

JUN 10 1968



MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

No. 129

Atlantic Salmon and Trout Investigations

Volume 12

1938



FISHERIES RESEARCH BOARD OF CANADA

MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

No. 129

Title

ATLANTIC SALMON AND TROUT INVESTIGATIONS, 1938

Author

Hear, William S.

Huntsman, A. G.

ATLANTIC SALMON AND TROUT INVESTIGATION

VOLUME XII

CONTENTS

<u>1938</u>		PP.
I.	Scale studies of the salmon of the Saint John district 1938. By William S. Hoar	1-55
II.	Miscellaneous notes. By William S. Hoar	1-7
III.	Salmon in Cape Breton Highlands National Park. By A. G. Huntsman	1-6
IV.	Salmon poaching on the Margaree river. By A. G. Huntsman	1-6
V.	The trout of Trout brook, lake Ainslie, N. S., and neighbouring streams. Summary report, with recommendations. By A. G. Huntsman	1-7
VI.	Preliminary report on a survey of streams to select one for experimental water control in distributing salmon. By A. G. Huntsman	1-6
VII.	Preliminary report on a survey to select streams for experimental production of salmon smolts. By A. G. Huntsman	1-5
VIII.	Report on Pomquet river, Antigonish county, N. S. By A. G. Huntsman	1-18

ATLANTIC SALMON INVESTIGATIONS

1938

Report No. I. Scale Studies of the Salmon of the Saint John
District 1938.

By William S. Hoar

Systematic scale collections were made from the salmon of the Saint John area of New Brunswick during the commercial fishing season of 1938. The data here presented are from a study of 454 samples from Saint John harbour, 237 samples from Lorneville - 5 miles to the westward - and 416 samples from Dipper Harbour - 20 miles to the westward. The latter point is at the western limit of the salmon fishing on the New Brunswick coast. Differences in the type of growth made and the ages of the various fish were noted. The data were analyzed particularly for group differences existing between the fish at various points in the Bay of Fundy and during different times in the season. The detailed results will be found in the appendices to this report. The notation there is that used by Menzies (1921, etc.,) with certain additions. The figure before the period denotes the number of years spent in the river, the figure after the period the number of sea years. "SM" signifies a spawning mark, "s" denotes an evident period of smolt spring growth; "c" before the number for sea years is a definite check in the growth of the first year at sea; "c" after the number for sea years a check during the second year; the number in brackets after the plus sign is for the average number of circuli added during the current year; "t" signifies that the bands formed during the current year were of a transitional nature (i. e. neither the narrow bands of

the "spring" fish nor the bold circuli of the "summer" fish); "e" signifies erosion (at the side of the scale) at the end of the first winter of the type sometimes called a false spawning mark; the comma signifies a peculiar type of growth made during the second summer in the sea where 2 or 3 comparatively broad circuli are formed in the midst of this area; "W" is for evidence of winter growth having commenced for the current year. Thus, "3.2" represents a fish which spent three winters in the river and two in the sea. "2.sc2e+(6)W" is a salmon which migrated as a two year smolt, made some transitional growth before commencing the rapid sea growth, formed a definite check during that first year, spent two years in the sea, and added six bands during the current year the last of which were on the whole narrower. At the end of the first winter in the sea there was some erosion of the scale. "2.2+SM,1" is a salmon which migrated as a two year smolt returned after two winters to spawn and subsequently made a full year's growth in the sea. Since the smolt migration this latter fish has presumably lived four full years.

Some General Characteristics of the Scales

The majority of the salmon of the Saint John area are either two or three years old at the time of migrating to the sea. Of the 1107 scale samples studied 42.9% had migrated as three year fish. One fish only was found which had migrated at four years. None showed a migration at one year although Dr. Huntsman (private communication) has examined a fish of this smolt age from the region of Grand Manan.

A certain number of scales show a growth which is transitional in nature between that of the river and that of the sea. We have associated this type of growth with the smolt metamorphosis (M.S. reports on the Margaree Salmon Investigation 1936 and 1937). Since it cannot always be recognized with certainty it was only recorded when very evident and no precise percentages can be given.

As a rule the salmon spends two full years in the sea before returning to spawn. Only 3.3% of all the fish studied had spent three years in the salt water as maiden fish. Only one maiden fish (0.09%) had spent four winters in the sea. Since the drift nets are not designed to take grilse this age fish is very rarely caught and our data here cannot be considered reliable for percentage purposes.

The sea growth of the salmon of the Saint John district is particularly remarkable for its uniformity. In many cases it is difficult to draw a sharp line between the summer and winter growth. In some scales (noted with a comma in the appendices) the growth of the second year presents a confusing feature in the form of two or three relatively broad circuli in the midst of the others. Because of the small amount of this growth, it was not considered to mark another summer, but rather to represent some peculiarity of the environmental conditions. Checks in the summer growth are common. They are particularly frequently seen in the growth for the first summer at sea. Menzies and MacFarlane (1924) discuss this feature in the growth of the scale and say that it appears as though the salmon was recovering from a bout of over feeding.

Many of the salmon show some erosion of the side of the scale after the first year in the sea - more rarely after the second year. Erosion is usually associated with the sojourn of the fish in fresh water, although Menzies (1921) has shown that this may occur while in the sea. The latter is apparently the case with our fish and it would be interesting to know something of the cause.

A few examples of winter growth for the current year were noted in the scales from the first of July onward. Mall (1926) states in his studies of the sea trout of Scotland that winter bands usually appear about the middle of August. In growth as uniform as that of the Saint John salmon these bands are not always certainly enough recognized to warrant presenting any percentages. It seemed however that the narrowing of the bands was noted first in the fish at Dipper Harbour (June 21) and last in the fish at Saint John (July 1.) It might seem that the summer's feeding is completed earliest where the food is most plentiful (Dipper Harbour). We cannot however vouch for the strict reliability of these dates.

