INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

RESTRICTED

Serial No. 2487
(B.g.14)

ICES/ICNAF Salmon Doc.71/1
(also ICNAF Res.Doc. 71/2)

ANNUAL MEETING - JUNE 1971

Food and feeding of Atlantic salmon at sea

by W.H. Lear
Fisheries Research Board of Canada
Biological Station, St. John's, Nfld.

Introduction

Very little information is available on the food and feeding of Atlantic salmon in the open ocean. Templeman (1967) on the basis of 10 stomachs examined in the Labrador Sea during 18 July - 23 August 1965 found that the salmon were feeding mainly on *Gonatus fabricii* and *Notolepis rissoi kroyeri*. On the West Greenland Banks salmon were feeding mainly on capelin and launce during 5-16 August 1965. During March-April, salmon were feeding mainly on *Paralepis coregonoides*, lantern fishes, amphipods, arctic squid and pelagic fish in the Labrador Sea and over oceanic depths east of the Grand Bank, Flemish Cap and NE Newfoundland Shelf (Templeman, 1968).

In coastal areas such as in the Baltic, salmon are known to feed mainly on sprat, herring, launce, stickleback, cod and *Belone belone* with smaller quantities of amphipods and shrimps (Thurow, 1966; Christensen, 1961; Chrzan, 1970). Dahl (1918) found that grilse caught near the Skagerrak contained herring, capelin and small amounts of euphausiids while one stomach was full of pelagic amphipods (*Parathemisto*). Hansen (1965) reported that salmon close to the Greenland coast in autumn ate mainly euphausiids and capelin with some launce. Blair (1965) examined the stomachs of 919 grilse and older salmon in Bay of Islands during June-July 1942. Of these, 127 contained food items mainly capelin and launce with small amounts of shrimp, smelt, cod, herring and brook trout. Lindsay and Thompson (1932) report that capelin and launce were found in the stomachs of salmon examined during the spring of 1931 in White Bay, Newfoundland.

Kendall (1935) examined stomachs of salmon which were returning from sea in the estuaries of the Penobscot and Saint John River in New Brunswick. In most instances he found that the stomachs were empty but in some Penobscot fish smelts were found and in a few of the Saint John River fish, medium-sized alewives were found.

Power (1969) examined the stomachs of 300 adult salmon entering the rivers in Ungava Bay, none of which contained any food. Two salmon taken in Whale River had unidentified fish remains in the lower intestine. A kelt which had spawned as a grilse in Whale River had sawflies and simulium larvae in its stomach prior to its arrival in the sea indicating that it had fed while in fresh water.

Keenleyside (1962) observed that adult salmon did not feed during the daytime in the Miramichi River, New Brunswick.

Jones (1959) states that sexually maturing salmon generally cease feeding even before entering fresh water from the sea.

Methods

The salmon stomachs (1814) used in this investigation were collected during research vessel cruises of the *A.T. Cameron* during August-October 1969 and 1970, using surface driftnets at a depth of 3 m; adult returns of tagged North American smolts recaptured along the West Greenland coast from Arsuk to Godhavn (Fig. 1), routine commercial sampling in West Greenland, Newfoundland and Labrador coastal areas, routine parasite investigations of Atlantic salmon at Carleton, Saint John River and in the Miramichi, and during a driftnet tagging cruise of the research vessel *Marinus* in the Miramichi estuary.

The complete viscera were frozen and subsequently thawed out at the Biological Station where they were first examined for internal parasites. The stomachs were then examined by the author. The stomachs were cut open and the contents, if any, separated by species and weighed in grams to the nearest tenth.

The salmon were weighed in kilograms to the nearest tenth. The lengths were recorded in millimeters for the research samples and tagged fish returns and to the nearest whole centimeter in the case of the commercial samples.

Tables 1-7 and Fig. 2-3 were compiled by arranging the data from the various areas into 10 cm length groups.

Results

Atlantic salmon were found to feed at different intensities and on a wide variety of organisms in the various areas considered in Table 1. There is also a considerable amount of variation with length in the amount of food per kg of salmon round weight (Fig. 2) and per salmon examined (Fig. 3). The condition factors also vary a great deal (0.88-1.32) between 10 cm length groups (Tables 2-7).

In the Saint John River estuary, Miramichi estuary and near Carleton, Que., most of the stomachs examined were empty. The main food items in terms of volume were unidentified (digested) fish remains, Atlantic herring, capelin, smelt, mackerel and stickleback. The salmon had very high condition factors (1.10-1.17).

In the coastal areas of Newfoundland, most of the stomachs contained food mainly capelin, fish remains, launce, herring, and amphipods. The condition factors were again very high (1.12-1.23).

In the Pack's Harbour area of Labrador 85% of the stomachs were empty. The main food items in terms of volume were pteropods, launce, baby Atlantic cod and capelin. The condition factor for this area (1.08) was lower than that for any other area except ICNAF Division 1B which also was 1.08.

Along the coast of West Greenland from Disko Island to Arsuk, most of the stomachs contained food, the main items of diet being capelin, launce, amphipods, euphausiids, fish remains and some *Paralepis coregonoides borealis* in ICNAF Division 1B.

The condition factors for salmon along the West Greenland coast are again fairly high ranging from 1.08 to 1.18.

In the Davis Strait and Labrador Sea, feeding was less intensive than along the coast, the main items of diet being *Paralepis coregonoides borealis*, arctic squid and unidentified fish remains. The condition factors (1.09-1.16) however are in the same general range as those for the West Greenland coastal waters.

Detailed lists of species found in the stomachs of the salmon caught in various areas and analyzed by 10 cm length groups are shown in Tables 1-7.

