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Report on St. John drift salmon in 1932.

Author

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REPORT ON ST. JOHN DRIFT SALMON IN 1932.

by

A. A. Blair

Contents

I. Material

Only drift salmon of the St. John River system are dealt with in this report. It was impossible to collect any information concerning the salmon in the St. John river. A number of trips were made to St. John and in all 1157 salmon were scaled, measured and weighed.

From the St. John Retaining pond twenty-three salmon were tagged, scaled, measured, weighed and liberated in the pond again. The same procedure was to be repeated with these fish in the fall during the stripping time. The writer was not able to be present at this time and unfortunately no tags were recovered for some mysterious reason. So no information could be gained from this experiment.

II. Methods

Approximately the same field and laboratory methods were adopted here as in previous salmon investigations and need not be described again.

III. Fluctuations in Numbers and Weights of Salmon.

The commercial salmon fishery of the St. John River system consists of traps in the river proper above the Reversing Falls, drift nets in the Harbor and in the Bay of Fundy a few miles off Lorneville, Lepreau and several other points.

The Lorneville salmon are brought to St. John in a "carrying" boat where they are sold to fish dealers. This carrying boat has been operated by Mr. Sidney Evans for a number of years. Since 1919 he has kept a record of the numbers and corresponding weights of salmon caught by each fisherman per day. He has been kind enough to give me these records which are analysed in the

following pages. Most of the drift fishing is done off Lorneville and these records should be a suitable index to the extent of the fishery in these years from 1919 to 1932 (except 1920 and 1922).

In these averages all salmon under 8 lbs. were excluded as grilse but those 8 lbs. or over were included as salmon. It was necessary to exclude grilse in the averages in order that the true variations in the weights of the salmon might be observed. However, very few had to be excluded as the size of the mesh in drift nets is too large to catch many grilse.

The catches of all the fishermen in any one year or fishing season were divided into periods of 5 days each. In this way any changes in numbers or weights as the season advances might be o observed. The period of 5 days was chosen as the drifters are allowed only 5 nights of fishing in each week, Saturday and Sunday being a weekly close time.

In tables 1 - 13 are given the numbers of salmon with corresponding weights as divided into 5-day periods with average weight per fish and average daily catch per fisherman in each period. From these tables it is evident that the numbers of salmon are sufficiently large to give good averages for the weight per salmon and the daily catch per fisherman in each period. Some of the periods at the beginning and at the end of the fishing season had to be left out as the numbers of salmon were not great enough to give reliable averages. As it is, the smallest number of salmon that has been used is 186 in the first period of 1919. A few others around 200 have also been used while practically all the others are well over 500 salmon. The reliability of the averages might readily be determined by referring to the above mentioned tables.

The numbers of salmon were reduced to the average daily catch per fisherman in order to do away with the number of active fishermen as a variable. Perhaps, it might be argued that this is unnecessary and that the true rise and fall of the catch would be recorded regardless of the number of fishermen but at any rate this seemed to be the safer method although requiring much more work.

The average daily catch per fisherman and the average weights for the various years from 1919 to 1932 as given in tables 1 - 13 are condensed in tables 14 and 15. Table 14 gives the average daily catch per fisherman in each 5-day period of each year separately from 1919 to 1932, average daily catch per fisherman in each 5-day period when all years from 1919 to 1932 are averaged, and the average daily catch per fisherman per year. Table 15 gives the average weight per fish in each 5-day period of each year separately from 1919 to 1932, average weight per fish in each 5-day period when all years from 1919 to 1932 are averaged, and the average weight per fish per year. The average weight of salmon for any one year and the average daily catch per fisherman for any one year are computed from all the records available for that year i.e. not only from salmon included in the various periods as given but in addition from salmon of other periods where the numbers were not considered reliable for averages. So these averages should really be placed in another table but for convenience are given here.

Table 1. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1919 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1919

Month	June			July			
Period Ending	14	21	28	5	12	19	26
Total Wt. of salmon.	2147.5	4074.5	4811.5	6482.5	11536.	4590.	5800.
Corresponding No. of salmon.	186.	349.	414.	551.	965.	375	452.
Av. Wt. of salmon.	11.5	11.7	11.6	11.8	12.0	12.2	12.8
Total No. of salmon.	350.	448.	460.	647.	1076.	431.	509.
Total No. fishermen.	93.	108.	91.	123.	140.	102.	121.
Av. Daily Catch per fisherman.	3.8	4.1	5.1	5.3	7.7	4.2	4.2

Legal Season March 1 - Aug. 15.

Table 2. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1921 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1921

Month	June			July				30	August
Period end. 11	18	25	2	9	16	23	30	5
Total wt. 13967. of salmon.	10533.5	26013.	22944.	15389.	19418.	9921.	6912.	3346.
Corres- 1182. ponding No. of salmon.	868.	2115.	1863.	1214.	1567.	806.	565.	278.
Av. wt. of salmon. 11.8	12.1	12.3	12.3	12.7	12.4	12.3	12.2	12.0
Total No. 1188. of salmon	868.	2115.	1863.	1225.	1570.	806.	587.	283.
Total No. 123. of fishermen.	147.	151.	153.	107.	121.	103.	85.	42.
Av. daily catch per 9.7 fisherman.	5.9	14.0	12.2	11.5	13.0	7.8	6.9	6.7

Legal Season March 1 - Aug. 15.

Table 3. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1923 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1923

Month	June			July				August	
Period end.	16	23	30	7	14	21	28	4	11
Total wt. of salmon.	6962.	7338.	6637.	18130.	16576.	17304.	17065.5	17682.	19133.
Corresponding No. of salmon.	623.	662.	588.	1485.	1431.	1488.	1463.	1512.	1685.
Av. wt. of salmon.									

Table 3 (contd.)

Av. wt. of salmon.	11.2	11.1	11.3	12.2	11.6	11.6	11.7	11.7	11.4
Total No. of salmon	636.	695.	616.	1615.	1496.	1523.	1621.	1560.	1718.
Total No.of fishermen.	156.	133.	120.	184.	161.	179.	185.	163.	183.
Av. Daily catch per fisherman.	4.1	5.2	5.1	8.8	9.3	8.5	8.8	9.6	9.4

Legal Season March 1 - Aug. 15.

Table 4. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1924 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1924

Month	June			July				August
Period end.	14	21	28	5	12	19	26	2
Total wt. of salmon.	10837.	8846.	18577.	13315.	28640.	14916.	22504.	15424.
Corresponding No.of salmon	901.	738.	1508.	1061.	2245.	1179.	1763.	1197.
Av. wt. of salmon.	12.0	12.0	12.3	12.5	12.8	12.7	12.8	12.9
Total No. of salmon.	919.	768.	1532.	1100.	2299.	1276.	1784.	1269.
Total No. of fishermen.	142.	149.	157.	148.	173.	137.	169.	157.
Ave Daily catch per fisherman.	6.5	5.2	9.8	7.4	13.3	9.3	10.6	8.1

Legal Season March 1 - Aug. 31.

Table 5. St. John Drift Salmon. Numbers of salmon with corresponding weight in 1925 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1925

Month	June				July				Aug.
Period end.	6	13	20	27	4	11	18	25	1
Total wt. of salmon	9552.	15610.	13417.	21890.	20193.	14178.	30973.	13922.	11238.
Corresponding No. of salmon.	764.	1242.	1066.	1737.	1586.	1112.	2388.	1089.	902.
Av. wt.of salmon.	12.5	12.6	12.6	12.6	12.7	12.8	13.0	12.8	12.5
Total No. of ~~salmon~~ fishermen	125.	173.	158.	161.	169.	145.	187.	150.	133.
Av. Daily catch per fisherman.	6.5	7.6	6.7	11.2	9.6	8.1	13.0	7.3	7.8

Total No. of Salmon- 813. 1307. 1066. 1806. 1619. 1169. 2435. 1098. 1039.

Legal Season March 1 - Aug. 31.

Table 6. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1926 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1926

Month	June			July				
Period ending	12	19	26	3	10	17	24	31
Total wt. of salmon	14143.	14346.	11731.	25447.	33055.	17346.	30041.	4548.
Corresponding No. of salmon	1167.	1186.	936.	2020.	2612.	1356.	2392.	364.
Av. wt. of salmon.	12.1	12.1	12.5	12.6	12.7	12.8	12.6	12.5
Total No. of salmon.	1208.	1211.	982.	2090.	2679.	1405.	2480.	376.
Total No. of fishermen.	137.	117.	140.	162.	190.	147.	181.	83.
Av. daily catch per fisherman.	8.8	10.4	7.0	12.9	14.1	9.6	13.7	4.5

Legal Season March 1 - Aug. 15.

Table 7. St. John Drift salmon. Numbers of salmon with corresponding weights in 1927 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1927.

Month	June			July					Aug.
Period end.	11	18	25	2	9	16	23	30	6
Total wt. of salmon	9728.	10612.	17178.	19099.	20893.	25188.	3176.5	13146.	4975
Corresponding No. of salmon.	836.	890.	1444.	1596.	1687.	2001.	255.	1027.	395
Av. wt. of salmon.	11.6	11.9	11.9	12.0	12.4	12.6	12.5	12.8	12.6
Total No. of salmon	850.	942.	1630.	1944.	2085.	2467.	326.	1486.	620.
Total No. of fishermen	139.	156.	181.	191.	141.	160.	73.	156.	125.
Av. daily catch per fisherman	6.1	6.0	9.0	10.2	14.8	15.4	4.5	9.5	500

Legal Season May 15 - Aug. 15.

Table 8. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1928 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1928

Month	June				July				Aug.
Period end.	9	16	23	30	7	14	21	28	4
Total wt. of salmon	3010.	6006.	10967.	14720.	15685.	12311.	9259.	13303.	6905.
Corresponding No. of salmon.	251.	498.	939.	12041	1317.	1024.	764.	1124.	598.
Av. wt. of salmon.	12.0	12.1	11.7	12.2	11.9	12.	12.1	11.8	11.5
Total No. of salmon.	394.	515.	1039.	1269.	1390.	1099.	798.	1160.	641.
Total No. of fishermen	87.	113.	131.	154.	154.	130.	134.	126.	75.
Av. daily catch per fisherman	4.5	4.6	7.9	8.2	9.0	8.5	6.0	9.2	8.5

Legal Season May 15 - Aug. 15

Table 9. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1929, divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1929

Month	June				July			
Period end.	8	15	22	29	6	13	20	27
Total wt. of salmon	3034.	7370.	5188.	7333.	13846.	7127.	18131.	8151.
Corresponding No. of salmon.	245.	582.	399.	538.	1016.	535.	1346.	617.
Av. wt. of salmon.	12.4	12.7	13.0	13.6	13.6	13.3	13.5	13.2
Total No. of salmon.	245.	582.	399.	538.	1016.	535.	1346.	619.
Total No. of fishermen.	45.	72.	62.	69.	69.	68.	78.	63.
Av. daily catch per fisherman.	5.4	8.1	6.4	7.8	14.7	7.9	17.3	9.8

Table 10. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1930 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1930

Month	June				July			
Period end.	7	14	21	28	5	12	19	26
Total wt. of salmon-lb.	23111.	22467.	19593.	26706.	21809.	47616.	29347.	10492.
Corresponding wt. of salmon.	1831.	1773.	1556.	2085.	1660.	3606.	2293.	831.
Av. wt. of salmon.	12.6	12.7	12.6	12.8	13.1	13.2	12.8	12.6
Total No. of salmon.	1890.	1794.	1595.	2099.	1730.	3694.	2313.	832.
Total No. of fishermen.	166.	157.	130.	162.	133.	162.	163.	88.
Av. daily catch per fisherman.	11.4	11.4	12.3	13.0	13.0	22.8	14.2	9.5

Legal Season May 15 - Aug. 15.