It has been customary to divide sea salmon into "spring" fish (those which have made no growth during the current season or have added bands of the winter type) and "summer fish (those which have added bold circuli during the current year). Many of the fish are difficult to classify on this basis since their scales show an intermediate type of growth. Menzies and MacFarlane (1924, b) note the same thing. Our data show that 50% of the salmon studied have added bold circuli during the current year. The detailed figures, given in table 1, indicate that during June there were

more "spring" near the river mouth than far out in the bay, while the percentages were about the same, or on the whole tending in the opposite direction during July. Also, the percentages of spring fish declined steadily at Saint John harbour but changes little elsewhere. If these fish are actually "spring" fish in the strictest sense of the word, we should expect this decline in their numbers during the latter part of the season. This certainly does not occur far out in the bay. From these figures it is hard to conceive of these fish as being a "spring" "run" of salmon. Rather, if there is any order it would seem to be in the fact that the numbers of these fish decrease as they move toward the river mouth. Why some fish should grow very rapidly and others scarcely at all during their final year in the sea is a mystery. Our data neither suggest the significance of this difference nor the basis for the terms "spring" and "summer" salmon. Menzies and MacFarlane (1924, b) incline to the opinion that these two groups are racially different. The reason for the intermediate types does not appear. Environmental influences seem unlikely under conditions as uniform as the Bay of Fundy.

Eight percent of the 1107 salmon had a spawning mark on their scale. Of these 19.3% had spawned first as grilse, while 9.0% had spawned twice and one fish of the 88 (1.1%) had apparently spawned three times.

So much appears from a general study of the Saint John salmon as a whole. The comparison of fish from the different places was particularly fruitful in showing certain facts relating to the distribution of salmon in the sea. These facts will now be discussed.

Distribution of the Smolts

The distribution of the three year smolt migrants in the Saint John area of the Bay of Fundy is shown graphically in figure 1. The results are summarized in table II. It is evident that there are consistently more of the three year smolt migrants at Saint John harbour than at Dipper Harbour, and that at any place there are more of the three year fish taken in the early part of the season. In general Lorneville shows a condition intermediate between that of the Saint John and Dipper Harbour fish. In studying the Lorneville data it must be remembered that collections ceased here on July 12. The results are in agreement with those for the salmon of Scotland. Menzies and MacFarlane (1924, b etc.) find that the proportion of two year smolt fish rises from month to month as the season progresses and that there are a greater proportion of two year smolts in the older age groups. The older smolts have a tendency to return to the river after spending the shortest possible time in the sea (Menzies, 1928). These workers state that this condition "is a characteristic of British rivers in general." The following analysis is suggested as a more definite explanation.

It is a recognized fact that the age at which the young salmon goes to sea is largely dependent upon environmental conditions especially temperature - (Menzies, 1923). The headwaters of the river (in the highlands and in the case of the Saint John more northerly areas) will be much colder in comparison with its lower reaches. Growth of the young salmon will be correspondingly slower. The salmon in the sea which migrated as three year smolts will, then, be those fish which as parr were located in the upper