Discussion

It is obvious from this investigation that Atlantic salmon cease to feed when they enter the estuary of their home river, since most of the food found in the stomachs at this time was almost all partially digested except for a few terrestrial insects and sticklebacks which had apparently just been eaten before the salmon were caught. These results agree with those of Power (1969), Kendall (1935), Jones (1959) and Keenleyside (1962).

In the Newfoundland coastal areas salmon eat a considerable volume of food during May-July and the amount eaten per salmon generally increases with each 10 cm increase in length. The amount of food per kg of salmon round weight also increases up to 79 cm but then decreases with increasing length. The main food items are capelin and launce at this time of year as was also reported by Blair (1965) and Lindsay and Thompson (1932). The large amounts of food in the stomachs at this time are reflected in the high condition factors especially for the Bonavista area (1.23).

In the Pack's Harbour area, 85% of the stomachs examined were empty. This was probably because of a lack of capelin and herring in the area since a report on cod investigations in this area states that during August 1970 no capelin, herring or mackerel had been seen up to August 10. The main items of diet in terms of volume were pteropods (*Spiratella helicina*).

In the West Greenland coastal areas, salmon were feeding almost continuously but far less intensively than in the Newfoundland coastal areas of Bonavista and St. Anthony (Fig. 1 and 2) but at about the same intensity as at Port-aux-Basques. In ICNAF Division 1A (mainly Disko Bay) salmon stomachs contained a wide range of food items but mainly capelin, launce, unidentified fish remains, amphipods, euphausiids with smaller amounts of Greenland halibut fry, striped wolffish fry, redfish fry, polar sculpin and arctic sculpin. In Division 1B, mainly over the shallow banks off Holsteinsborg, specimens of *Paralepis coregonoides borealis* were found in 4 of 135 stomachs examined. The large amounts of capelin, launce and euphausiids agree with the results of Hansen (1965) but also of importance in the stomachs at this time are amphipods.

In the Davis Strait *Paralepis coregonoides borealis* was the only species occurring in both of the stomachs which contained food.

In the Labrador Sea *Paralepis coregonoides borealis* account for the largest volume of food eaten and arctic squid (*Gonatus fabricii*) next in importance. These large amounts of arctic squid were also found by Templeman (1967) in this area but the paralepids were found only in the 1970 samples from West Greenland and Labrador Sea with none being found in those for 1968 and 1969.

It is to be noted that although condition factors fluctuate from area to area, all have a value above 1 when all the length groups are combined and only in two areas (Pack's Harbour and ICNAF Division 1E) for the 80-89 cm length group and in two areas (1B and 1E) for the 40-59 cm length group to the values decrease below 1. This would tend to indicate that the salmon, while at sea, are feeding almost continuously and fairly intensively.

Acknowledgments

I am indebted to Dr. A. W. May and Mr. J.H.C. Pippy for making available to me stomachs of salmon collected during the course of some of their field trips.

References

Blair, A. A. 1965. Bay of Islands and Humber River Atlantic salmon investigations. J. Fish. Res. Bd. Canada 22(2): 599-620.

Christensen, O. 1961. Preliminary results of an investigation on the food of Baltic Salmon. ICES, Salmon and Trout Committee. C.M. No. 93, 6 p.

Chrzan, F. 1960. Results of investigations on the food of the salmon and sea trout off the Polish Baltic coasts. ICES, Salmon and Trout Committee, C.M. No. 70, 4 p.

Dahl, Knut. 1918. Salmon and trout: A Handbook. Salmon Trout Ass. London, p. 1-107.

Hansen, P. M. 1965. Report on recaptures in Greenland waters of salmon tagged in rivers in America and Europe. Int. Comm. Northw. Atlant. Fish. Redbook 1965, Part III, p. 194-201.

Jones, J. W. 1959. The salmon. Collins, London. 192 p.

Keenleyside, M.H.A. 1962. Skin-diving observations of Atlantic salmon and brooktrout in the Miramichi River, New Brunswick. J. Fish. Res. Bd. Canada 19(4): 625-634.

Kendall, W. C. 1935. The fishes of New England. The salmon family. Part 2 - the salmons. Mem. Boston Soc. Nat. Hist., 9(1): 1-166.

Lindsay, S. T., and H. Thompson. 1932. Biology of the salmon (*Salmo salar* L.) taken in Newfoundland waters in 1931. Rep. Newfoundland Fish. Res. Comm., 1(2): 1-80.

Power, G. 1969. The salmon of Ungava Bay. Arctic Institute of North America. Tech. Paper No. 22, 72 p.

Templeman, W. 1967. Atlantic salmon from the Labrador Sea and off West Greenland, taken during *A.T. Cameron* cruise, July-August 1965. Res. Bull. Int. Comm. Northw. Atlant. Fish., No. 4, p. 5-40.

1968. Distribution and characteristics of Atlantic salmon over oceanic depths and on the bank and shelf slope areas off Newfoundland, March-May, 1966. Res. Bull. Int. Comm. Northw. Atlant. Fish., No. 5, p. 62-85.

Thurow, F. 1966. Beitraege zur Biologie und Bestandkunde des Atlantischen Lachses (*Salmo salar* L.) in der Ostsee. Ber. Dt. Wiss. Komm. Meeresforsch. 18(3/4): 223-379. (Transl. from German by Fish. Res. Bd. Canada Transl. Ser. No. 1211, 1969).