Table 11. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1931 divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1931

Month	June				July				August
Period end.	6	13	20	27	4	11	18	25	1
Total wt. of salmon	15628	4778	25973	28167	16126	30749	32328	10192	6777
Corresponding No. of salmon	1299	393	2142	2308	1294	2437	2525	795	540
Av. wt. of salmon.	12.0	12.2	12.1	12.2	12.5	12.6	12.8	12.8	12.6
Total no. of salmon.	1324	415	2161	2336	1322	2490	2560	800	606
Total no. of fishermen	169	55	172	172	154	162	176	91	105
Av. daily catch per fisherman	7.8	7.5	12.6	13.6	8.6	15.4	14.5	8.8	5.8

Legal Season May 15 - Aug. 15.

Table 12. St. John Drift Salmon. Numbers of salmon with corresponding weights in 1932, divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

1932

Month	June				July				
Period ending.	4	11	18	25	2	9	16	23	30
Total wt. of salmon-lb.	3956	3176	10414	11905	23154	10476	8303	4862	2579
Corresponding no. of salmon.	325	266	883	1026	1939	881	664	391	215
Av. wt. (lb.)	12.2	11.9	11.8	11.7	11.9	11.9	12.5	12.4	12.0
Total No. of salmon.	335	285	904	1027	1945	1161	1345	1200	1017
Total No. of fishermen.	110	66	155	152	210	168	173	153	139
Av. daily catch per fisherman.	3.3	4.3	5.8	6.8	9.3	6.9	7.8	7.8	7.3

Legal Season May 15 - Aug. 15

Table 13. St. John Drift Salmon. Numbers of salmon with corresponding weights, a total of years from 1919 to 1932 (except 1920 and 1922) divided into 5-day periods with average wt. per fish and average daily catch per fisherman in each period.

Total. 1919-1932 (except 1920 and 1922).

Month	June				July				August	
Period end.: range.	4-9	11-16	18-23	25-30	2-7	9-14	16-21	23-28	30-4	5-11
	June									
Period end.: average.	7	13	20	27	4	11	18	25	3	7
Total wt. of salmon	58291	117191.5	141302	195668.5	216230.5	248545	227103	149430	85211	27454
Corresponding No. of salmon	4715	9649	11678	15903	17388	19749	17946	11978	6920	2358
Av. wt. of salmon	12.4	12.1	12.1	12.3	12.4	12.6	12.7	12.5	12.3	11.6
Total no. of salmon	5001	10049	12096	16410	18281	21008	19469	13235	8581	2621
Total no. of fishermen	702	1426	1618	1710	1850	1747	1757	1503	1096	350
Av.daily catch per fisherman	7.1	7.0	7.5	9.6	9.9	12.0	11.1	8.8	7.8	7.5

Table 13 cont'd.

Legal Season:	1919-1923:	March 1 - August 15.
	1924-1925:	March 1 - August 31.
	1926:	March 1 - August 15.
	1927-1932:	May 15 - August 15.

In figures 1 to 12 the average daily catch per fisherman and the average weight per fish are plotted against the period of the season for each year separately from 1919 to 1932 (except 1920 and 1922). In fig. 13 the average daily catch per fisherman and the average weight per fish are plotted against the period of the season when all the years from 1919 to 1932 are averaged. In fig. 14 the average daily catch per fisherman per year and the average weight per fish per year are plotted against years. In all of the above figures the average daily catch per fisherman is taken from table 14 while the average weight per fish is taken from table 15.

a. Fluctuations in Numbers of Salmon.

The following is a discussion of the numbers of salmon. In 1919 the catch rose gradually from 3.8 salmon per fisherman period ending June 14 to a maximum of 7.7 July 12th and then decreased to 4.2 July 26. In 1921 there was a decrease from 9.7 June 11 to 5.9 June 18 and then an increase to 14.0 June 25. There was then a decrease to 11.5 July 9. July 16 there was an increase to 13.0 but after that a gradual decrease to 6.7 August 5. So the maximum catch was at June 25 followed by almost equally good catches until July 16. In 1923 the catch increased gradually from 4.1 June 16 to 8.8 July 7 and did not vary much for the rest of the season but the maximum catch was 9.6 on August 4. In 1924 the catch increased at the first of the season until a maximum of 13.3 salmon was reached on July 12, when the catch decreased for the remainder of the season. In 1925 the catch rose more or less gradually from 6.5 June 6 to a

maximum of 13.0 on July 18 and then decreased for the remainder of the season. In 1926 a maximum catch of 14.1 was reached on July 10 with a rough increase and decrease before and after this date. In 1927 there was a gradual increase from 6.1 on June 11 to a maximum of 15.4 on July 16, followed by a decrease to 5.0 August 6. In 1928 there were more or less two maxima one of 9.0 on July 7 and the other of 9.2 July 28. In 1929 there was an increase from 5.4 June 8 to a maximum of 17.3 July 20 with an intervening low of 7.9 on July 13. In 1930 the catch began at a high level of 11.4 June 7 and increased only slightly to 13.0 July 5 but a sudden maximum of 22.8 was reached July 12 followed by a gradual decrease to 9.5 July 26. In 1931 there was an increase from 7.8 June 6 to 15.4 July 11 with an intervening low on July 4. Then there was a gradual decrease to 5.8 August 1. In 1932 there was a gradual increase from the extreme low of 3.3 June 4 to a maximum of 9.3 July 2 followed by a decrease to 7.3 July 30.

In summing up it seems that no curve for the catch can be said to be typical. However, in several respects the catch curves for the various years agree or disagree as follows. The maximum catch is almost invariably in July and practically always around the middle of July. In 1921 the maximum catch was on June 25 but there was a secondary maxima on July 16 with good fishing in between these dates. In 1923 the maximum catch was on August 4 but there was a secondary maxima on July 14, and in this year the catch remained at about the same high level from July 7 to Aug. 11 at the end of the season. So on the average the maximum catch for the year is in the middle of July. This is shown in fig. 13 which represents an average of all the years from 1919 to 1932. This shows the maximum catch for the average of the various years to be on July 11.

All of the years show an increase in the catch until the maximum is reached. In slightly over half the cases the increase is irregular, i.e. a sudden drop in the catch for one week or a good c catch one week with a poor catch the next week. The examples are: years 1921, 1924, 1925, 1926, 1928, 1929, and 1931. The remaining years 1919, 1923, 1927, 1930 and 1932 show a steady or regular increase in the catch until the maximum is reached. No doubt the primary factor causing these fluctuations in the catches is concerned with the weather conditions but whether it be wind, temperature or both is hard to say at present.

In every year the catch decreased after the maximum catch is reached. In 1923 the decrease was slight as the catch was at a steady high level from July 7 to Aug. 11. Also in 1928 the decrease was slight and the catch similar to that in 1923 as it remained high from June 23 to Aug. 4 with a considerable drop on July 21. In 1932 the maximum catch was on July 2 and then dropped considerably but remained at a steady level from July 9 to July 30 only dropping slightly in the last period. The decrease might be called regular or s steady in the following years: 1919, 1921, 1929, 1930, 1931, 1923, 1928. The years 1924, 1925, 1926, 1927, and 1932 show irregular decreases.

By averaging the catches for corresponding periods in the various years 1919 to 1932 as in fig. 13, the irregular fluctuations due to weather conditions are removed. In this way a general curve, showing the time of rise and fall in the abundance of St. John drift salmon, is procured. There is a gradual increase in abundance from 7.1 salmon per fisherman per day on June 7, to a maximum catch of 12.0 salmon per fisherman per day on July 11. From July 11 on the numbers decrease gradually until the catch is only 7.5 salmon per

Table 14. St. John Drift Salmon. Average daily catch per fisherman in each 5-day period of each year separately from 1919 to 1932, average daily catch per fisherman in each 5-day period when all years from 1919 to 1932 are averaged, and the average daily catch per fisherman per year.

1932	Period end.	4	11	18	25	2	9	16	23	30		Total average
	Av. daily catch per fisherman.	3.3	4.3	5.8	6.8	9.3	6.9	7.8	7.8	7.3		6.8
1931	"	6 7.8	13 7.5	20 12.6	27 13.6	4 8.6	11 15.4	18 14.5	25 8.8	1 5.8		10.8
1930	"	7 11.4	14 11.4	21 12.3	28 13.0	5 k3.0	12 22.8	19 14.2	26 9.5			13.1
1929	"	8 5.4	15 8.1	22 6.4	29 7.8	6 14.7	13 7.9	20 17.3	27 9.8			9.6
1928	"	9 4.5	16 4.6	23 7.9	30 8.3	7 9.0	14 8.5	21 6.0	28 9.2	4 8.5		7.4
1927	"		11 6.1	18 6.0	25 9.0	2 10.2	9 14.8	16 15.4	23 4.5	30 9.5	6 5.0	9.1
1926	"		12 8.8	19 10.4	26 7.0	3 12.9	10 14.1	17 9.6	24 13.7	31 4.5		10.5
1925	"	6 6.5	13 7.6	20 6.7	27 11.2	4 9.6	11 8.1	18 13.0	25 7.3	1 7.8		8.8
1924	"		14 6.5	21 5.2	28 9.8	5 7.4	12 13.3	19 9.3	26 10.6	2 8.1		8.4
1923	"		16 4.1	23 5.2	30 5.1	7 8.8	14 9.3	21 8.5	28 8.8	4 9.6	11 9.4	7.6
1921	"		11 9.7	18 5.9	25 14.0	2 12.2	9 11.5	16 13.0	23 7.8	30 6.9	5 6.7	10.1
1919	"		14 3.8	21 4.1	28 5.1	5 5.3	12 7.7	19 4.2	26 4.2			4.9
Total average		7 (4-9) 7.1	13 (11-16) 7.0	20 (18-23) 7.5	27 (25-30) 9.6	4 (2-7) 9.9	11 (9-14) 12.0	18 (16-21) 11.1	25 (23-28) 8.8	3 (30-4) 7.8	7 (5-11) 7.5	9.0

fisherman per day on August 7, i.e. the catch falls off to about the same amount as in the beginning of the run. Thus this run of salmon reaches its climax and begins to decline during the time limit of the legal fishing season. So, in general, the maximum catch for the year is 12.0 salmon per fisherman per day while the average catch for the entire year is 9.0 salmon per fisherman per day.

The average daily catch per fisherman per year is shown in fig. 14 and extends from 1919 to 1932 but the years 1920 and 1922 are missing. The poorest catch was made in 1919 when only 4.9 salmon per fisherman per day was the average. Other poor years were 1923 (7,6), 1928 (7.4) and 1932 (6.8). The best year was 1930 when 13.1 salmon was the average. Other good years were 1921 (10.1) and 1926 (10.5). Some sort of periodicity in numbers of salmon is evident but the records do not extend over enough years to warrant any conclusions as to the extent of the periodicity. It would be well to continue the compilation of such records as these in the future.