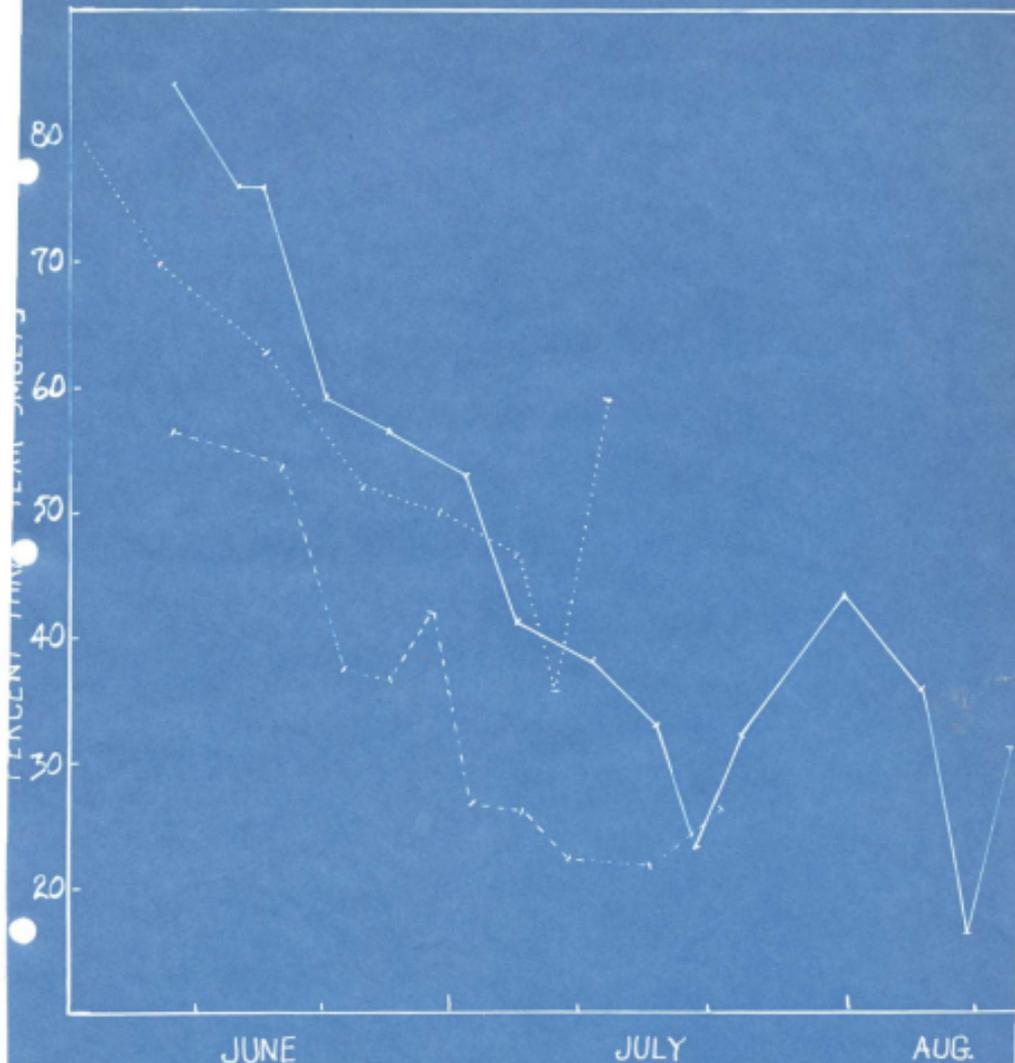


Figure 1. Percentage of three year smolts in the salmon catch at Saint John harbour (continuous line), at Lorneville (dotted line), and at Dipper Harbour (broken line) during the season of 1938.

and colder reaches of the river. Conversely the two year smolt migrants will, generally speaking, have come from nearer the river's mouth. In the sea the two year smolt group is farthest from the river, the three year group nearest its mouth. The relative positions are the same during both the river and the sea life. Salmon in the sea have a similar distribution to that which they had as parr in the river. A mass movement of the young salmon to a distant and specific feeding grounds would not appear from this. Whether the proportions of the different aged parr in the river corresponds with the proportions in the corresponding parts of the bay cannot be said with certainty. In the Margaree river, Nova Scotia, there are about 73% of three year smolts leaving Forest Glen brook in the headwaters of the river in comparison with 27% at the harbour mouth. The figures for the Saint John data are of a similar order. It should be noted that the Dipper Harbour fishermen, during the first part of the season set their drifts far out (10 to 12 miles off shore) and to the eastward (off Masquash and Tiner's Point). This with the later general river movement of the salmon as a whole will account for the high percentage of three year smolts here during the early part of the season. The time when the fishing commenced to the westward (off Point Lepreau and Dipper Harbour) coincides very well with the time when the percentage level of three year smolts reached its base (about July 1). It seems that in the western part of the bay - Point Lepreau and Dipper Harbour - there are about 25% of three year smolts as compared to 75 or 80% near Saint John harbour. This percentage will, of course, change at Saint John harbour as the salmon moves riverward (see figure 1).

It will be noted that the general downward trend in the percentage of three year smolts is interrupted in every case by a definite upward swing (figure 1). This occurs first at Dipper Harbour, then at Lorneville and lastly at Saint John harbour. It is conceivable that some physical condition, such as heavy rains and high waters was responsible for forcing the salmon outward and backward into the bay after the commencement of the river movement. The forcing out of these fish would account for the increasing percentage of these fish at Dipper Harbour. The fact that no "new" fish are coming in from the outside will account for it at Saint John harbour. Lorneville may show a combination of both factors. The bodily movement of the mass of fish as a whole in response to some stimulus is interesting.

Thus the study of the distribution of the smolt in the Bay of Fundy suggests that the young salmon do not migrate actively to some pre-determined feeding grounds, but rather that they move out into the sea a certain distance depending on their position in the river. Those parr nearest the river mouth are farthest out in the sea as adult salmon. Some mixing and straying is of course to be expected, but in general the same relative positions are maintained. Condition factor data (presented elsewhere) suggests the same thing. Is it not fairer to say that those fish nearest the mouth of the river, and where the river influence is strongest, return earliest in the season, rather than that the older smolts have a tendency to return after spending the shortest possible time in the sea? Also, is it not more reasonable to explain the higher percentage of older smolts in the youngest sea feeding age groups on a basis of distribution. Those fish nearest the rivers influence tend to return earliest.

Distribution of the Three-Year Sea Salmon

It has been noted that less than 4% of the maiden salmon have spent more than two winters in the sea. The distribution of these three year sea salmon (table II) is interesting. It is evident that the concentration of these fish is at Dipper Harbour - i.e. at the farthest point of fishing from the mouth of the river. Also the numbers of these fish increases with time at Saint John but declines elsewhere. Some few salmon at a great distance from the river apparently loose contact with its influence for a time and fail to return after the customary two winters spent in the sea. Where the river's influence is greatest, in the vicinity of Saint John harbour, all fish return^{as} grilse or two year fish. No three year maiden fish appear here during the early part of the season. Again, it is suggested that the movements of the salmon to the river are dependent upon the effective influence of the latter, and that salmon loosing contact with this are forced to spend an extra year in the sea. If there is a "homing instinct" in the biological constitution of the salmon it would seem to be dependent upon the proper water conditions for its action. That some salmon return as two-year and some as three-year fish seems to be a result of environmental rather than racial tendencies.

On the average, these older salmon seem to return to the river earlier in the season than the bulk of the fish. This is suggested by the fall in the percentage of these from June to July at Lorneville and Dipper Harbour, and from July to August at Saint John harbour.