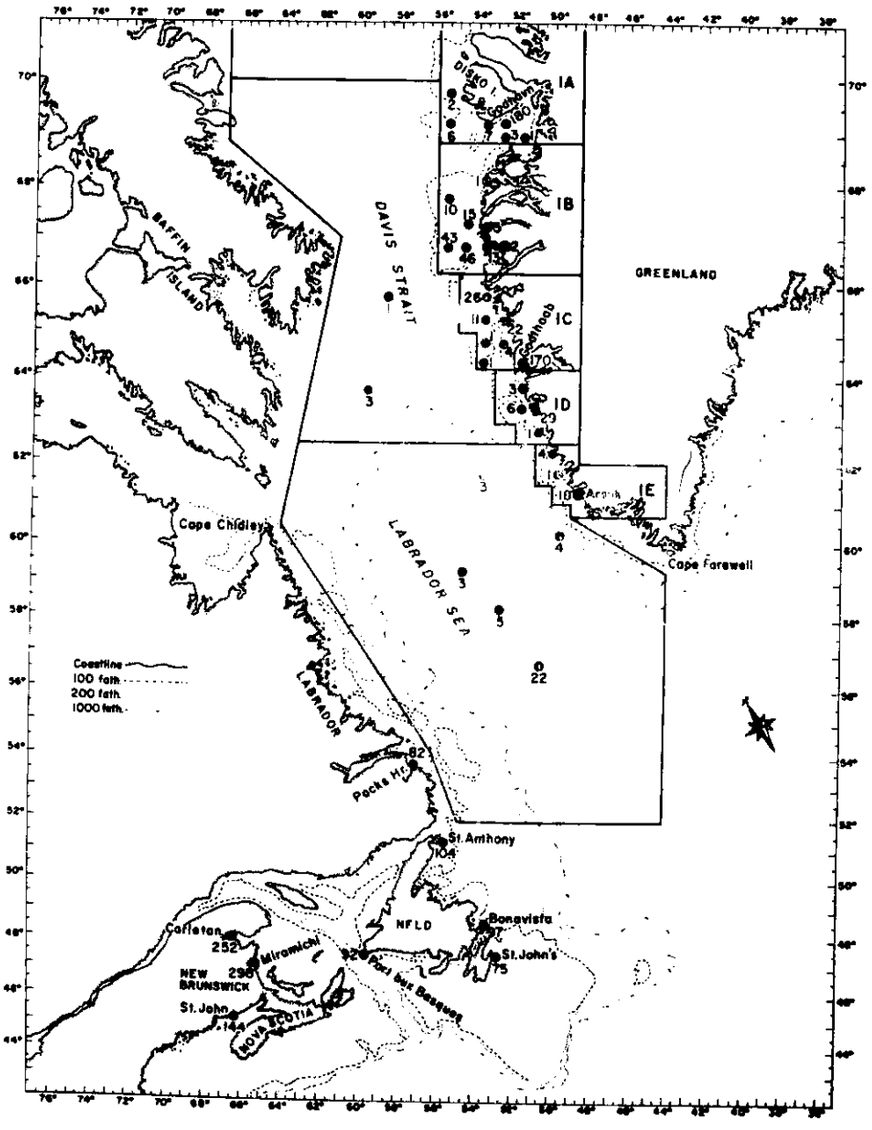

Fig. 1. Area map showing sampling stations, number of stomachs sampled in each locality and place names mentioned in the text.

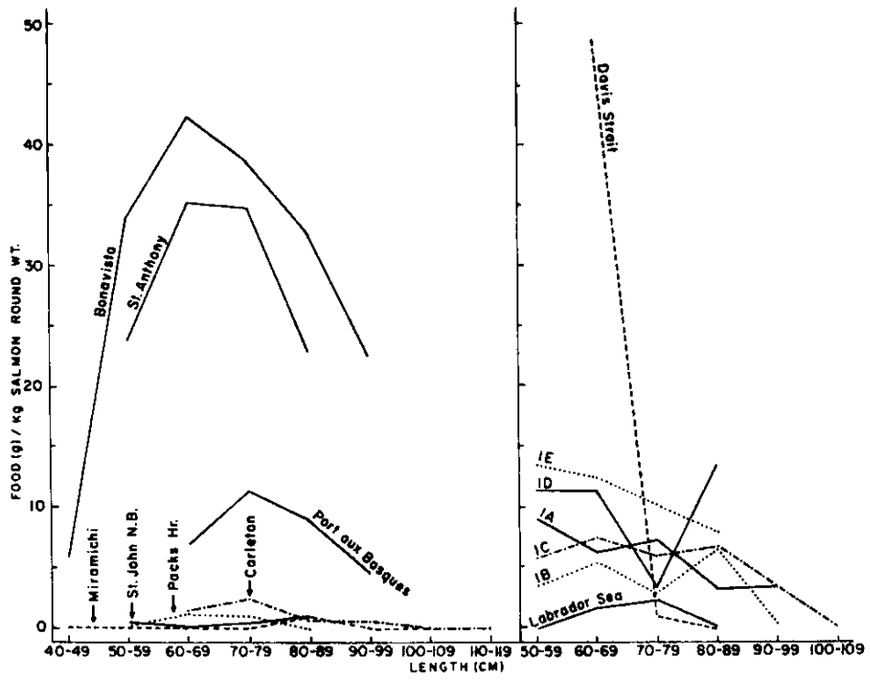

Fig. 2. Average weight of food (g) per Kg of salmon round weight by 10 cm length groups for different areas.