The variations in the average daily catches per fisherman from one period to another are quite considerable. During any one of the years the greatest variation (13.3 fish) from the lowest average daily catch per fisherman to the highest was in 1930. Here the lowest average was 9.5 fish in July 26 and the highest was 22.8 fish in July 12, a difference of 13.3 fish. The least variation during any of the years was in 1919. Here the lowest average was 3.8 fish in June 14 and the highest was 7.7 fish in July 12, a difference of only 3.9 fish. The average variation from the lowest to the highest average daily catch per fisherman for all the years from 1919 to 1932 is 8.2 fish, i.e. in general the difference between

the lowest and highest average daily catch per fisherman per period in any one year would be around 8.2 fish. Considering average catches per period independently of years, the lowest average daily catch per fisherman is 3.3 fish in June 4, 1932, and the highest average daily catch per fisherman is 22.8 fish in July 12, 1930.

Likewise the yearly average daily catches per fisherman vary a good deal from one year to another. The lowest average was 4.9 fish for the year 1919 and the greatest average was 13.1 fish for the year 1930, a difference of 8.2 fish. In general the average daily catch per fisherman is 9.0 fish which was computed from all the salmon of all the years from 1919 to 1932.

b. Fluctuations in Weights of Salmon.

In 1919 the average weight per salmon increased gradually from 11.5 lb. June 14 to a maximum of 12.8 lb. July 28 at the end of the season. In 1921 the increase was gradual until the maximum of 12.7 lb. was reached on July 9, which was followed by a gradual decline the remainder of the season. In 1923 there was a slight decrease in weight from June 16 to June 23 but after that it increased to a maximum of 12.2 lb. on July 7 followed by a gradual decrease. In 1924 there was a steady and considerable increase from 12.0 lb. June 14 to 12.9 lb. Aug. 2. In 1925 the weight began at the high level of 12.5 June 6 and then showed a gradual increase to the maximum of 13.0 lb. on July 18 followed by a gradual decline to 12.5 lb. at the end of the season. 1926 was somewhat similar to 1925. The weight rose gradually from 12.1 lb. June 12 to a maximum of 12.8 July 17 and then declined gradually at the end of the season. In 1927 the weight increased gradually from 11.6 lb. June 11 to a maximum of 12.8 July 30 and then decreased slightly the following and last period. In 1928 the maximum weight was 12.2 June 30 but the

increase before and the decrease after that date were quite irregular. In 1929 the weights were high for the whole season, starting out at 12.4 lb. June 8 increasing gradually to a maximum of 13.6 on June 29 and July 6 and then showing an irregular decrease for the rest of the season. (1929 records are from McCavour's banks directly and do not include other Lorneville fish for Leonard's, and McCormack and Zatzman etc. as Sidney Evans did not have records for 1929. This, however, does not seem to explain the high level of the weights but must be kept in mind.) In 1930 the weights increased irregularly to a maximum of 13.2 July 12 and then decreased gradually. In 1931 the weights increased to a maximum of 12.8 on July 18 and 25 and then decreased slightly the next and last period. In 1932 the weights decreased gradually from 12.2 lb. June 4 to 11.7 June 25. This was followed by a gradual increase to a maximum of 12.5 July 16 and then a gradual decrease at the end of the season.

On the whole the fluctuations in weights during the season are not so prominent as in the numbers of salmon caught, i.e. the changes in the weights during the season seem to be more gradual than do the changes in the numbers of salmon. The maximum weight in the various years occurs much more frequently in July than in June or August. In the average for all the years 1919-1932 (fig. 13) the maximum weight occurs on July 18 so in this respect is similar to the maximum catch for all the years which was also in the middle of July but one period earlier (July 11). There are no secondary maxima in the weight curves for any of the years.

The weight curves for all of the years show a gradual increase in the periods immediately preceding the maximum period but many of the years do not show an increase for the first few periods of the year. In 1923 there is a decrease from the first to the second

period, June 23. Similarly in 1932 there is a gradual decrease from the first period to the second (June 11), third (June 18), and fourth (June 25) periods. In 1919, 1928, 1930, and 1931 the second period shows an increase in the weight followed by a decrease in the third period. The years 1924 and 1926 show no increase in weight from the first to the second period. The years 1925 and 1927 are somewhat similar in that in 1925 the second period shows a slight increase over the first period but the third and fourth periods remain the same as the second while in 1927 the second period shows quite an increase over the first period but the third period remains the same as the second period. Only two years viz., 1921 and 1929, show a steady increase in the weight from the first period to the maximum period.

All of the years except 1919 and 1924 show a decrease in the weight after the maximum weight is reached. In these two years the maximum weight is in the last period of the year, the weights increasing quite uniformly from the beginning of the season to the last. In 1927 and 1931 the maximum period was late in the season also, being the one before the last.

So, when the weights of all the years are averaged as in fig. 13 the curve shows a decrease from 12.4 lb. June 7 to 12.1 lb. June 13 and June 20 followed by a uniform increase to a maximum of 12.7 lb. July 18. Then follows a decrease in weight for the remaining periods to 11.6 lb. Aug. 7 which is the last period.

In explaining the fluctuations in the weights of salmon for the various periods throughout the season the age determinations of 624 St. John drift salmon of 1932 are useful. The percentage of Sea Groups in Drift Fish is given in Table 19 and the average weights of Sea Groups in Table 21. The average weight per fish in each 5-day period for 1932 is given in fig. 12, and since the age determinations

are for 1932 perhaps it would be logical to refer to fig. 12 rather than to fig. 13 which represents the average weight curve for the various years 1919-32. But it is believed, although not proved, that the results of age determinations as given in tables 19 and 21 should remain practically the same from year to year and so are equally applicable to the weight curves of any of the years.

Table 19 shows that the percentage of salmon in the 2 Sea Group decreases from 14% in June 16-22 to 9.3% June 28-30 and to 1.6% in July 19-20. Also the percentage of salmon in the 3 and 3+ Sea Groups decreases from 2.2% June 16-22 to .5% in June 28-30 and July 19-20. The opposite condition holds in the S.M. group as the percentage increases from 3.5 June 16-22 to 7.8% June 28-30 and to 10.5% July 19-20. Now by referring to table 21 we can see how the weights of the various sea groups fluctuate during the season and we can also see the relative importance of the various age groups in determining the average weight of all the sea groups taken together. The weight of the 2 Sea Group remained at 12.4 lb. for both periods in June and increased to 12.7 lbs. in July 19-20 but this is an average of only three fish so is not reliable. So we might conclude that the 2 Sea Group does not increase in weight as the season advances. This would be expected at any rate since the number of ridges at the periphery do not increase since the last winter band. The weight of the 2+ Sea Group at this rate should increase as the season advances and does increase appreciably from 12.4 lb. June 16-22 to 12.8 lb. June 28-30 to 13.4 lb. July 19-20. In comparing the total weights (table 21) for the sea groups we see that the 3, 3+ Sea Group are the heaviest fish weighing 20.8 lb. while the S.M. group comes next weighing 16.4 lb. The 2+ Sea Group (12.9 lb.) is slightly heavier than the 2 Sea Group (12.4 lb.).

The 2+ Sea Group determines the general weight level since they make up 82.9% of the catch (table 19). So the total weight for all of the age groups (table 21) in any of the periods should more or less correspond with the weight of the 2+ Sea Group. Table 21 shows that they do correspond quite well but there are slight variations. The total weight, 12.8 lb., is slightly higher than the weight, 12.4, of the 2+ Sea Group in June 16-22. This increase in the total weight of all the groups is due mainly to the 2.2% of salmon weighing 21.8 lb. in the 3,3+ group but also partly to the 3.5% of salmon weighing 15.8 lb. in the S.M. group. In June 28-30 period the average weight of the 2+ group increases to 12.8 lb. but the average for the total only increases to 12.9 lb. which is much less of an increase than that in the 2+ sea group. But the number of salmon in the 3, 3+ sea group has been reduced to .5% so that the total average has not increased as much as the 2+ sea group average. In the next period July 19-20 the average for the 2+ group has increased considerably to 13.4 lb. while the average for the total has also increased considerably to 13.9 lb. But in this period the 3, 3+ group still contains only .5% of the total number of salmon. However the S. M. Group has increased to 10.5% of the total and the average weight of this group has also increased from 15.3 lb. to 17.4 lb. So the increase in the total average in this period is due to both the 2+ and the S. M. groups.

The period June 16-22 in table 21 corresponds approximately to the period June 25 in fig. 12, June 28-30 corresponds to July 2, and July 19-20 corresponds to July 23. In fig. 12 the increase is from 11.7 June 25 to 11.9 July 2, to 12.4 July 23 ~~in~~ which is quite similar to the increase in table 21 from 12.8 June 16-22 to 12.9 June 28-30, to 13.9 July 19-20. However, the scale used in weighing the salmon in table 21 evidently weighs about a pound higher than the scales used in weighing the salmon of fig. 12.

So that from the above facts it seems quite probable that the decrease in the average weights for the first few periods in 1932 fig. 12 and also in fig. 13 is due to the decrease in the percentage of salmon making up the 3,3+ sea group and thus the effect would be lost. Or rough weather in the early part of the season preventing the drifters from fishing might allow the early running 3,3+ sea group to pass into the river unmolested.

Some years do not show this decrease in the average weight for the first few periods. The ice leaving the rivers at a later date might prevent the early running of the 3,3+ sea group.

The gradual increase in weight reaching a maximum in the middle of July is apparent in all the years and is easily explained by the increase in weight of the 2+ sea group as shown above, the increase in the percentage of the heavier S.M. group and the decrease in the percentage of the 2 group which does not increase in weight.

The decrease in weight at the end of the season after the maximum weight is reached is due to the poor condition of the salmon. The salmon taken in the early part of the season have only recently left their main feeding grounds and come to the surface to enter the river when conditions are suitable. The fact that the weights do increase at first as the season advances is proof enough that all the salmon do not leave their feeding grounds at the same time. Some come to the surface where there is less food available or they are less anxious to feed. Consequently they increase in weight but very little if at all. Others remain feeding voraciously for a longer period and consequently increase in weight as the season advances. These salmon coming to the surface at various times during the season are taken by the drifters and so the average weight increases as the season advances. In this particular case we are referring to the 2+ sea group.

Moreover, as the season advances, the ovaries are increasing in size. In the fish at the surface, the fat stored in the body is

being used up faster than it is being replaced. So the fish begins to lose weight and as the season advances the loss in weight is increased. The heavier fish coming from the depths tend to increase the average weight as the season advances but the fish at the surface losing weight as the season advances tend to decrease the average weight. So that finally the amount of increase is just balanced by the amount of decrease, i.e. the maximum average weight is reached. There are just enough heavier fish coming from the depths to counterbalance the loss in weight experienced by the fish remaining at the surface. But when there are not enough of the heavier fish repeatedly coming from the depths the average weight begins to decrease as the fish at the surface are losing condition rapidly.