Distribution of the Spawned Fish

Data for the salmon showing a spawning mark on their scales is summarized in tables II and III. It should be stated here that any but the most general statements regarding the spawned fish must be regarded with skepticism. The age of the spawned fish cannot always be determined with certainty. Moreover the numbers of these are not always large enough for accurate percentages. They do, however, probably show the general trend. With these facts in mind we submit the following suggestions regarding the distribution of the Saint John spawned salmon.

It is evident from the June data that the concentration of spawned fish is in the region of Dipper Harbour during this period (table II). From Huntsman's study of the Saint John kelts (1938) we should expect the reverse, viz., that the spawned fish were predominantly near the harbour. It has been noted that 19.3% of these salmon spawned first as grilse. A separation of the groups (table III) shows that there is on the whole a larger percentage of the grilse spawners farther out in the bay. Since the salmon tagged by the Fisheries Department and studied by Dr. Huntsman were post-grilse salmon our figures may not be strictly comparable. It is conceivable that this latter group behave more nearly the same as the maiden fish, and that this might account for the concentration of spawned fish at Dipper Harbour. However, when the grilse spawners were removed and only the two-year salmon considered the same order prevailed (table III). In the spring of 1938, at least, the concentration of spawned fish was greatest in the outer portion of the bay, and least near the harbour.

Menzies (1921) notes that the proportion of previously spawned fish increases steadily as the season advances. Our data for Saint John harbour show the same order. In the bay however - at Dipper Harbour - there is little change in the percentages from June to July. These fish, in opposition to the older maiden fish, seem to return to the river later or more slowly than do the main mass of the salmon.

Fish with more than one spawning mark are too rare to show the details of their distribution with any degree of certainty. The meagre data (table III) suggest, however, that these fish are far out in the bay and that they return late to the river. Fifty percent of the fish spawning more than once had spawned first as grilse. It will be recalled that only 19.3% of the lot were grilse spawners. The chances of survival for a second spawning are greater if the fish spawns first as a grilse.

The number of fish which have spent a full year in the sea since first spawning is least at Saint John harbour and greatest at Dipper Harbour. We might expect this from our studies of the three-year maiden salmon. The fish farthest from the river are least apt to be able to return at the spawning time. It could hardly be that these fish far out in the bay had made less recovery since spawning as feeding conditions are much better here (see Fisheries Statistics of Canada). The river influence again seems to be important in the salmon's return.

Summary

1. Over 99% of the salmon of the Saint John area of the Bay of Fundy have spent either two or three years in the river before migrating as smolts.
2. Only 3.3% of the maiden fish have spent more than two full years in the sea. This sea growth is notably uniform in nature.
3. 50% of these sea fish have made some rapid scale growth during the current year. The significance of the terms "spring" and "summer" fish would not appear from this study.
4. Checks occur in the scale growth of both sea years - particularly in the first. Some erosion of the scale at the end of the first winter is common. Winter growth for the current year is evident in a few scales from the first of July onward.
5. 8% of the salmon studied had a spawning mark on their scales. Of these 19.3% spawned first as grilse and one fish only spawned after its third year. 9.0% of the fish had spawned more than once and one fish (1.1%) three times.
6. The fish which come from the headwaters of the river - that is the older smolt - are nearest the harbour in the sea. Conversely smolt derived from the lower portions of the river are farthest out in the bay. The fish nearest the harbour in the sea, on the whole, enter the river first. Salmon in this body of water move as a whole in response to stimuli rather than as individuals.
7. The older maiden fish tend to be farthest from the river mouth. Environmental conditions result in the added year at sea. On the whole these older fish return to the river earlier or faster than the average.

8. The majority of the spawned salmon are far out in the bay during the early part of the season. The proportion of previously spawned fish increases steadily in the harbour with the advance of the season. Fish that have spawned first as grilse seem on the whole to be farther out in the bay than the others. The grilse spawners have a better chance of survival than those spawning in their second year.

Literature Cited

- HUNTSMAN, A. G., J. Fish. Res. Bd. Can. 4 (2) 1938.
- MEENZIES, W. J. M., Fisheries, Scotland, Salmon Fish., 1920, 1 and 2,
13 - 22, June 1921.
- Idem, 1921 4, March 1923.
- MEENZIES, W.J.M. and P. R. C. MacFARLANE., Idem, 1924, 1, 1924a.
- Idem, 1924, 3, 1-52, 1924b.
- HALL, G. H., Idem, 1926, 1, 1-42, 1926.

TABLE I

Percentages of "Spring" Fish

<u>Date and Place</u>	<u>Total number of Salmon</u>	<u>2-year or Number</u>	<u>"Spring" fish Percentage</u>
<u>Saint John</u>			
June	131	74	56%
July	165	67	41%
June and July	296	141	48%
August	82	24	29%
 <u>Lorneville</u>			
June	146	78	53%
July(1-12)	40	27	68%
June and July	186	105	56%
 <u>Dipper Harbour</u>			
June	120	47	39%
July	210	87	41%
June and July	330	134	40%
 TOTAL	794	404	51%

TABLE II

Percentages of Differently Aged Salmon

Date and Place	Number of Fish	3-year		3-Year		Sea-life		With Spawning Mark	
		No.	%	No.	%	No.	%	No.	%
<u>Saint John</u>									
June	142	97	68.3%	--	--	4	2.8%		
July	209	80	38.2	4	1.9%	18	8.6		
August	103	29	28.1	1	1.0	19	18.4		
June and July	351	177	50.4	4	1.1	22	6.3%		
TOTAL	454	206	43.1	5	1.1	41	9.0		
<u>Lorneville</u>									
June	162	100	61.7%	5	3.1%	9	5.5%		
July(1-12th)	75	34	45.3	2	2.7	5	6.6		
June and July	237	134	56.5	7	2.9	14	5.9		
<u>Dipper Harbour</u>									
June	149	67	44.9%	11	7.4%	12	8.1%		
July	267	67	25.1	13	4.9	21	7.9		
June and July	416	134	32.2	24	5.8	33	7.9		
TOTAL (all salmon)	1107	474	42.8	36	3.3	88	8.0		