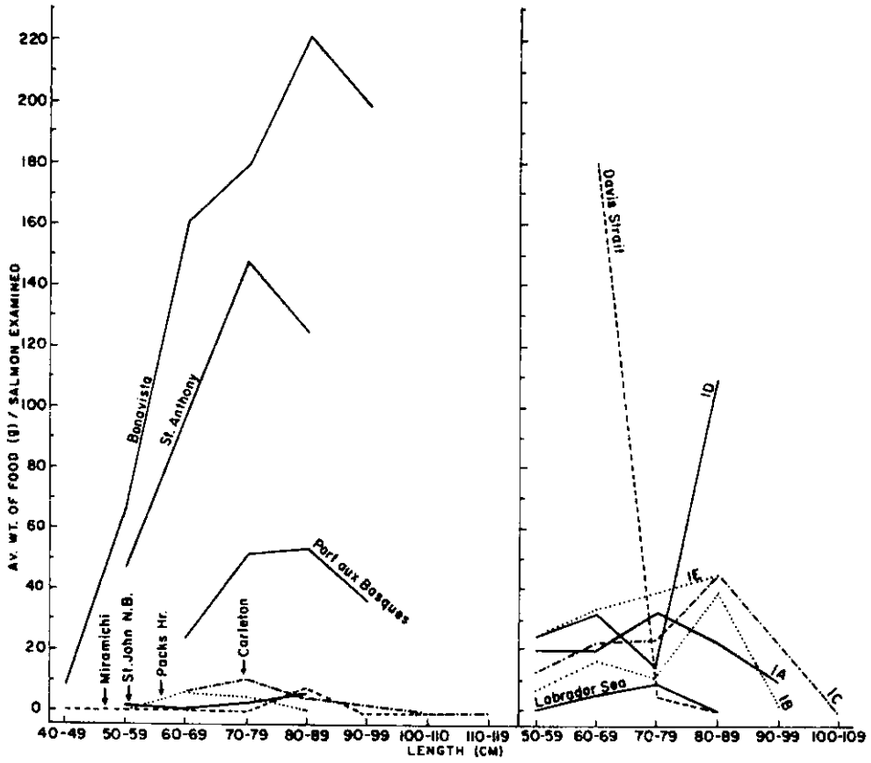

Fig. 3. Average weight of food (g) per salmon examined by 10 cm length groups for different areas.

Table 1. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

All length groups combined.

Area Date Salmon length (cm)	St. John, N.B. June 26-July 2/70 49-86	Miramichi June 12-July 9/70 49-103	Carleton June 15-16/70 66-113	Port aux Basques May 20-June 15/70 63-90	St. John's, Nfld. June 8-14/69	Bonavista June 18-24/70 49-91	St. Anthony June 26-July 6/70 52-85	Pack's Hr. July 6-25/70 54-87	ICNAF "1A" Sept. 11-Oct. 26 1969-70 58-91	ICNAF "1B" Sept. 1-Nov.? 1968-70 57-90	ICNAF "1C" Aug. 31-Nov. 4 1968-70 52-102	ICNAF "1D" Aug. 16-Oct. 23/69 57-88	ICNAF "1E" Aug. 6-Oct. 14/69 58-86	Davis Strait Sept. 5&6/70 69-80	Labrador Sea Sept. 6-Oct. 4 1969&70 57-88	Total	% by weight
Empty	- (110)	- (291)	- (182)	- (10)	- (1)	- (2)	- (3)	- (70)	- (17)	- (24)	- (26)	- (7)	- (0)	- (2)	- (12)	-	-
Unidentified material	...	...	...	...	377.4(43)	...	...	...	...	...	374.2(94)	...	...	...	...	751.6	1.43
Fish remains	81.1(19)	14.0(5)	21.9(14)	65.2(14)	...	...	...	5.8(4)	315.3(77)	162.1(32)	244.3(29)	100.3(14)	82.1(9)	...	14.6(8)	1115.7	2.12
Unidentified invertebrate	...	...	...	2.6(1)	...	...	9.0(2)	...	29.5(4)	17.5(6)	...	12.6(2)	...	...	...	62.2	0.12
Lepeophtheirus salmonis	...	...	...	...	...	...	...	...	0.2(2)	...	...	...	...	...	...	0.2	<0.01
Terrestrial insects	...	1.7(1)	...	...	...	...	...	...	...	...	...	...	...	...	...	1.7	<0.01
Plant material	...	...	0.1(1)	0.1(1)	...	...	...	...	...	...	...	...	...	...	...	0.2	<0.01
Atlantic herring	149.6(4)	191.4(1)	...	237.3(3)	...	33.8(1)	...	...	...	...	...	...	...	...	...	612.1	1.16
Alewife	97.1(1)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	97.1	0.18
Capelin	...	...	1736.8(45)	1658.5(31)	5122.3(59)	12374.0(95)	10652.7(96)	19.8(1)	3252.8(105)	595.5(22)	3944.2(165)	711.8(18)	517.1(15)	...	7.5(1)	40593.0	77.24
American smelt	...	...	117.7(6)	...	...	...	...	...	...	...	...	...	...	...	4.9(1)	117.7	0.22
Lantern fish (spp.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4.9	0.01
Paralepis sp.	...	...	...	25.0(3)	...	...	...	...	...	...	...	...	...	...	...	25.0	0.05
Clupea harengus harengus	...	...	...	...	...	...	...	...	...	234.2(4)	...	...	...	189.4(2)	116.2(4)	539.8	1.03
Three spine stickleback	1.7(3)	...	7.2(4)	...	...	...	...	...	...	...	...	...	...	...	...	8.9	0.02
Atlantic cod	...	...	...	...	...	5.9(1)	29.0(2)	30.9(2)	...	...	...	...	...	...	...	65.8	0.13
Arctic cod	...	...	...	...	...	...	...	...	...	...	...	34.1(1)	...	...	...	34.1	0.06
Launce	...	...	...	2048.8(68)	2210.8(47)	71.3(3)	43.1(11)	44.1(1)	478.6(57)	773.7(42)	441.6(68)	181.1(16)	30.3(4)	...	...	6323.7	12.03
Atlantic mackerel	67.2(1)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	67.2	0.13
Striped wolffish	...	...	...	...	...	...	...	...	2.1(1)	...	...	...	...	...	...	3.1	0.01
Daubed shanny	...	...	...	...	...	...	...	...	3.3(2)	...	...	...	...	...	...	3.3	0.01
Redfish	...	...	...	...	...	...	...	...	1.1(4)	...	...	0.5(2)	20.6(2)	...	...	22.2	0.04
Polar sculpin	...	...	...	...	...	...	...	...	3.2(2)	...	...	...	...	...	...	3.2	0.01
Arctic sculpin	...	...	...	...	...	...	...	...	1.4(1)	...	...	...	...	...	...	1.4	<0.01
Atlantic sea poacher	...	...	...	...	...	...	...	...	0.4(1)	...	...	...	...	...	...	0.4	<0.01
Lumpfish	1.2(1)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.2	<0.01
Greenland halibut	...	...	...	...	...	59.8(1)	...	...	23.3(7)	...	...	...	...	...	...	83.1	0.16
Clam shell**	...	...	...	...	...	...	...	...	...	9.0(1)	...	...	...	...	...	2.0	<0.01
Pteropods	...	...	...	...	...	...	...	237.6(5	...	...	...	...	...	...	...	237.6	0.45
Arctic squid	...	...	...	...	...	...	...	...	...	...	...	...	...	...	97.2(15)	97.2	0.18
Polychaete worm	3.3(1)	...	...	...	...	...	...	...	...	0.8(1)	...	...	...	...	...	4.1	0.01
Amphipods	...	...	...	144.3(12)	0.5(1)	...	33.7(6)	[illegible]	124.2[illegible]	208.3(48)	66.7(31)	223.5(15)	59.8(10)	...	...	855.8	1.63
Euphausiids	2.5(7)	...	1.7(1)	0.6(2)	...	...	...	0.1(1)	[illegible].6(92)	158.3(36)	101.2(20)	2.5(7)	37.4(4)	...	0.1(1)	820.0	1.56
Total salmon stomachs examined (No.)	144	298	250	92	75	97	104	82	199	139	235	39	23	4	37	1814	
Total round weight of salmon whose stomachs were examined (kg)	681.45	1277.80	1457.48	406.60	*300.00	343.60	350.90	341.70	733.46	465.76	719.93	112.77	64.95	18.10	128.80	7403.30	
Total food in stomach (g)	403.7	207.1	1885.4	4182.1	7711.0	12544.8	10764.5	330.7	4752.0	2150.4	5172.2	1266.4	747.3	189.4	240.5	52555.5	99.99
Total food (g) per kg of salmon round wt.	0.6	0.2	1.3	10.3	25.7	36.5	30.7	1.0	6.5	4.6	7.2	11.2	11.5	10.5	1.9	7.1	
Av. wt. of food (g) per salmon examined	2.8	0.7	7.5	45.5	102.8	129.3	103.5	4.1	23.9	15.9	22.0	33.5	32.5	47.4	6.5	29.0	
Condition factor	1.10	1.17	1.14	1.14	-	1.23	1.12	1.08	1.16	1.08	1.18	1.15	1.10	1.16	1.09	-	