The fish at the surface do not immediately make for the river and enter it. They swim back and forth for a considerable time before entering the river. The fact that the average weight decreases after a maximum is reached is proof enough for this. They must linger in the salt water for some time before entering the river. If all of the salmon made for the river immediately after leaving their feeding grounds and coming to the surface the average weight in the drift fish should increase until the run is finished. That such a condition is possible is shown in figs. 1 and 4 for the years 1919 and 1924 respectively. The weight increases right up until the end of the season long after the maximum catch is reached. So that in these years the conditions for entering the river must have been more favorable than in the other years. Just what the factors are inducing these salmon to play around in salt water before entering the river have not yet been definitely determined. Some seem to think that it takes some time for them to become accustomed to the changes in salinity coming from salt water to fresh water. But it seems quite probable that the

temperature of the water would play a considerable role i.e. a high temperature might hasten the development of the ovaries and cause the salmon to leave the sea earlier than in other years. This fact would then explain the weight curves for 1919 and 1924.

The average weight per fish per year is shown in fig. 14 (taken from table 15). The average weight was low in 1919 at 12.0 lb., in 1923 at 11.6 (which is the lowest yearly average), in 1928 at 11.9 lb., and in 1932 at 12.0 lb. The average weight was high in 1921 at 12.3 lb., in 1925 at 12.7, and in 1929 at 13.2 lb. (which is the highest yearly average). The average daily catch per fisherman is also shown in fig. 14. The low years for both numbers and weights of salmon agree viz., 1919, 1923, 1928 and 1932. The high weights, however, come one year previous to the high catches i.e., a high weight in 1925 followed by a high catch in 1926, and a high weight in 1929 followed by a high catch in 1930. So whatever is the factor causing the decline in numbers and weights of salmon, it first affects the weights and then the numbers of salmon finally having the greatest effect on both numbers and weights in the same year.

That the average weight is not directly affected by the average catch is shown by the yearly averages in fig. 14 by the fact that the high weights precede the high catches by one year. It is also shown in figs. 1-13 where the average daily catch per fisherman and the average weight per fish are plotted together in 5-day periods for the various years from 1919 to 1932. In fig. 13 the maximum weight is on July 18, one period later than the maximum catch in July 11. In each of the years separately the average weights and average catches sometimes vary in the same direction but they just as often vary in opposite directions. So it seems necessary to conclude that the increase to a maximum about the middle of July and the following decrease occurs independently in both the average weights and average catches, i.e. the one is not directly determined by the other.

One One striking feature about the average weights is the slight extent of the variations from one year to another and from one period to another.

First let us consider the variations in the average weights from one period to another. During any one year the greatest variation (1.3 lb.) from the lowest average weight of the year to the highest was in 1919. Here the lowest average was 11.5 lb. in June 14 and the highest was 12.8 lb. in July 28, a difference of 1.3 lbs. The least variation during any of the years was in 1925. Here the lowest average weight was 12.5 lb. in June 6 and Aug. 1, and the greatest average weight was 13.0 lb. in July 18, a difference of only .5 lbs. The average variation from the lowest to the highest average weight for all the years from 1919 to 1932 is .9 lb. i.el in general the difference between the lowest and highest average weight per period in any one year would be around .9 lb. Considering average weights per period independently of years, the lowest average weight is 11.1 lb. in June 23, 1923, and the highest average weight is 13.6 lb. in July 6, 1929.

Similarly the yearly average weights per fish do not vary a great deal. The lowest average was 11.6 lb. for the year 1923 and the greatest average weight was 13.2 lb. for the year 1929, a difference of only 1.6 lb. In general the average weight per fish is 12.4 lb. which was computed from all the salmon of all the years from 1919 to 1932.

From June 16 to July 20, 1932, 1157 salmon from St. John drift catches were measured and weighed. These measurements have been divided into four periods and the average weights and average lengths for each period determined. The periods ending June 18, June 25, July 1, and July 20 were selected so as to correspond as

nearly as possible to the periods ending June 18, June 25, July 2, and July 23 respectively in fig. 12 showing the average weights for 1932 as computed from the records of weights of St. John drift salmon given me by Sidney Evans. Table 22 shows my measurements for 1932 and table 15, fig. 12 shows those of Sidney Evans.

Table 22. Showing average lengths and average weights of 1157 St. John drift salmon in 1932 when separated into various periods during the year.

Period end.	June 16-18	June 22-25	June 28-July 1	July 19-20	June 16-July 20 Average	
No. of fish	203	321	431	202	1157	
Av. Wt.	12.6	12.6	12.9	13.8	12.9	lb.
Av. Length	80.7	80.4	81.1	82.4	81.0	cm.

Here we see that the average weight remains the same at 12.6 lb. from June 18 to the period ending June 25. On July 1 it increases to 12.9 lb. and on July 20 it increases to 13.8 lb. The average for the 1157 salmon from June 16 to July 20 is 12.9 lb. In fig. 12 the average weight decreases slightly from 11.8 lb. June 18 to 11.7 lb. June 25. It then increases to 11.9 lb. July 2 and to 12.4 lb. July 23. The yearly average is 12.0 lb. In general the weights in table 22 are approximately one pound heavier than those in table 15, this being due to different scales being used. But the fluctuations in the average weights from one period to another agree fairly well except that the average weight in table 22 does not decrease from the first period to the second period whereas it does decrease slightly in table 15, but this difference is negligible. The fluctuations in the average lengths in table 22 agree perfectly with the fluctuations in average weights in table 15. The average lengths decrease from 80.7 cm. June 18 to 80.4 cm. June 25. They then increase to 81.1 cm. July 1 and to 82.4 cm. July 20. Therefore, since the two sets of measurements for St. John drift salmon in 1932 agree so well it may be concluded that the records given me by Sidney Evans for 1932 and also for all years from 1919 to 1932 are as accurate as can be desired.

Table 15. St. John Drift Salmon. Average weight per fish in each 5-day period of each year separately from 1919 to 1932, average weight per fish in each 5-day period when all years from 1919 to 1932 are averaged, and the average weight per fish per year.

											Total Average
32 Per. end.	4	11	18	25	2	9	16	23	30		
av.wt. lb.	12.2	11.9	11.8	11.7	11.9	11.9	12.5	12.4	12.0		12.0
31 "	6.	13	20	27	4	11	18	25	1		
	12.0	12.2	12.1	12.2	12.5	12.6	12.8	12.8	12.6		12.4
30 "	7	14	21	28	5	12	19	26			
	12.6	12.7	12.6	12.8	13.1	13.2	12.8	12.6			12.9
29 "	8	15	22	29	6	13	20	27			
	12.4	12.7	13.0	13.6	13.6	13.3	13.5	13.2			13.2
28 "	9	16	23	30	7	14	21	28	4		
	12.0	12.1	11.7	12.2	11.9	12.0	12.1	11.8	11.5		11.9
27 "		11	18	25	2	9	16	23	30	6	
		11.6	11.9	11.9	12.0	12.4	12.6	12.5	12.8	12.6	12.2
26 "		12	19	26	3	10	17	24	31		
		12.1	12.1	12.5	12.6	12.7	12.8	12.6	12.5		12.5
25 "	6	13	20	27	4	11	18	25	1		
	12.5	12.6	12.6	12.6	12.7	12.8	13.0	12.8	12.5		12.7
24 "		14	21	28	5	12	19	26	2		
		12.0	12.0	12.3	12.5	12.8	12.7	12.8	12.9		12.6
23 "		16	23	30	7	14	21	28	4	11	
		11.2	11.1	11.3	12.2	11.6	11.6	11.7	11.7	11.4	11.6
21 "		11	18	25	2	9	16	23	30	5	
		11.8	12.1	12.3	12.3	12.7	12.4	12.3	12.2	12.0	12.3
19 "		14	21	28	5	12	19	26			
		11.5	11.7	11.6	11.8	12.0	12.2	12.8			12.0
Total	7	13	20	27	4	11	18	25	3	7	
verage "	(4-9)	(11-16)	(18-23)	(25-30)	(2-7)	(9-14)	(16-21)	(23-28)	(30-4)	(5-11)	
	12.4	12.1	12.1	12.3	12.4	12.6	12.7	12.5	12.3	11.6	12.4

Fig. 1 - 3.
Average daily catch per fisherman and average weight per fish in each 5-day period of years 1919, 1921, and 1923.

——————— weight in lb.
– – – – – – – – number of salmon.

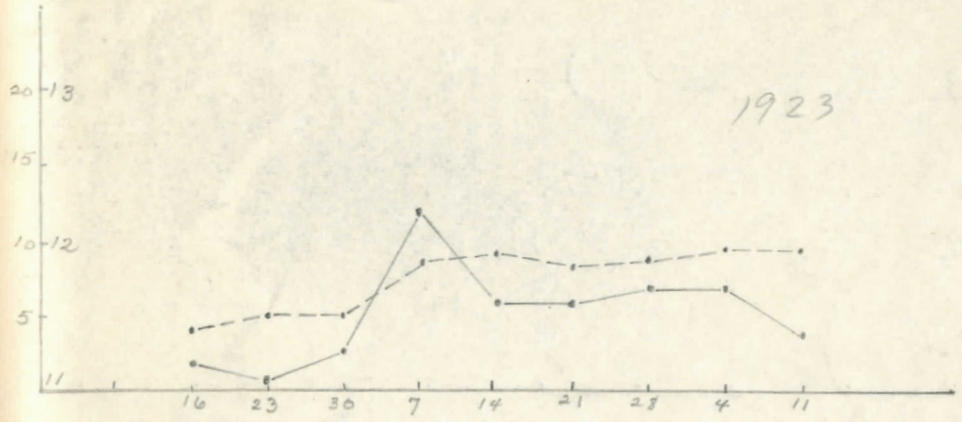


Fig. 3.

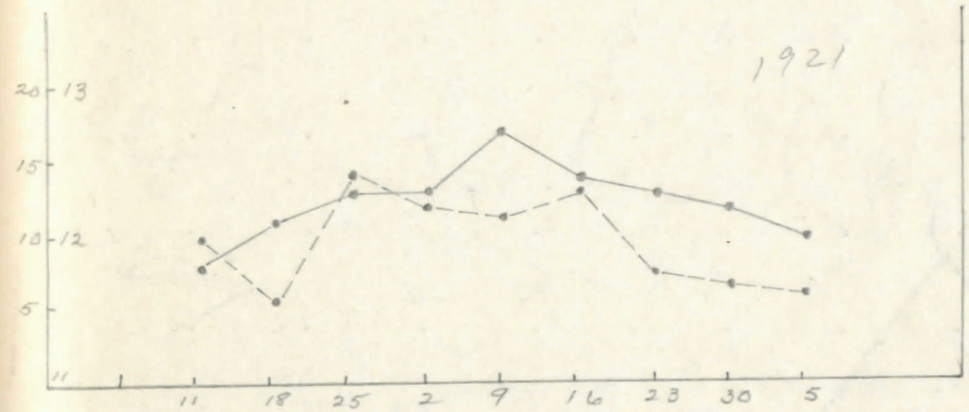


Fig. 2.