TABLE IIIDistribution of the Spawned Fish

Place and Date	No. of Spawned Fish	as Grilse		Full yr. in sea since spawning		More than 1 spawning		Percentage of total spawning at 2 year
		No.	%	No.	%	No.	%	
<u>Saint John</u>								
June	4	1	25%	--	--	--	--	2.1%
July	15	3	17%	13	76%	2	11.0%	7.1%
August	19	1	5%	7	37%	3	16%	17.4%
June and July	21	4	18%	13	59%	2	9.0%	
Total	41	5	12%	20	49%	5	12.0%	
<u>Lorneville</u>								
June	9	3	33%	9	100%	--	--	3.7%
July	5	--	--	3	60%	--	--	6.6%
June and July	14	3	21%	12	86%			
<u>Dipper Harbour</u>								
June	12	2	17%	10	83%	--	--	6.7%
July	21	7	33%	14	67%	3	14%	5.2%
June and July	33	9	27%	24	73%	3	9.9%	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 3	85 cm.	13 $\frac{1}{2}$ lb.	F	1.00	3.2
2		83	12	F	0.95	3.2+(3)
3		79	11 $\frac{1}{2}$	F	1.05	3.2+(4)
4		82	12 $\frac{1}{2}$	F	1.01	3.2+(4)
5		81	12 $\frac{1}{2}$	F	1.04	2.2
6		83	12 $\frac{1}{2}$	F	0.99	3.2e
7		82	12 $\frac{1}{2}$	F	1.01	3.2+(4)
8		82	11 $\frac{1}{2}$	F	0.95	3.2+(3)
9		85	12 $\frac{1}{2}$	F	0.94	3.2
1	June 11	80	12 $\frac{1}{2}$	F	1.10	3.e2+(3)
2		82	13	F	1.07	3.2
3		81	12	F	1.02	3.2+(8)
4		94?	14 $\frac{1}{2}$	F	0.80	3.2+(4)
5		83	13 $\frac{1}{2}$	M	1.07	3.2+(5)
6		80	13	F	1.15	3.2
7		81	13	F	1.10	3.2
8		83	15	M	1.19	2.2+(6)
9		78	12	F	1.15	3.2
10		82	14	F	1.15	2.s2
1	June 13	80	12	F	1.06	3.2+(5)
2		82	12 $\frac{1}{2}$	F	1.03	?2
3		87	14 $\frac{1}{2}$	F	1.00	3.e2
4		83	12 $\frac{1}{2}$	F	0.99	2.s2
5		80	12	F	1.06	2.e2
6		85	14 $\frac{1}{2}$	M	1.07	3.2+SM+1+(2)
7		85	14	F	1.03	3.2+(5)
8		83	14	F	1.11	3.2e
9		80	11	M	0.97	2.2e
10		77	10 $\frac{1}{2}$	F	1.04	3.e2+(4)
11		80	10	F	0.88	3.e2+(t5)
12		84	14	M	1.07	3.2+(4)
13		83	13	F	1.03	3.e2
14		72	8 $\frac{1}{2}$	F	1.03	3.2
15		82	12 $\frac{1}{2}$	M	1.03	2.2+(5)
16		77	10	M	0.99	3.2
17		84	15	F	1.15	3.2
18		76	11	F	1.13	3.2+(3)
19		83	13 $\frac{1}{2}$	F	1.07	2.2+(6)
20		82	14	F	1.15	3.2e1+(4)
21		87	14 $\frac{1}{2}$	F	1.00	3.e2+(t6)
22		77	10 $\frac{1}{2}$	F	1.04	3.e2
23		87	16 $\frac{1}{2}$	F	1.14	3.2