*Av. wt. of St. John's salmon estimated by averaging the weights of the combined samples from Port aux Basques and Bonavista.
**Clam shell around the body of a launce.

Table 2. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

Length group 40-59 cm

Area Date Salmon length (cm)	St. John, N.B. June 30, July 2/70 55-58	Miramichi June 12-July 9/70 49-56	Bonavista June 18-24/70 49-59	St. Anthony June 26-July 6/70 52-59	Pack's Hr. July 24, 25/70 54-57	ICNAF "1A" Sept. 23, Oct. 1/69 58	ICNAF "1B" Sept. 16-18 1969-70 57-59	ICNAF "1C" October/68 Sept. 1-18,1969,70 52-59	ICNAF "1D" Aug. 16-Oct. 10/69 57-59	ICNAF "1E" September/69 58	Labrador Sea Sept. 30/70 57	Total June 12-Oct. 10 49-59	% by weight
Empty	- (3)	- (34)	- (1)	- (2)	- (5)	- (0)	- (1)	- (5)	- (2)	- (0)	- (0)	-	-
Unidentified material	...	...	...	...	...	...	...	43.5(17)	...	...	...	43.5	0.83
Fish remains	5.6(2)	...	...	...	0.1(1)	...	...	5.2(2)	2.9(1)	24.5(1)	0.2(1)	38.5	0.73
Terrestrial insects	...	1.7(1)	...	...	...	...	...	...	...	...	...	1.7	0.03
Capelin	...	...	2860.5(43)	1710.7(34)	...	25.4(2)	4.1(1)	317.9(22)	109.6(3)	...	...	5028.2	95.68
Launce	...	...	...	11.7(4)	...	12.4(2)	5.7(1)	33.2(10)	10.7(2)	...	...	73.7	1.40
Pteropods	...	...	...	...	0.7(1)	...	...	...	...	...	...	0.7	0.01
Amphipods	...	...	...	19.9(3)	...	...	2.1(1)	0.7(1)	22.8(2)	...	...	45.5	0.87
Euphausiids	...	...	...	...	...	20.6(1)	1.6(1)	0.5(1)	0.7(2)	...	...	23.4	0.45
Total salmon stomachs examined (No.)	5	35	44	37	7	3	2	31	6	1	1	172	
Total round wt. of salmon whose stomachs were examined (kg)	9.75	54.90	85.60	73.20	14.00	6.40	3.80	67.80	12.79	1.80	2.00	332.04	
Total food in stomachs (g)	5.6	1.7	2860.5	1742.3	0.8	58.4	13.5	401.0	146.7	24.5	0.2	5255.2	100.00
Total food in stomach (g) per kg of salmon round wt.	0.6	0.0	33.4	23.8	0.1	9.1	3.6	5.9	11.5	13.6	0.1	15.8	
Av. wt. of food (g) per salmon examined	1.1	0.0	65.0	47.1	0.1	19.5	6.8	12.9	24.5	24.5	0.2	30.6	
Condition factor	1.09	1.10	1.18	1.12	1.16	1.09	0.97	1.18	1.07	0.92	1.08	-	