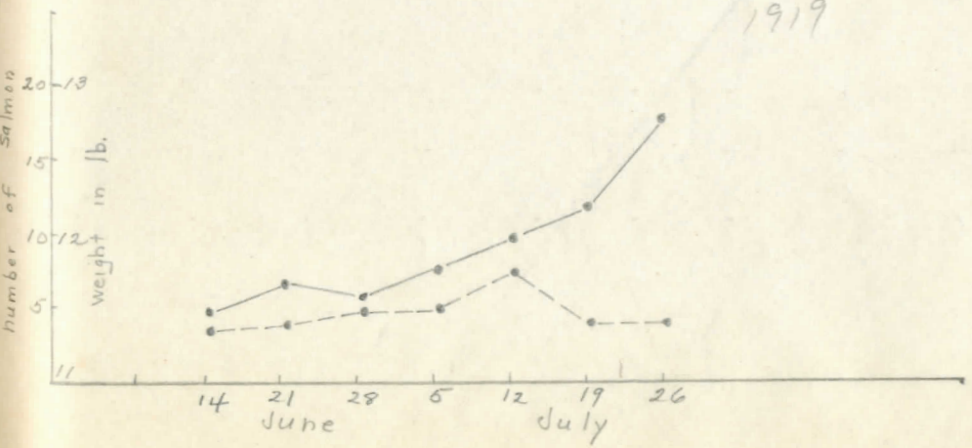


Fig. 1.

Fig. 4 - 6. Average daily catch per fisherman and average weight per fish in each 5-day period of years 1924, 1925, and 1926.

———— Weight in lb.
- - - - - - - - - Number of salmon.

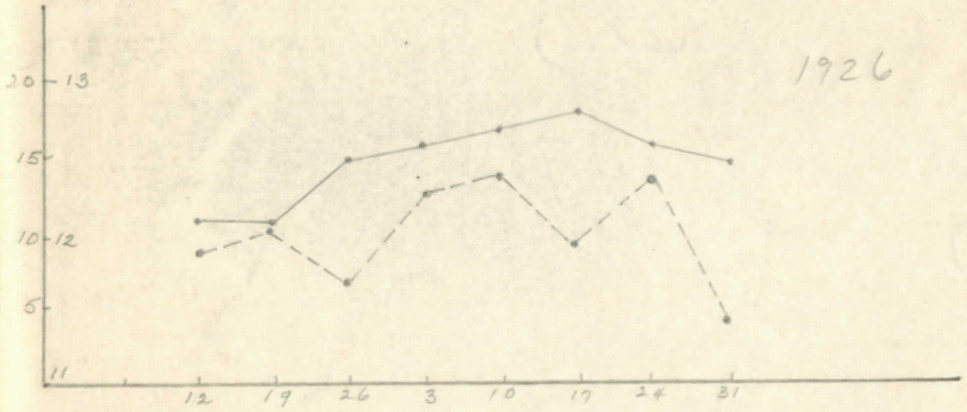


Fig. 6

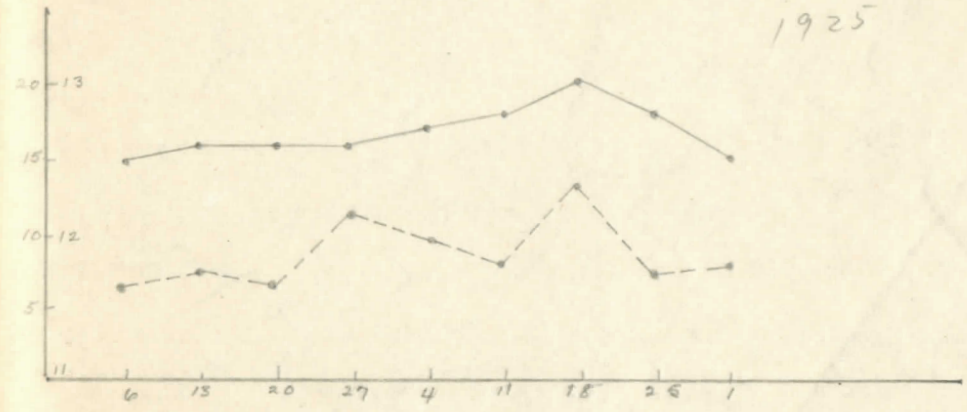


Fig. 5

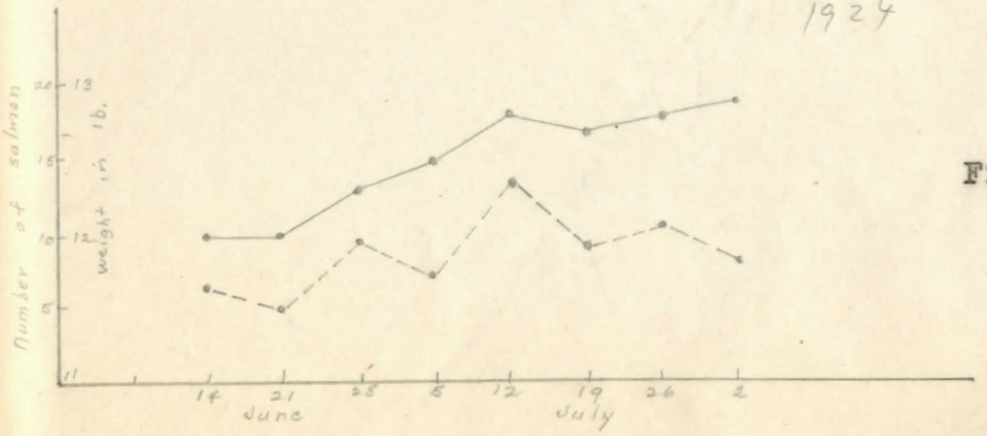
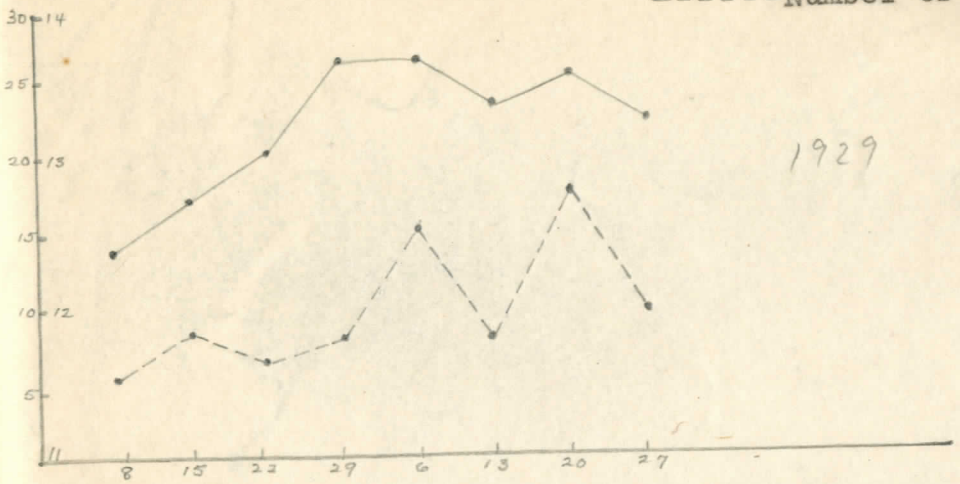


Fig. 4

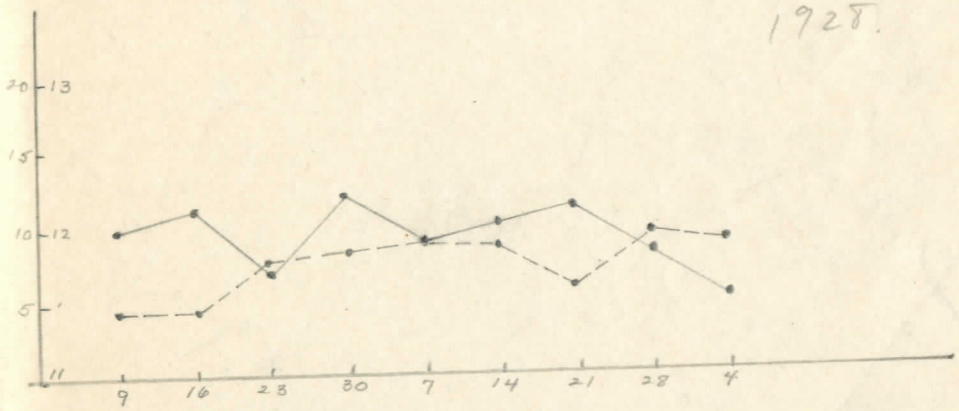
Fig. 7-9 Average daily catch per fisherman and average weight per fish in each 5-day period of years 1927, 1928, and 1929.

———Weight in lb.
------Number of Salmon.



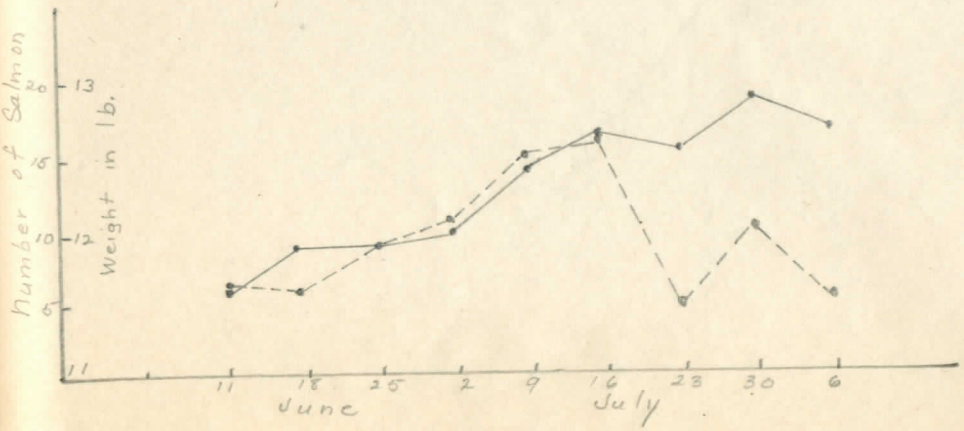
1929

Fig. 9



1928.

Fig. 8

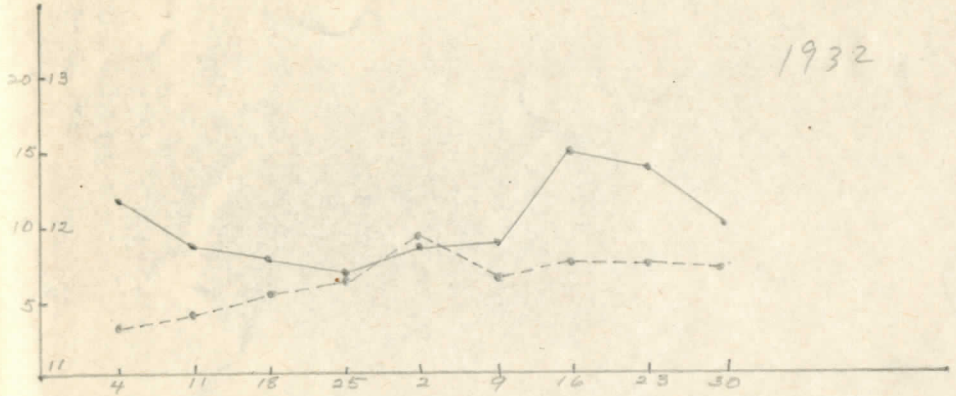


1927.