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
24	June 13	87	14 $\frac{1}{2}$	M	1.00	3.2+SM+1
25		78	12	F	1.15	3.2
26		83	12	F	0.99	3.2
27		78	11	F	1.05	3.2
28		78	10 $\frac{1}{2}$	F	1.00	3.2
29		78	11	F	1.05	2.2+(4)
30		85	13	M	0.96	3.e2
31		81	11 $\frac{1}{2}$	F	0.98	3.2
32		80	13	F	1.15	2.2+(5)
33		84	15	F	1.15	3.e2
34		98	22	F	1.06	2.2+SM+1
	June 14	76	9 $\frac{1}{2}$	M	0.98	
		84	13 $\frac{1}{2}$	F	1.03	
		77	12	F	1.19	
		81	12	F	1.02	
		81	12 $\frac{1}{2}$	F	1.06	
		83	14 $\frac{1}{2}$	F	1.15	
		79	12	F	1.10	
		78	12 $\frac{1}{2}$	F	1.19	
		81	14 $\frac{1}{2}$	M	1.23	
		83	13 $\frac{1}{2}$	M	1.07	
		87	16 $\frac{1}{2}$	F	1.14	
		85	14	M	1.03	
		78	13 $\frac{1}{2}$	F	1.29	
		78	11 $\frac{1}{2}$	F	1.10	
		86	15 $\frac{1}{2}$	F	1.10	
		87	18 $\frac{1}{2}$	F	1.27	
		82	13	M	1.07	
		79	12 $\frac{1}{2}$	M	1.15	
		83	13 $\frac{1}{2}$	M	1.07	
		77	10 $\frac{1}{2}$	M	1.04	
		76	11	F	1.19	
		81	12 $\frac{1}{2}$	F	1.06	
		83	15	F	1.19	
		83	15 $\frac{1}{2}$	F	1.23	
		81	12	F	1.02	
		76	10	F	1.03	
		86	16	F	1.14	
		81	12 $\frac{1}{2}$	M	1.06	
		81	12	F	1.02	
		86	17	F	1.21	
		81	13 $\frac{1}{2}$	M	1.15	
		82	14	F	1.15	
		86	15	M	1.06	
		84	14 $\frac{1}{2}$	M	1.11	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 15	79	10 $\frac{1}{2}$	M	0.96	3.2+(5)
2		80	11	M	0.97	3.2
3		76	11 $\frac{1}{2}$	F	1.19	3.2+(4)
4		82	12	F	0.99	3.2
5		82	12	M	0.99	3.2+(5)
6		84	15	F	1.15	3.2
7		82	12 $\frac{1}{2}$	F	1.03	3.2+(8)
8		83	9 $\frac{1}{2}$	M	0.75?	2.2
9		79	11 $\frac{1}{2}$	F	1.05	2.2
10		78	11	F	1.05	3.2
11		84	13	M	0.99	3.2
12		88	16	M	1.06	3.2
13		83	13 $\frac{1}{2}$	F	1.07	3.2+(5)
14		78	11 $\frac{1}{2}$	M	1.10	3.2
15		78	11 $\frac{1}{2}$	F	1.10	3.2
16		77	11 $\frac{1}{2}$	F	1.14	3.2+(3)
17		83	14 $\frac{1}{2}$	F	1.15	3.2+(5)
18		86	16	M	1.14	2.2
19		82	12	F	0.99	3.2
20		84	14	M	1.07	3.2+(5)
21		85	14	F	1.03	2.2e
22		79	13	F	1.19	3.2
23		82	12	M	0.99	2.2+(4)
24		83	13 $\frac{1}{2}$	F	1.07	3.2
25		79	13	M	1.19	2.2s
26		81	13	F	1.11	
27		85	14 $\frac{1}{2}$	M	1.07	
28		84	14 $\frac{1}{2}$	F	1.11	
29		82	14 $\frac{1}{2}$	F	1.19	
30		82	12	M	0.99	
31		83	12 $\frac{1}{2}$	F	0.99	
32		82	12	F	0.99	
33		82	15	M	1.23	
34		79	11 $\frac{1}{2}$	F	1.05	
1	June 20	83	12	F	0.95	2.2+(6)
2		82	12	M	0.99	2.2
3		81	13	F	1.11	3.2
4		77	9	F	0.89	3.2
5		80	11 $\frac{1}{2}$	F	1.01	2.2s
6		84	11 $\frac{1}{2}$	M	0.88	2.2
7		85	13	M	0.96	2.2
8		82	12 $\frac{1}{2}$	F	1.03	3.2
9		78	10	M	0.96	3.2+(5)
10		81	11 $\frac{1}{2}$	F	0.98	3.2(8)
11		80	12	F	1.06	3.2
12		82	12 $\frac{1}{2}$	F	1.03	3.2+(5)
13		84	11 $\frac{1}{2}$	F	0.88	3.2+(t)
14		78	9 $\frac{1}{2}$	F	0.91	3.2+(6)
15		81	11	M	0.94	2.2 ¹

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>	
16	June 20	85	13	M	0.96	3.202	
17		88	16 $\frac{1}{2}$	M	1.09	21+SM+1	
18		79	11 $\frac{1}{2}$	F	1.05	2.2+(4)	
19		79	9 $\frac{1}{2}$	M	0.87	2.22	
20		74	9	F	1.01	3.2	
21		84	12 $\frac{1}{2}$	F	0.96	2.2+(3)	
22		87	14	F	0.96	2.22	
23		89	16	M	1.02	3.2	
24		79	11 $\frac{1}{2}$	F	1.05	3.2+(6)	
25		82	12	M	0.99	3.2	
26		83	12 $\frac{1}{2}$	M	0.99	3.20+(5)	
27		78	10 $\frac{1}{2}$	F	1.00	3.2+(4)	
28		81	11 $\frac{1}{2}$	F	0.98	3.2+(4)	
29		81	11	M	0.94	2.2+(3)	
30		85	13 $\frac{1}{2}$	M	1.00	2.2	
31		82	12	F	0.99	3.2	
32		77	10	F	0.99	2.22+(6)	
33		78	10 $\frac{1}{2}$	F	1.00	3.2+(5)	
34		83	13	M	1.03	3.2+(7)	
		June 21	87	14	F	0.96	
			79	10 $\frac{1}{2}$	F	0.96	
			83	14	F	1.11	
			81	15	F	1.28	
			86	17	F	1.21	
			80	12	F	1.06	
			81	12	F	1.02	
			94	19 $\frac{1}{2}$	F	1.07	
			86	13 $\frac{1}{2}$	M	0.96	
			80	12	M	1.06	
			84	13 $\frac{1}{2}$	F	1.03	
			76	11	F	1.13	
			81	13	M	1.11	
			83	15 $\frac{1}{2}$	F	1.23	
			84	12	F	0.96	
	85		13	F	1.00		
	87		14 $\frac{1}{2}$	F	1.00		
	83		14 $\frac{1}{2}$	F	1.15		
	91		15 $\frac{1}{2}$	M	0.93		
	86		15 $\frac{1}{2}$	F	1.10		
	83		12	F	0.95		
	82		13 $\frac{1}{2}$	F	1.11		
	79		10 $\frac{1}{2}$	F	0.96		
	82		13 $\frac{1}{2}$	F	1.11		
	84		13 $\frac{1}{2}$	M	1.03		
	82		12	F	0.99		
	80		12 $\frac{1}{2}$	F	1.10		
	78		10 $\frac{1}{2}$	F	1.00		
	81		13	M	1.11		
	82		13 $\frac{1}{2}$	M	1.11		
	82	13	M	1.07			