Table 3. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

Length group 60-69 cm

Area Date Salmon length (cm)	St. John, N.B. June 26-July 2/70 62-69	Miramichi June 16-July 9/70 62-69	Carleton June 15/70 66-69	Port aux Basques May 22-June 15/70 63-69	Bonavista June 18-24/70 64-69	St. Anthony June 27-July 6/70 60-69	Pack's Hr. July 8-25/70 61-69	ICNAF "1A" Sept. 11-Oct. 26 1969-70 60-69	ICNAF "1B" Sept. 1-Nov. 10 1968-70 60-69	ICNAF "1C" Sept. 1-Nov. 4 1968-70 60-69	ICNAF "1D" Aug. 17-Oct. 23/69 60-69	ICNAF "1E" Aug. 6-Oct. 14/69 60-67	Davis Strait Sept. 5/70 69	Labrador Sea Sept. 6-Oct. 4 1969-70 61-69	Total May 22-Nov. 10 60-69	% by weight
Empty	- (4)	- (29)	- (8)	- (2)	- (0)	- (1)	- (8)	- (10)	- (14)	- (16)	- (5)	- (0)	- (0)	- (7)	-	-
Unidentified material	...	...	...	...	...	...	...	...	...	279.4(67)	...	...	...	...	279.4	2.20
Fish remains	2.0(2)	0.6(1)	2.2(3)	7.4(3)	...	1.2(1)	0.6(1)	204.7(56)	125.0(17)	191.7(24)	68.7(11)	48.7(6)	...	6.7(3)	659.5	5.19
Unidentified invertebrate	...	...	...	...	...	...	...	28.2(3)	17.5(6)	...	8.4(1)	...	...	...	54.1	0.43
Lepeophtheirus salmonis	...	...	...	...	...	...	...	0.2(2)	...	...	...	...	...	...	0.2	0.00
Capelin	...	...	76.2(4)	94.1(4)	610.0(4)	1376.9(12)	19.8(1)	1815.5(69)	385.1(14)	3014.5(126)	512.2(14)	493.9(13)	...	7.5(1)	8405.7	66.19
Lantern fish	...	...	...	...	...	...	...	...	...	...	...	...	...	4.9(1)	4.9	0.04
Paralepis coregonoides borealis	...	...	...	...	...	...	...	...	108.9(2)	...	...	...	180.4(1)	...	289.3	2.28
Arctic cod	...	...	...	...	...	...	...	...	...	...	34.1(1)	...	...	...	34.1	0.27
Launce	...	...	...	...	...	...	...	333.4(36)	466.7(26)	299.9(48)	170.4(14)	30.3(4)	...	...	1703.5	13.41
Striped wolffish	...	...	...	373.5(15)	34.9(1)	...	44.3(1)	3.1(1)	...	...	...	...	...	...	3.1	0.02
Redfish	...	...	...	...	...	...	...	0.7(1)	...	...	0.5(2)	...	...	...	1.2	0.01
Polar sculpin	...	...	...	...	...	...	...	2.7(1)	...	...	...	...	...	...	2.7	0.02
Arctic sculpin	...	...	...	...	...	...	...	1.4(1)	...	...	...	...	...	...	1.4	0.01
Greenland halibut	...	...	...	...	...	...	...	15.0(2)	...	...	...	...	...	...	15.0	0.12
Clam shell*	...	...	...	...	...	...	...	...	2.0(1)	...	...	...	...	...	2.0	0.02
Arctic squid	...	...	...	...	...	...	...	...	...	...	...	...	...	78.8(11)	78.8	0.62
Polychaete worm	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.8	0.01
Amphipod	...	...	...	17.4(2)	...	...	0.1(1)	108.9(21)	0.8(1)	56.0(27)	200.5(12)	29.1(8)	...	...	558.4	4.40
Euphausiid	0.1(1)	...	...	0.1(1)	...	...	...	312.5(57)	146.4(33)	100.7(19)	1.7(4)	37.4(4)	...	0.1(1)	604.6	4.76
Total salmon stomachs examined (No.)	6	30	15	21	4	14	11	134	85	178	31	19	1	19	568	
Total round weight of salmon whose stomachs were examined (kg)	21.65	105.70	49.36	71.50	15.30	39.10	35.50	440.40	255.25	522.51	87.64	51.28	3.70	55.70	1754.59	
Total food in stomachs (g)	2.1	0.6	78.4	492.5	644.9	1378.1	64.9	2776.3	1404.4	3942.2	996.5	639.4	180.4	98.0	12698.7	100.00
Total food in stomach (g) per kg of salmon round wt.	0.1	0.0	1.6	6.9	42.2	35.2	1.8	6.3	5.5	7.5	11.4	12.5	48.8	1.8	7.2	
Av. wt. of food (g) per salmon examined	0.4	0.0	5.2	23.5	161.2	98.4	5.9	20.7	16.5	22.1	32.1	33.7	180.4	5.2	22.4	
Condition factor	1.26	1.14	1.08	1.12	1.26	1.09	1.10	1.16	1.07	1.14	1.13	1.09	1.13	1.07	-	

*Clam shell around the body of a launce.

