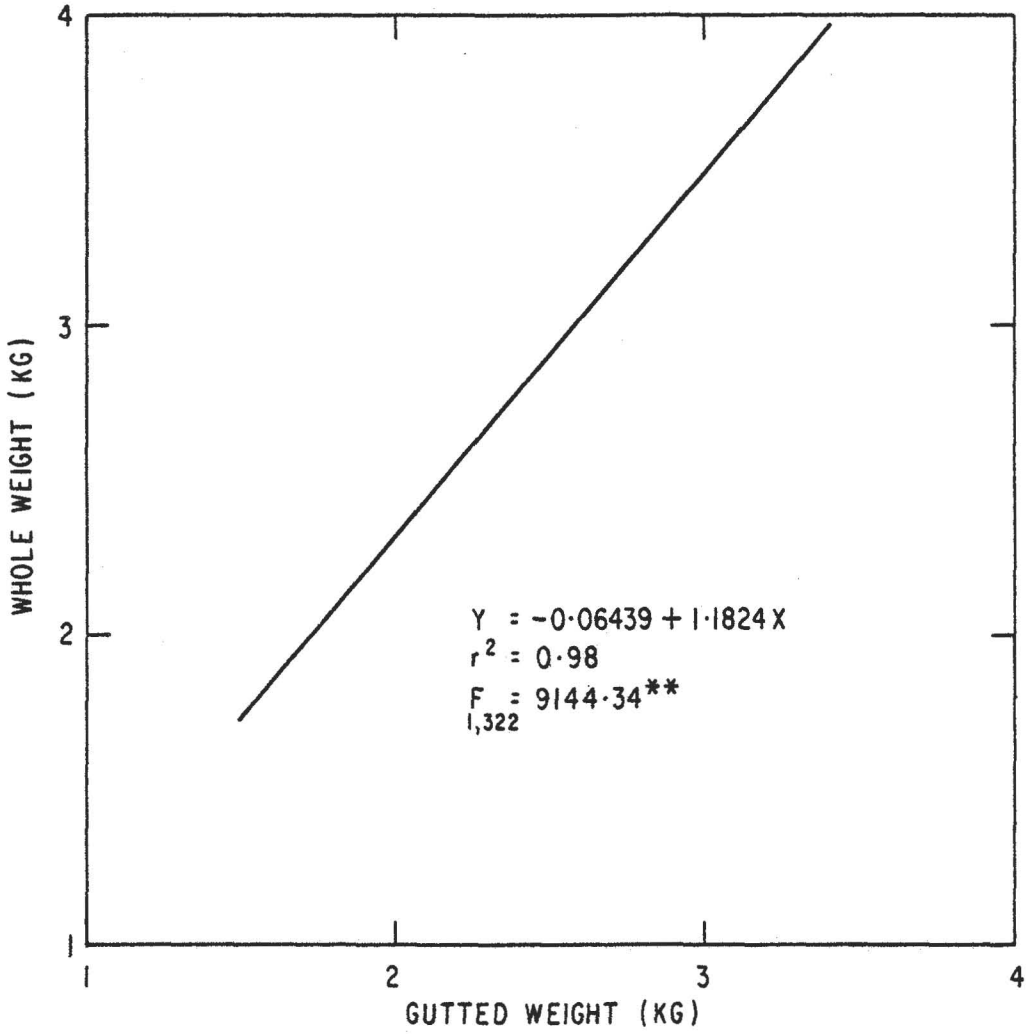

Fig. 1. The relationship between whole weight and gutted weight for Atlantic Salmon caught at West Greenland in 1980.