Fig. 7

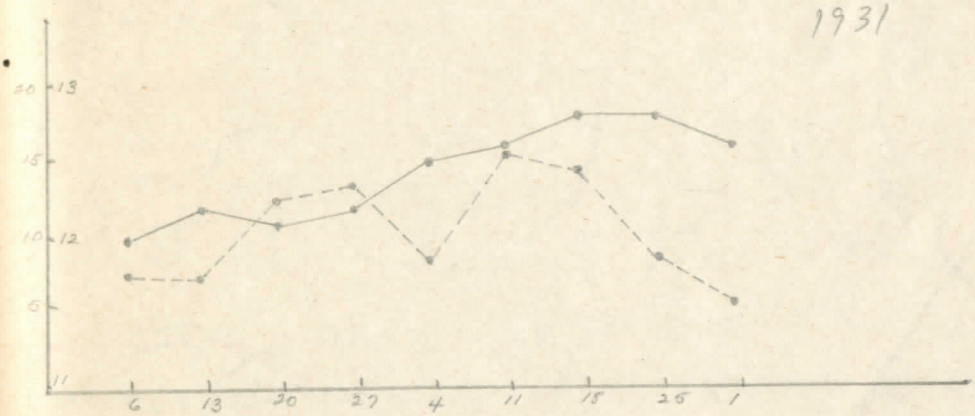
Fig. 10 - 12 Average daily catch per fisherman and average weight per fish in each 5-day period of years 1930, 1931, and 1932.

———— Weight in lb.
- - - - - - - - - Number of Salmon.



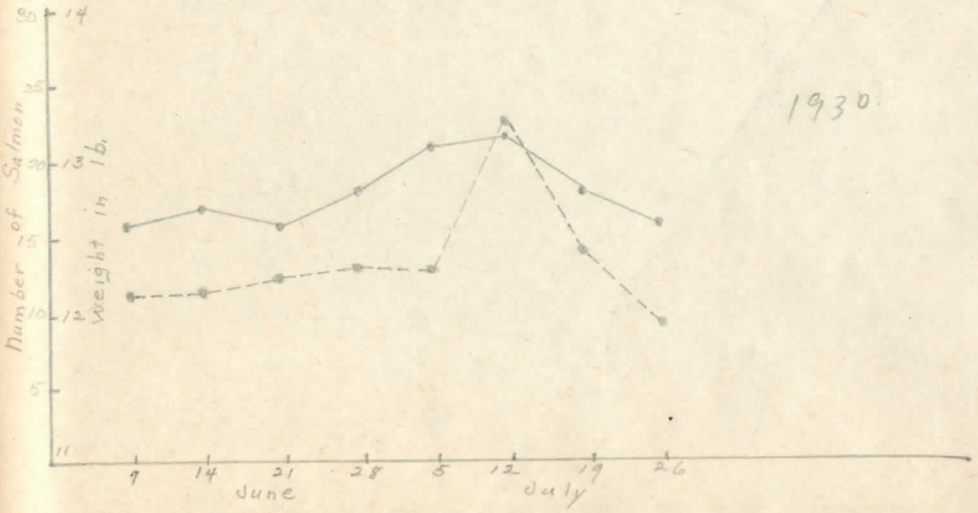
1932

Fig. 12



1931

Fig. 11



1930

Fig. 10

Weight in lb.
Number of Salmon

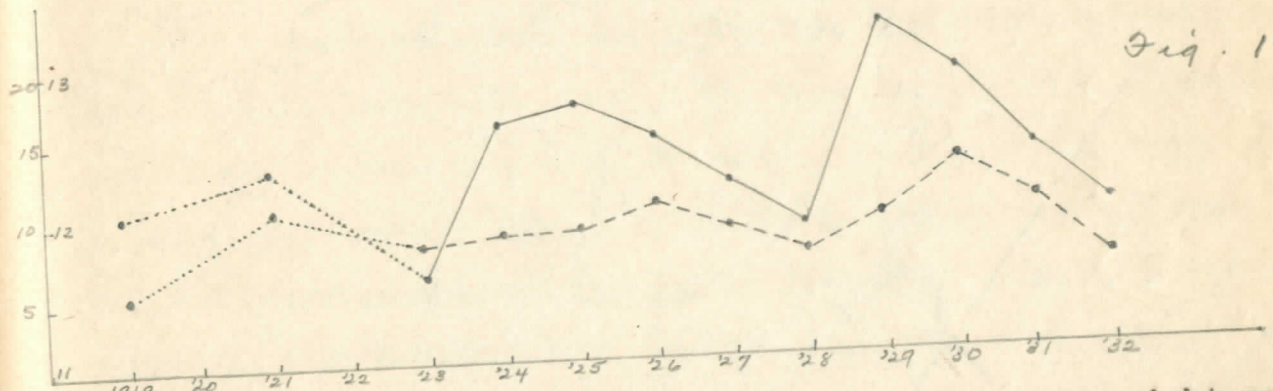


Fig. 14.

Average daily catch per fisherman per year and average weight per fish per year.

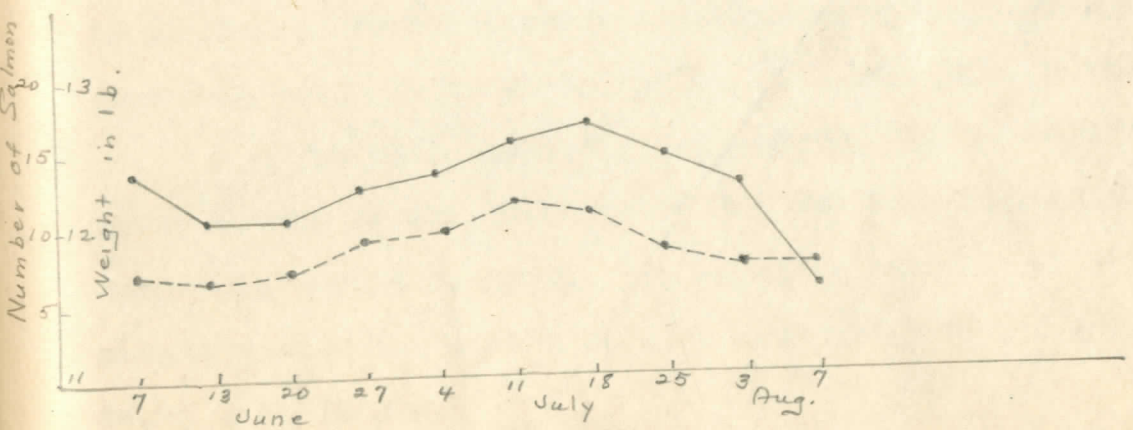


Fig. 13.

Average daily catch per fisherman and average weight per fish in each 5-day period when all years from 1919 to 1932 are averaged.

IV. Sea Ages

The percentage of sea groups in the total number of 624 drift salmon examined is given in table 19, which also shows the change in the proportion of the sea groups at different times of the year. From June 16-22, 228 fish were examined, from June 28-30, 205 fish, and from July 19-20, 191 fish, making a total number of 624 fish from June 16 to July 20. Unfortunately the fish could not be collected at regular intervals during the entire fishing season.

Only two grilse (1+ group) i.e. .3% were taken. This was to be expected as the size of the mesh in the drift nets is far too large for the regular capture of grilse which make up the smallest sea group.

The next larger sea group than the grilse is the 2 sea group and it forms only 8.6% of the total of 624 fish. However, in June 16-22 it made up 14% of the total, in June 28-30, only 9.3%, and in July 19-20 merely 1.6%. So that relative numbers of these fish fall off considerably as the season advances. This is what we should expect as they have not been feeding since the final winter or at least show no plus growth on the scale since the last winter band formation. So we conclude that they cease feeding early in the year in order to proceed toward entering the river in preparation for the spawning which takes place far up the river late in the fall.

The next larger salmon compose the 2+ sea group which forms 82.9% of the total. This is by far the most important group to the commercial drift fishery. The relative numbers in this group increase slightly with the season e.g., 80.3% June 16-22, 81.9% June 28-30, and 86.9% July 19-20.

The 2 and 2+ sea groups together form 91.5% of the total catch. The percentage decrease from 94.3% at the beginning of the season to 88.5% at the end of the season, due mainly to the decreasing of proportion of 2 sea group fish.

The 3 sea group fish are large fish but are very scarce. Only 5 (2.2%) were taken in June 16-22, none in June 28-30, and 1 (.5%) in July 19-20, making a total of 6 or 1.0% of the total. Only one salmon in the 3+ sea group was taken and this in June 28-30, making .1% of the total. Together the 3 and 3+ sea groups account for 1.1% of the total number of salmon. So these older fish are very scarce indeed and they are similar to the 2 sea group in that their proportion decreases with season.

The S.M. sea group i.e. fish which have previously spawned on one occasion account for 7.1% of the total number. So they are relatively important to the fishery, about on a par with the 2 sea group. Contrary to the 2 sea group however their relative importance increases with advance of the season. In June 16-22 they form 3.5%, in June 28-30 7.8% and in July 19-20 have increased to 10.5% of the catch. Thus during the last of the season no doubt they would far exceed 10% of the catch. On the spawning beds it is just hard to say how their numbers would compare with the other sea groups. Such things should be further investigated.

Table 19. Percentage of Sea Groups in Drift Fish.

Winters in Sea.	1+	2	2+	Total 2, 2+	3	3+	Total 3, 3+	S.M.	Total Number.
June 16-22	--	14.	80.3	94.3	2.2	--	2.2	3.5	228
June 28-30	.5	9.3	81.9	91.2	--	.5	.5	7.8	205
July 19-20	.5	1.6	86.9	88.5	.5	--	.5	10.5	191
Total	.3	8.6	82.9	91.5	1.0	.1	1.1	7.1	624

V. Previously Spawned Fish.

Of the total number of 624 salmon examined only 44 i.e. 7.1% had a spawning mark on their scales showing that they had spawned on one previous occasion. So when captured they were on their second spawning journey. No salmon were found with two spawning marks.

In table 24 these 44 fish which have previously spawned on one occasion are divided so as to show the time of spawning, absence after spawning, and the time of the year when captured on their second spawning journey. Here we see that 37 (84%) out of the 44 fish with a spawning mark first spawned as grilse i.e. after spending only one winter in the sea. All of these were long absence fish which means that after their first spawning they remained in the sea over one year before making a second spawning journey to the river. Seven (16%) of the 44 salmon with a spawning mark first spawned after spending two winters in the sea. One of these seven salmon was a short absence fish which means that after its first spawning it remained in the sea less than one year before returning to the river on a second spawning journey. This was the only short absence fish found and it was taken in the last period viz. July 19-20. This seems to be the rule for short absence fish viz., entering the river late in the year on their second journey to the river. So in the total this makes 43 salmon (98%) that were long absence fish. So St. John salmon can hardly be called annual spawners.

Table 24. Fish which have previously spawned on one occasion showing the time of spawning, absence after spawning, and the time when captured on the second spawning journey.

First spawning	First Sea Winter (Grilse)
Absence after spawning	

Table 24. Fish which have previously spawned on one occasion showing the time of spawning, absence after spawning, and the time when captured on the second spawning journey.

First Spawning	First Sea Winter (Grilse)	Second Sea Winter (Salmon)			Total		
Absence after spawning	Long (over 1 year)	Short (less than 1 yr.)	Long	Total	Short	Long	Total
June 16-22	6		2	2		8	8
June 28-30	14		2	2		16	16
July 19-20	17	1	2	3	1	19	20
Total	37	1	6	7	1	43	44

VI. Smolt Ages (River Ages).

In table 17 will be found the percentage of smolt ages in each sea group and in the total number of salmon in the different periods during the year and for all the periods together.