Table 4. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

Length group 70-79 cm

Area Date Salmon length (cm)	St. John, N.B. June 26-July 2/70 70-79	Miramichi June 12-July 9/70 70-79	Carleton June 15-16/70 70-79	Port aux Basques May 22-June 15/70 70-79	Bonavista June 18-19/70 70-79	St. Anthony June 26-July 6/70 70-79	Pack's Hr. July 6-25/70 70-79	ICNAF "1A" Sept. 12-Oct. 1 1969-70 70-79	ICNAF "1B" Sept. 8-Nov.? 1968-70 70-79	ICNAF "1C" Aug. 31-Oct. 12 1968-70 70-77	ICNAF "1D" Autumn 1969 71	Davis Strait Sept. 5/70 70-73	Labrador Sea Sept. 6-Oct. 4 1969-70 70-76	Total May 22-Nov.? 70-79	% by weight
Empty	- (83)	- (203)	- (96)	- (8)	- (1)	- (0)	- (48)	- (5)	- (9)	- (3)	- (0)	- (1)	- (4)	-	-
Unidentified material	...	...	...	...	...	...	...	...	...	16.8(4)	...	...	...	16.8	0.08
Fish remains	69.0(13)	2.4(1)	1.6(2)	57.8(11)	...	7.8(1)	0.6(1)	81.6(18)	18.0(11)	8.1(2)	10.1(1)	...	7.7(4)	264.7	1.20
Unidentified invertebrate	...	...	...	2.6(1)	...	...	...	1.3(1)	...	...	4.2(1)	...	...	8.1	0.04
Plant material	...	...	0.1(1)	0.1(1)	...	...	...	...	...	...	...	...	...	0.2	<0.01
Atlantic herring	63.9(2)	...	...	173.8(2)	33.8(1)	...	...	...	...	...	...	...	...	271.5	1.23
Alewife	97.1(1)	...	...	...	...	...	...	...	...	...	...	...	...	97.1	0.44
Capelin	...	...	1286.3(28)	1450.5(23)	7591.9(42)	6328.3(41)	...	1356.0(32)	139.7(4)	253.7(9)	...	...	...	18406.4	83.22
American smelt	...	...	117.7(6)	...	...	...	...	...	...	...	...	...	...	117.7	0.53
Paralepis sp.	...	...	...	25.0(3)	...	...	...	...	...	...	...	...	...	25.0	0.11
Paralepis coregonoides borealis	...	...	...	...	...	...	...	...	...	...	...	...	...	125.2	0.57
Three spine stickleback	0.7(1)	...	2.6(2)	...	...	...	...	...	...	...	...	9.0(1)	116.2(4)	3.3	0.01
Atlantic cod	...	...	...	...	5.9(1)	26.0(1)	30.9(2)	...	...	...	...	...	...	62.8	0.28
Launce	...	...	...	1513.4(46)	36.4(2)	29.9(6)	...	169.9(17)	245.6(12)	50.7(6)	...	...	...	2045.9	9.25
Daubed shanny	...	...	...	...	...	...	...	3.3(2)	...	...	...	...	...	3.3	0.01
Redfish	...	...	...	...	...	...	...	0.4(3)	...	...	...	...	...	0.4	<0.01
Polar sculpin	...	...	...	...	...	...	...	0.5(1)	...	...	...	...	...	0.5	<0.01
Agonus decagonus	...	...	...	...	...	...	...	0.4(1)	...	...	...	...	...	0.4	<0.01
Lumpfish	1.2(1)	...	...	...	...	...	...	...	...	...	...	...	...	1.2	0.01
Greenland halibut	...	...	...	...	59.3(1)	...	...	7.8(4)	...	...	...	...	...	67.6	0.31
Pteropods	...	...	...	...	...	...	236.9(4)	...	...	...	...	...	...	236.9	1.07
Arctic squid	...	...	...	...	...	...	...	...	...	...	...	...	18.4(4)	18.4	0.08
Polychaete worm	3.3(1)	...	...	...	...	...	...	...	...	...	...	...	...	3.3	0.01
Amphipods	...	...	...	106.9(9)	...	0.8(2)	...	15.3(7)	31.3(10)	...	...	...	...	154.3	0.70
Euphausiids	2.2(5)	...	1.7(1)	0.5(1)	...	...	0.1(1)	178.0(22)	4.7(6)	...	...	...	...	187.2	0.85
Total salmon stomachs examined (No.)	106	204	133	64	43	43	54	56	39	14	1	2	16	775	
Total round weight of salmon whose stomachs were examined (kg)	485.30	915.60	590.89	292.00	199.95	183.80	237.80	247.60	151.90	56.17	4.09	8.70	63.90	3437.70	
Total food in stomachs (g)	237.4	2.4	1410.0	3330.6	7727.8	6392.8	268.5	1814.5	439.3	329.3	14.3	9.0	142.3	22118.2	100.00
Total food in stomach (g) per kg of salmon round wt.	0.5	0.0	2.4	11.4	38.6	34.8	1.1	7.3	2.9	5.9	3.5	1.0	2.2	6.4	
Av. wt. of food (g) per salmon examined	2.2	0.0	10.6	52.0	179.7	148.7	5.0	32.4	11.3	23.5	14.3	4.5	8.9	28.5	
Condition factor	1.07	1.12	1.06	1.14	1.13	1.05	1.06	1.17	1.04	1.08	1.14	1.19	1.07	-	