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	June 21	79	11	F	1.01	
		87	15	F	1.03	
		76	10	M	1.03	
	June 24	87	14 $\frac{1}{2}$	F	1.00	
		83	13	F	1.03	
		78	11	M	1.05	
		83	14 $\frac{1}{2}$	F	1.15	
		80	12 $\frac{1}{2}$	F	1.10	
		84	15	F	1.15	
		82	11 $\frac{1}{2}$	F	0.94	
		85	14 $\frac{1}{2}$	M	1.07	
		83	13	F	1.03	
		83	12	F	0.95	
		82	11 $\frac{1}{2}$	M	0.94	
		83	12 $\frac{1}{2}$	F	0.99	
		76	11 $\frac{1}{2}$	F	1.19	
		85	14 $\frac{1}{2}$	F	1.07	
		83	13	M	1.03	
		80	12 $\frac{1}{2}$	F	1.10	
		79	12 $\frac{1}{2}$	F	1.15	
		86	15	F	1.06	
		86	14	F	1.00	
		85	14 $\frac{1}{2}$	F	1.07	
		86	15 $\frac{1}{2}$	M	1.10	
		87	15 $\frac{1}{2}$	F	1.07	
		76	10 $\frac{1}{2}$	F	1.09	
		89	16 $\frac{1}{2}$	M	1.06	
		78	10	F	0.96	
		79	10 $\frac{1}{2}$	F	0.96	
		80	13 $\frac{1}{2}$	F	1.19	
		81	11 $\frac{1}{2}$	F	0.98	
		82	12 $\frac{1}{2}$	M	1.03	
		78	10 $\frac{1}{2}$	F	1.00	
		82	13	M	1.07	
		81	13	F	1.11	
		82	13 $\frac{1}{2}$	M	1.11	
		85	17 $\frac{1}{2}$	F	1.29	
1	June 25	83	12 $\frac{1}{2}$	F	0.99	2.2e
2		81	13	F	1.11	3.2e+(5)
3		80	13	F	1.15	2.s2
4		82	14	M	1.15	3.2
5		81	13 $\frac{1}{2}$	F	1.15	2.2
6		83	14	F	1.11	2.2+(10)
7		82	12	M	0.99	2.s2e+(t)
8		79	13	F	1.19	3.2+(3)
9		87	14 $\frac{1}{2}$	F	1.00	3.2
10		80	11 $\frac{1}{2}$	M	1.01	3.2+(4)
11		80	12 $\frac{1}{2}$	F	1.10	3.2
12		82	12 $\frac{1}{2}$	M	1.03	3.2

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
13	June 25	86	15	F	1.06	3.2
14		81	12 $\frac{1}{2}$	M	1.06	2.e2
15		84	13 $\frac{1}{2}$	M	1.03	2.e2
16		82	12	F	0.99	2.2+(3)
17		79	11	F	1.01	3.2e
18		81	12	F	1.02	2.2
19		81	12	F	1.02	3.2e
20		84	13 $\frac{1}{2}$	F	1.03	2.s2
21		82	12 $\frac{1}{2}$	M	1.03	3.2+(4)
22		83	14 $\frac{1}{2}$	F	1.15	3.2
23		88	17	F	1.13	3.2+(4)
24		79	11	F	1.01	2.2
25		79	11	F	1.01	2.2
26		85	12 $\frac{1}{2}$	F	0.94	3.2e
27		80	11 $\frac{1}{2}$	F	1.01	2.s2+(5)
28		88	14 $\frac{1}{2}$	M	0.96	3.2
29		85	14 $\frac{1}{2}$	F	1.07	3.2+(4)
30		82	13	F	1.07	3.2
	June 30	85	14	F	1.03	
		81	14	F	1.19	
		83	13	F	1.03	
		81	11 $\frac{1}{2}$	F	0.98	
		84	12 $\frac{1}{2}$	F	0.96	
		75	9 $\frac{1}{2}$	M	1.02	
		84	13 $\frac{1}{2}$	F	1.03	
		75	12 $\frac{1}{2}$	F	1.34	
		80	12	M	1.06	
		88	15	F	1.00	
		83	16	M	1.27	
		85	14 $\frac{1}{2}$	M	1.07	
		85	15 $\frac{1}{2}$	F	1.15	
		82	13	F	1.07	
		87	13 $\frac{1}{2}$	F	0.93	
		82	12	F	1.03	
		85	14 $\frac{1}{2}$	F	1.07	
		88	17	F	1.13	
		79	12 $\frac{1}{2}$	F	1.15	
		84	13	F	0.99	
		77	9 $\frac{1}{2}$	F	0.94	
		82	11 $\frac{1}{2}$	F	0.94	
		82	12	M	0.99	
		85	14	F	1.03	
		85	14 $\frac{1}{2}$	M	1.07	
		82	13	F	1.07	
		85	15 $\frac{1}{2}$	F	1.15	
		90	17	M	1.06	
		85	14 $\frac{1}{2}$	F	1.07	
		86	15	F	1.06	
		87	16	M	1.10	
		82	13 $\frac{1}{2}$	F	1.11	
		80	11 $\frac{1}{2}$	F	1.01	
		84	16	F	1.22	

Appendix A.