The numbers of salmon in each of the sea groups separately are so small that it is useless to discuss each alone. Even in the total of all the sea groups the variations are so great that further mark is necessary before much dependance can be placed on the results. For instance, in June 16-22 most of the salmon were three year smolts viz., 2 year smolts 37.3%, 3 year smolts 59.2%, and 4 year smolts 3.5%. In June 28-30 the 2 year smolts increased while the 3 and 4 year smolts decreased slightly viz. 42% 2 year smolts, 56.6% 3 year smolts, and 1.4% 4 year smolts. In July 19-20 there were no 4 year smolts, the 2 year smolts were in the majority having increased tremendously to 60.2% leaving only 39.8% 3 year smolts. The results for this last period correspond more nearly with those found in 1930 for the St. John salmon which were also taken at the same time of year.

So, of the total number of 624 salmon, 45.8% were 2 year smolts, 52.4% were 3 year smolts, and 1.8% were 4 year smolts. As was said before due to such extreme fluctuations it is now necessary to continue this part of the investigation further in an attempt to determine the validity of such variations.

Table 17. Percentage of Smolt Ages in each Sea Group.

Winters in Sea.	1+		2				2+				2, 2+			
Winters in river	3	T	2	3	4	T	2	3	4	T	2	3	4	T
June 16-22			37.5	56.3	6.2	32	38.8	57.9	3.3	183	38.6	57.7	3.7	215
June 28-30	100	1	26.3	73.7		19	43.5	55.4	1.1	168	41.7	57.2	1.1	187
July 19-20	100	1	33.3	66.7		3	58.4	41.6		166	58.0	42.0		169
Total	100	2	33.3	63.0	3.7	54	46.6	51.8	1.6	517	45.4	52.9	1.7	571

cont'd

3			3+		3, 3+				S.M.			Total			
2	3	T	4	T	2	3	4	T	2	3	T	2	3	4	T
20	80	5			20	80	100	5	12.5	87.5	8	37.3	59.2	3.5	228
			100	1			100	1	50	50	16	42.0	56.6	1.4	205
100		1			100			1	80	20	20	60.2	39.8		191
33.3	66.7	6	100	1	28.6	57.1	14.3	7	56.8	43.2	44	45.8	52.4	1.8	624

VII. Average Sizes of Sea Groups.

The average lengths of the sea groups for the entire year and for different periods during the year together with the average for all the sea groups together are given in table 20. The average weights of the sea groups are similarly given in table 21. Each age group will now be discussed separately.

a. 1+ Sea Groups (Grilse)

	Length (cm.)	Weight (lb.)
Minimum	65	7.5
Average	66	7.5
Maximum	67	7.5

This is the smallest sea group of all and only two examples were found so these averages do not mean much. The average length of these two specimens is 66 cm. and the average weight is 7.5 lb.

b. 2 Sea Group

	Length (cm.)	Weight (lb.)
Minimum	71.	8.5
Average	79.9	12.4
Maximum	85.	16.

This group is composed of fish slightly smaller on the average than the 2+ sea group. The average length is 7919 cm. and the average weight is 12.4 lb. There does not seem to be any definite trend to the average lengths nor the average weights from one period to another. The average lengths increased from 79.8 cm. in June 16-22 to 80.3 cm. in June 28-30 and then decreased to 79.0 cm. in July 19-20. The average weights remained the same at 12.4 lb. in June 16-22 and June 28-30 but increased slightly to 12.7 lb. in July 19-20. The numbers of salmon in these periods are very small especially the last period with only three salmon.

c. 2+ Sea Group

	Length (cm.)	Weight (lb.)
Minimum	68.	8.
Average	80.6	12.9
Maximum	90.	18.5

This sea group is the best represented of all since it makes up 82.9 percent of the total catch. So the averages are quite reliable.

The average length is 80.6 cm. and the average weight is 12.9 lb. Both of these averages are slightly greater than those for the 2 sea group. The average lengths increase from 80.2 cm. in June 16-22 to 80.6 cm. in June 28-30, and to 81.1 cm. in July 19-20. The average weights increase from 12.4 in June 16-22 to 12.8 lb. in June 28-30, and to 13.4 lb. in July 19-20. This was discussed more fully in dealing with records of catches.

d. Total of 2,2+ Sea Groups.

	Length (cm.)	Weight (lb.)
Minimum	68.	8
Average	80.6	12.8
Maximum	90.	18.5

The averages for the 2 and 2+ sea groups together are practically the same as for the 2+ sea group and need not be discussed further.

e. 3 Sea Group

	Length (cm.)	Weight (lb.)
Minimum	91.	18.
Average	97.1	21.6
Maximum	101.	24.

This is the largest and heaviest sea group of all with average length of 97.1 cm. and average weight of 21.6 lb. There are only seven fish in this group.

f. 3+ Sea Group.

Only one fish in this group with a length of 86 cm. and a weight of 15 lb.

g. Total of 3,3+ Sea Groups.

	Length (cm.)	Weight (lb.)
Minimum	86.	15.
Average	95.8	20.8
Maximum	101.	24.

Only 8 fish in all with average length of 95.8 cm. and average weight of 20.8 lb.

h. S.M. Sea Group.

	Length (cm.)	Weight (lb.)
Minimum	80.	12.
Average	88.1	16.4
Maximum	103.	25.

In both length and weight this group is exceeded by the 3 Sea Group only. In point of age they are as old if not older than the 3 sea group but have not been feeding steadily and have lost condition due to spawning. The average length is 88.1 cm. and the average weight is 16.4 lb. The average lengths decrease from 87.4 cm. in June 16-22 to 86.5 cm. in June 28-30, and then increase to 89.7 cm. in July 19-20. The weights also fluctuate in the same manner viz., from 15.8 lb. in June 16-22 to 15.3 lb. in June 28-30, and to 17.4 lb. in July 19-20.

i. Total of all Sea Groups (except 1+).

	Length (cm.)	Weight (lb.)
Minimum	68.	8.
Average	81.3	13.2
Maximum	103.	25.

The average length is 81.3 cm. and the average weight is 13.2 lb. The average weight of 13.2 lb. for the fish examined is slightly higher than the average, 12.9 lb., of the 1157 fish measured in 1932 (table 22). It is considerably higher than the yearly average, 12.0 lb., of the weight records for 1932 procured from Sidney Evans (table 15).

The average lengths increase from 80.9 cm. in June 16-22 to 81.1 cm. in June 28-30, and to 82.1 cm. in July 19-20. Similarly the weights increase from 12.8 lb. in June 16-22 to 12.9 lb. in June 28-30, and to 13.9 lb. in July 19-20. These weights agree almost exactly with the average weights of the 1157 fish in corresponding periods as given in table 22. The variations agree with those of corresponding periods in the weight records for 1932 (table 15) but the weights of the Sea Groups are about a pound heavier than those of the xxxx weight records for 1932. Since the variations in weights for selected periods in 1932 agree when taken from three different

sources viz., weight records for 1932 (table 15), total number of salmon measured in 1932 (table 22), and the average weights of all the Sea Groups together (table 21)., we may conclude that the sample of 1157 salmon measured and the sample of 623 salmon examined for ages are adequate samples for showing variations in average weights at different periods of the year.

The longest and heaviest salmon of all the sea groups was no. 990 with a length of 103 cm. and weighing 25 lb. It was a female salmon taken July 19. It was six years old, having spawned as a sea 2 year old. The scale reading is as follows: 2R, sw sw +/sw S.

The shortest and lightest salmon of all the sea groups (except 1+) was no. 215 with a length of 68 cm. and weighing 8 lb. It was a female salmon taken June 22. It was 5 years old, the scale reading being as follows: 3+ R, 2+ 7 S.

Table 20. Average Lengths of Sea Groups.

Winters in Sea.	1+	2	2+	Total 2, 2+	3	3+	Total 3, 3+	S.M.	Total except 1+
June 16-22		32 79.8	183 80.2	215 80.2	6 97.2		6 97.2	8 87.4	229 80.9
June 28-30	1 65	19 80.3	168 80.6	187 80.6		1 86.	1 86.	16 86.5	204 81.1
July 19-20	1 67	3 79.0	166 81.1	169 81.1	1 97.		1 97.	20 89.7	190 82.1
Total	2 66	54 79.9	517 80.6	571 80.6	7 97.1	1 86.	8 95.8	44 88.1	623 81.3

Table 21. Average Weights of Sea Groups.

Winters in sea	1+	2	2+	Total 2, 2+	3	3+	Total 3, 3+	S.M.	Total except 1+
June 16-22		32 12.4	183 12.4	215 12.4	6 21.8		6 21.8	8 15.8	229 12.8
June 28-30	1 7.5	19 12.4	168 12.8	187 12.7		1 15.	1 15.	16 15.3	204 12.9
July 19-20	1 7.5	3 12.7	166 13.4	169 13.4	1 20.5		1 20.5	20 17.4	190 13.9
Total	2 7.5	54 12.4	517 12.9	571 12.8	7 21.6	1 15.	8 20.8	44 16.4	623 13.2

VIII. Drift Salmon containing Food.

In table 23 is shown the number and percentage of St. John drift salmon with or without food contents in the stomach or intestine. These stomachs were collected at Leonard Brothers and McCavour's as the fish were being opened. All of the viscera were preserved so that the sex was later determined by the attached sexual organs. In some cases, however, these had been detached so that it was impossible to determine the sex.

All of the fish were drift salmon. All of the fish recorded for June were opened at Leonard Brothers. Thirteen of these were received on June 22, 12 on June 28, and 10 on June 29, making 35 in all for June. On July 27 there were 72 salmon opened at McCavours. So in all there were 107 salmon stomachs opened which is a very small number which at the most can afford only an indication of the feeding habits of the drift salmon.

In June 14% of the salmon examined had food remains in their stomachs. On July 27, 17% of the salmon contained food remains in their stomachs. According to this the percentage with food increased which is just the opposite to what one would expect. However, the number examined is far from sufficient. In the total of 107 fish examined 17, i.e. 16% contained food remains thus showing signs of recent feeding.

In June 20% of the males were found to contain remains of food in their stomachs while only 10% of the females were so found. Similarly in July 24% of the males and only 12% of the females showed signs of recent feeding. And in the total number of males this makes 23% with food while in the total number of females there were only 11% with food. So it seems that the proportion of males which showed signs of recent feeding was much greater than the proportion of females.

Concerning the feeding of the Miramichi salmon Dr. Belding has kindly furnished me with the following information. "I would say that out of 485 salmon examined from the drift in 1930, 35 had food in the stomach. Of 249 salmon from the Miramichi at Millerton one had food in the stomach. The percentages of fish with food were as follows in the drift:

Week beginning	June	15	-	18.6	percent.
"	"	22	-	8.1	"
"	"	29	-	7.5	"
"	July	6	-	3.3	"
"	"	13	-	4.2	"

After these weeks no salmon with food were taken. The percentage of drift salmon with food viz., 7.2% (35 out of 485), is much less for the Miramichi than for the St. John drift (16%). The proportion of the Miramichi drift with food decreases uniformly from 18.6% in June 15 to 4.2% in the week beginning July 13, and to nil thereafter. This seems quite the natural thing to expect and it is believed that a regular series for the St. John drift would show the same.

No efforts have as yet been made to determine the nature of contents found in the stomachs of St. John drift salmon except to note that the contents were practically all the remains of recently digested fishes or fish.