Table 5. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

Length group 80-89 cm

Area Date Salmon length (cm)	St. John, N.B. June 26-July 2/70 80-86	Miramichi June 18-July 5/70 80-89	Carleton June 15-16/70 80-89	Port aux Basques May 20-June 4/70 80-88	Bonavista June 19-24/70 80-89	St. Anthony June 26-July 6/70 80-85	Pack's Hr. July 8-23/70 80-87	ICNAF "1A" Sept. 12-27 1969-70 82-88	ICNAF "1B" Sept. 8-Nov.? 1968-70 81-87	ICNAF "1C" October/68 80-87	ICNAF "1D" Sept. 30/69 88	ICNAF "1E" Aug. 27/69 86	Davis Strait Sept. 6/70 80	Labrador Sea Sept. 10/69 88	Total May 20-Nov.? 80-89	% by weight
Empty	- (20)	- (23)	- (44)	- (0)	- (0)	- (0)	- (9)	- (1)	- (0)	- (1)	- (0)	- (0)	-(1)	-(1)	-	-
Unidentified material	...	...	...	...	...	...	...	...	...	29.4(4)	...	...	...	...	...	...
Fish remains	4.5(2)	11.0(3)	17.0(8)	...	...	...	4.5(1)	0.6(1)	18.6(3)	39.3(1)	18.6(1)	...	...	...	29.4	0.72
Atlantic herring	85.7(2)	191.4(1)	...	63.5(1)	...	...	...	...	...	...	...	...	...	...	114.1	2.79
Capelin	...	...	295.7(9)	113.9(4)	1111.7(5)	1236.8(9)	...	55.9(2)	30.5(2)	194.7(4)	90.0(1)	6.8(1)	...	...	340.6	8.32
Pandalopis coregonoides borealis	...	...	...	...	...	...	...	...	125.3(2)	...	...	...	...	...	3136.0	76.63
Three spine stickleback	1.0(2)	...	4.6(2)	...	...	...	...	...	...	...	...	...	...	...	125.3	3.06
Atlantic cod	...	...	...	...	...	3.0(1)	...	...	...	...	...	...	...	...	5.6	0.14
Launce	...	...	...	124.9(6)	...	1.5(1)	...	5.7(1)	55.7(3)	7.2(1)	...	...	...	...	3.0	0.07
Atlantic mackerel	67.2(1)	...	...	...	...	...	...	...	...	...	...	...	...	...	195.0	4.76
Redfish	...	...	...	...	...	...	...	...	...	...	...	...	...	...	67.2	1.64
Greenland Halibut	...	...	...	...	...	...	...	...	...	...	...	20.0(1)	...	...	20.0	0.49
Amphipods	...	...	...	19.7(1)	...	10.0(1)	...	0.3(1)	...	...	...	...	...	...	0.5	0.01
Euphausiids	0.2(1)	...	...	...	...	...	...	...	2.1(2)	1.2(1)	0.2(1)	17.9(1)	...	...	51.1	1.25
								4.5(2)	...	...	0.1(1)	...	...	...	4.8	0.12
Total salmon stomachs examined (No.)	27	27	63	6	5	10	10	3	6	6	1	1	1	1	167	
Total round weight of salmon whose stomachs were examined (kg)	164.75	180.80	425.25	35.30	33.90	54.80	54.40	20.20	36.82	40.52	8.25	5.60	5.70	7.20	1073.49	100.00
Total food in stomachs (g)	158.6	202.4	317.3	322.0	1111.7	1251.3	4.5	67.2	232.2	271.8	108.9	44.7	0.0	0.0	4092.6	
Total food in stomach (g) per kg of salmon round wt.	1.0	1.1	0.7	9.1	32.8	22.8	0.1	3.3	6.3	6.7	13.2	8.0	0.0	0.0	3.8	
Av. wt. of food (g) per salmon examined	5.9	7.5	5.0	53.7	222.3	125.1	0.5	22.4	38.7	45.3	108.9	44.7	0.0	0.0	24.5	
Condition factor	1.09	1.16	1.13	1.03	1.15	0.99	0.98	1.11	1.05	1.20	1.21	0.88	1.11	1.06	-	

Table 6. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

Length group 90-99 cm

Area Date Salmon length (cm)	Miramichi June 18/70 90	Carleton June 15-16/70 90-99	Port aux Basques June 15/70 90	Bonavista June 19/70 91	ICNAF "1A" Oct. 13/69 91	ICNAF "1B" November/68 90	Total June 15-Nov. 90-99	% by weight
Empty	-(1)	- (28)	- (0)	- (0)	- (0)	- (0)	-	-
Fish remains	...	1.1(1)	...	...	26.9(1)	0.5(1)	28.5	8.07
Capelin	...	78.6(4)	...	199.9(1)	...	...	278.5	78.90
Launce	...	...	37.0(1)	...	7.2(1)	...	44.2	12.52
Amphipods	...	...	...	...	...	1.8(1)	1.8	0.51
Total salmon stomachs examined (No.)	1	33	1	1	1	1	38	
Total round weight of salmon whose stomachs were examined (kg)	9.00	307.10	7.80	8.85	9.94	7.50	350.19	
Total food in stomach (g)	0.0	79.7	37.0	199.9	34.1	2.3	353.0	100.00
Total food in stomach (g) per kg of salmon round wt.	0.0	0.3	4.7	22.6	3.4	0.3	1.0	
Av. wt. of food (g) per salmon examined	0.0	2.4	37.0	199.9	9.94	2.3	9.29	
Condition factor	1.23	1.16	1.07	1.17	1.32	1.03	-	

Table 7. Stomach contents of Atlantic salmon caught in various areas and at different seasons 1968-70 showing weight of food (g) and number of occurrences (in brackets).

Length group 100-119 cm

Area Date Salmon length (cm)	Miramichi June 18/70 103	Carleton June 15-16/70 101-113	ICNAF "1C" Oct. 1/69 102	Total June 15-Oct. 1 101-113	% by weight
Empty	-(1)	-(6)	-(1)	-	-
Total salmon stomachs examined (No.)	1	6	1	8	
Total round weight of salmon whose stomachs were examined (kg)	11.80	84.88	11.77	108.45	
Total food in stomachs (g)	0.0	0.0	0.0	0.0	0.0
Total food in stomach (g) per kg of salmon round wt.	0.0	0.0	0.0	0.0	
Av. wt. of food (g) per salmon examined	0.0	0.0	0.0	0.0	
Condition factor	1.08	1.15	1.11	-	