Are these drift salmon, with food remains in their stomachs, feeding in the surface layers where they are captured by the drift nets or are they feeding at greater depths and are captured after ascending quickly to the surface waters? Either the one or the other may reasonably be the case and proof for either is equally lacking. Opinions only are prevalent. To be consistent with the results found for average weights of salmon at different times of the year it seems reasonable to picture the actively feeding salmon to be at considerable depths. Numbers of these salmon at various times of the year leave

the main feeding grounds and gradually reach the surface waters where food is much scarcer. So the numbers of non-actively feeding salmon accumulating at the surface increase unless they have already begun to enter the river. It is believed that salmon coming to the surface waters would do so gradually and that food found in the stomachs of salmon at the surface had been procured in the surface waters. Perhaps this could be definitely determined by a detailed study of the stomach contents and the distribution of such animals.

Table 23. Number and percentage of St. John drift salmon with or without food contents in the stomach or intestine.

Date 1932	Sex	Number of Salmon			Percent of Salmon		
		With food	Without food	Total	With food	Without food	Total
June	M	1	4	5	20	80	100
22	F	1	9	10	10	90	"
28	?	3	17	20	15	85	"
29	Total	5	30	35	14	86	"
July	M	4	13	17	24	76	"
27	F	6	45	51	12	88	"
	?	2	2	4	50	50	"
	Total	12	60	72	17	83	"
	M	5	17	22	23	77	"
Total	F	7	54	61	11	89	"
	?	5	19	24	21	79	"
	Total	17	90	107	16	84	"

IX. Regenerations and Scale Checks.

Scales may be classified as normal and abnormal. Normal scales have uniformly wide ridges representing the summer growth and uniformly narrow ridges representing the winter growth. The winter band thus forms a regularly occurring check in the growth of the fish. Abnormal scales sometimes have narrow ridges in the summer growth area in place of wide ridges. These may be called irregular checks in contrast to the regularly occurring winter checks. Abnormal scales may also be lacking in ridges in the central area of the scale. This is due to scales being lost and rapidly growing scales, which are devoid of ridges, taking their places. The ridges begin to grow again

when the old scale has been entirely replaced. Regenerations and scale checks may occur in the zone of the scale representing sea growth or in the zone representing river growth. These areas will now be discussed separately.

a. In Sea Zone of Scale.

A large number of salmon have some scales showing regenerations in the summer area of the scale while other scales from the same fish have all the summer ridges present (i.e. show no regeneration) but some of the ridges are closer together than others representing a check corresponding to the regenerated area of the other scales. Sometimes this check represents a complete cessation of growth rather than retardation of growth. Fish no. 72, 187, 195, and 202 afford good examples of scales with checks corresponding to regenerations. What has happened is that the fish has accidentally lost some scales. These are immediately replaced by other scales having no ridges. This apparently causes a local drain on the components which make up the scale structure. So during this regeneration the surrounding scales are retarded in growth hence we have a check in the surrounding scales to exactly correspond with the place of regeneration on the regenerated scale. The severity of the check in the surrounding scales would depend on the number of scales lost and the distance from the regenerating area of the fish (i.e. from the place where scales were lost).

Fish no. 566 represents a regenerated area of the scale corresponding to the last winter band of sea growth. Fish no. 570 and no. 577 show a check just before the last winter band corresponding to regenerations in other scales from the same fish.

Fish no. 203 shows a wide check in the scale during the first summer at sea but has no regenerations to correspond. So it

is believed that this wide check represents a time of poor growth for the fish in general. That is the fish has been experiencing poor feeding and consequently did not growx as much as usual. This sort of check would be more nearly related to the so-called winter checks, which are due no doubt to scarcity of food but perhaps to a combination of scarcity of food and adverse temperature conditions. So we see that all of the irregular checks must not be considered as due to regenerating scales.

In previously spawned fish i.e., fish whose scales bear a spawning mark, there is a large proportion of the scales bearing regenerations corresponding to the spawning mark in the remaining scales. In fish which have previously spawned the proportion of regenerated scales is usually much larger than in maiden fish. The reason is no doubt due to the fact that the fish which have entered the river and spawned have had many more chances of losing scales than the fish which have not yet entered the river. Salmon entering the river may wiggle through drift nets and thus lose scales (Miramichi Salmon Report 1931). Salmon traps in the river and anglers farther up river may be other means by which salmon may lose scales. And finally on the spawning beds lashing against the stony bed of the spawning redd the salmon may lose a large number of its scales. So it is no great wonder that the spawning mark is always accompanied by regenerated scales on previously spawned salmon.

b. <u>In River Zone of Scale.</u>

Scale regenerations are much more common in the river zone of the scale than in the sea zone. This makes it difficult to determine the age of the fish and in some cases renders it impossible. However, it is usually possible to determine the age if about 20 to 30 scales are available. On the other it is quite unsafe to attempt to

assess the age of a fish by means of a few scales. In the river, brooks, and streams the young fish comes in contact with many more obstacles than do the large salmon at sea. So perhaps this would explain why there are so many more regenerations in the river zone than in the sea zone of the scale.

Some of the regenerations correspond to winter checks while others correspond to checks during the summer growth. Fish no. 70 is a good example of a regeneration which might make scale reading difficult for amateurs. From good scales it was determined that the fish was 3 years in the river. Some of the scales had the first year regenerated but the regeneration contained ridges. So the fish might be thought to be only 2 years in the river. The regenerated ridges, however, are much wider apart than is normally the case so it would be quite impossible to go wrong if all precautions available were exercised. Fortunately such cases are not very common.

Checks have been found in the river during first and second summers with regenerations to correspond. The checks have been found to vary in intensity in different scales from the same fish, even being absent in some while quite severe in others. Of course other checks in scales have been noted when no regenerations could be found. So, no doubt, all of the checks are not caused by regenerating scales.

There is little difficulty in distinguishing an irregular check from a winter check since the winter check is quite constant in intensity and is present in all the scales from the same fish while the irregular check varies in intensity in different scales of the same fish even being absent in some scales. Besides there are many other distinguishing characters.

X. Displaced Scales.

During growth in the river scales are sometimes displaced in the scale pocket. It is likely due to the fish receiving a thrust of some sort which is not sufficient to remove the scale from the pocket but merely displaces it in the pocket. So the disarranged scale remains to be surrounded later by the normally growing scale material. So in later life the large scale shows the small and abnormally orientated scale quite clearly in the centre. Fish no. 200 is a good example of a displaced scale. Other scales from the same fish show regenerations to correspond, thus showing that other scales were lost at the same time when this scale was displaced.

Most of the scales seem to have been displaced during the first winter in the river. Fish no. 761, 739, 1139 are examples showing scale displacement, at first winter in the river with regenerations to correspond. Fish no. 673 and 983 had displaced scales but no corresponding regenerated scales. No. 664 showed a displaced scale in the second year in the river with a check and a regenerated scale to correspond. So from this scale it seems quite definite that checks may be produced by the regeneration of lost scales and that some of the scales may not be lost but merely displaced in the scale pocket.

XI. Abnormally Small Scales

In some of the scale samples a number of very small scales were found which were mixed in with the larger normal scales. In most cases they were abnormally small regenerations but corresponded to larger normal regenerations. In fish no. 661, 1043, 1062 the regenerated scales corresponded to a check in the normal scales.

In fish no. 243 and 1030 the regenerated scale corresponded to a spawning mark. In the case of no. 1030 the scales were taken from a healed over scar. In fish no. 666 the small scales were not regenerated.

These small scales must have been crowded at some time or other so that they were not able to grow into normal scales. The branching of rows of scales might be caused in a similar manner. Such abnormally small scales might account for the variations in scale counts as experienced by systematic ichthyologists.

When these small scales were first found it was thought that they were regenerating scales replacing scales recently lost. But this is evidently not the case as they are similar to the normal scales except for their small size and would increase in size only in proportion with the normal scales and not at a faster rate which would be required of regenerating scales in replacing recently lost scales.

XII. Scale Absorption.

Scale absorption is quite the common thing to be found at the periphery of the scales when the fish are entering the river for spawning. The absorption is quite regular beginning at the posterior part of the scale and gradually working forward as the spawning time approaches. Subsequent scale growth around this irregular scale leaves the customary spawning mark. No. 746 has a peculiar scale. Inside the spawning mark are a number of ridges followed centrally by a regenerated area. Evidently the central area had been regenerated, some ridges were present then the spawning journey caused considerable absorption of the ridges leaving a very peculiar scale. Other scales were similar and a bit puzzling at first.

But the scales are also absorbed at other times and for

other reasons than at spawning. Fish no. 560 shows some scales with a check during the second summer at sea with even scale absorption in some. Other scales have only a slight check while in some the check is not visible. Fish no. 103, and 133 show scale absorption during the second summer in the river in one scale. No. 179 shows a check in the second year in the river of varying intensities in different scales some even being absorbed while other scales show regenerations to correspond. No. 247 shows a check the first year in the river with one scale partly absorbed and other scales showing regenerations. Scales from the same fish also show a check during the second summer at sea with two scales greatly absorbed at the side. So in the above examples of scale absorption the explanation would seem to be that so many scales were lost that surrounding scales were even absorbed to a certain degree in order to replace the lost scales as quickly as possible. In this way scales near to the regenerating area would show scale absorption while other scales farther from the regenerating area would only show the check while scales still farther away would be normal.

Quite a number of scales also show scale absorption at winter bands both in the river and at sea. In some cases it is represented by little gouges at the side of the winter band which may or may not be filled in by the growing in of subsequent ridges. The scales from some fish are much more absorbed than others. The scales from some fish are absorbed only at the posterior border of the winter band and subsequent summer ridges bending around the absorbed part much as in a spawning mark. The scales from two fish were quite absorbed and it was difficult to distinguish from a spawning mark. These were no. 1107 and no. 1144, and they each had one spawning mark but it was finally decided, whether correctly or not is hard to say, that the

second scale absorption did not represent a spawning mark. So it would seem that food might be so scarce during winter months as to even cause the scales to be partly absorbed.

XIII Narrow Sea Winter Bands

The sea winter bands are very narrow in most of the St. John fish. The ridges are quite compact, i.e. they are very close together thus making a very narrow winter band. In some cases, moreover, the winter ridges are not very numerous even as few as four or in one case only two ridges composing the winter band. Also these winter bands are usually quite definite i.e. are quite distinct from the summer ridges. The winter ridges do not usually merge gradually with the summer ridges but more often form a definite break between summer and winter bands. The narrow winter bands practically always taper at the sides of the scale i.e. they almost disappear in the posterior half of the scale, while the wide winter bands more often extend back without tapering at the sides. This is one characterisitic which makes it easy to distinguish a narrow winter band from a check. The checks extend right back without tapering. The summer growth though is quite uniform in character. The ridges are quite uniformly spaced with very few checks and the spaces between ridges are quite wide in strong contrast to the condition in the narrow winter bands.

The summer and winter bands are quite different from those above described for the St. John salmon. The winter ridges are not so close together, the distinction between winter and summer growth is usually quite gradual, the summer ridges are not so widely spaced, and in general the distinction between winter and summer growth is not so definite.

It is at present somewhat difficult to say just what factor or factors might be acting to bring about these differences. It might possibly be food directly or it might be food indirectly by means of temperature. Food and temperature are perhaps quite different in the two feeding areas. Further work is necessary on this point and, moreover, the scales from the two regions must be compared more minutely as the above comparative description is based purely on memory from having determined the ages of salmon from both regions by means of their scales.