ST. JOHN HARBOUR DATA.

No.	Date	Length	Weight	Sex	K	History
1	July 1	75	9 $\frac{1}{2}$	F	1.02	2.e2+(6)
2		85	15	F	1.11	3.2+(5)
3		82	11 $\frac{1}{2}$	F	0.94	2.2+(4)
4		85	13 $\frac{1}{2}$	F	1.00	3.2+(5)W
5		80	12	M	1.06	2.e2
6		79	13	M	1.19	2.2
7		83	14 $\frac{1}{2}$	F	1.15	2.e2e+(4)
8		79	11	F	1.01	3.e2+(4)
9		97	20 $\frac{1}{2}$	M	1.02	3.2+SM+1
10		83	14	F	1.11	2.2+(8)
11		80	12	F	1.06	2.eo2+(t)
12		80	13	F	1.15	2.e2+(5)
13		85	14	M	1.03	3.3
14		80	13 $\frac{1}{2}$	F	1.19	2.e2
15		80	11 $\frac{1}{2}$	F	1.01	3.2+(4)
16		86	16 $\frac{1}{2}$	F	1.17	3.2+(6)W
17		82	12 $\frac{1}{2}$	F	1.03	3.2
18		81	12 $\frac{1}{2}$	F	1.06	3.2+(5)
19		83	14 $\frac{1}{2}$	F	1.15	3.2
20		85	16	F	1.18	2.2+(6)W
21		84	14 $\frac{1}{2}$	F	1.11	3.2+(5)
22		81	13	F	1.11	2.e2+(5)W
23		76	12	F	1.24	2.2+(4)
24		81	14 $\frac{1}{2}$	F	1.23	2.2+(5)
25		82	13 $\frac{1}{2}$	F	1.11	2.2e+(4)
26		80	10	M	0.88	3.2
27		81	14	F	1.19	3.2+(6)
28		82	13 $\frac{1}{2}$	F	1.11	2.2+(4)W
29		80	12 $\frac{1}{2}$	F	1.10	3.2+(3)
30		83	14	F	1.11	3.2+(5)
31		87	18 $\frac{1}{2}$	F	1.27	27.2+(4)
32		84	18	F	1.38	3.2+(4)
33		82	16 $\frac{1}{2}$	F	1.35	3.2+(6)
34		85	18	F	1.33	3.2
	July 4	83	13 $\frac{1}{2}$	M	1.07	
		83	12 $\frac{1}{2}$	F	0.99	
		80	12	F	1.06	
		87	15	F	1.03	
		82	14 $\frac{1}{2}$	F	1.19	
		80	14	F	1.24	
		79	13	F	1.19	
		88	15 $\frac{1}{2}$	F	1.03	
		84	14 $\frac{1}{2}$	F	1.11	
		82	13	F	1.07	
		79	13	F	1.19	
		85	16	M	1.18	
		85	14 $\frac{1}{2}$	F	1.07	
		90	16 $\frac{1}{2}$	M	1.03	
		81	13	F	1.11	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	July 4	80	13 $\frac{1}{2}$	F	1.19	
		79	14	F	1.29	
		83	15 $\frac{1}{2}$	F	1.23	
		83	15	M	1.19	
		80	12 $\frac{1}{2}$	F	1.10	
		81	12 $\frac{1}{2}$	F	1.06	
		80	11	M	0.97	
		85	15	F	1.11	
		78	13	F	1.24	
		83	12	F	0.95	
		78	11	M	1.05	
		82	13 $\frac{1}{2}$	F	1.11	
		81	12 $\frac{1}{2}$	F	1.06	
		84	14	F	1.07	
		76	11	F	1.13	
		80	10 $\frac{1}{2}$	F	0.93	
		76	11 $\frac{1}{2}$	F	1.19	
		80	12	F	1.06	
		83	13	F	1.03	
1	July 5	71	8	F	1.01	3.e2+(7)
2		92	18 $\frac{1}{2}$	M	1.08	3.2+SM+1(4)
3		80	11	F	0.97	3.2+(t8)
4		97	21 $\frac{1}{2}$	F	1.07	3.2+SM+1
5		80	13 $\frac{1}{2}$	F	1.19	3.2+(6)W
6		86	17 $\frac{1}{2}$	F	1.24	2.2+(6)
7		78	10	F	0.96	2.2
8		93	16	M	0.90	3.2+(8)
9		85	15 $\frac{1}{2}$	F	1.15	3.e2
10		80	12	F	1.06	2.2
11		83	14 $\frac{1}{2}$	F	1.15	2.e2+(4)
12		78	11	F	1.05	2.e2
13		84	14 $\frac{1}{2}$	F	1.11	2.2
14		83	14 $\frac{1}{2}$	F	1.15	3.2+(5)
15		78	10 $\frac{1}{2}$	M	1.00	2.2
16		83	14 $\frac{1}{2}$	F	1.15	3.2+(6)
17		82	13	F	1.11	3.2+(7)
18		84	13 $\frac{1}{2}$	F	1.03	2.e2e+(3)
19		90	14	M	0.87	2.1+SM+1+(2)
20		78	10 $\frac{1}{2}$	F	1.00	2.2+(7)
21		88	17	M	1.13	3.2e+(6)
22		86	15 $\frac{1}{2}$	M	1.10	2.e2
23		78	10	M	0.96	3.e2+(5)
24		84	16	F	1.22	2.2e
25		81	12 $\frac{1}{2}$	F	1.06	2.e2
26		78	11 $\frac{1}{2}$	F	1.10	3.2+(6)
27		78	10	F	1.00	2.e2+(5)
28		85	15 $\frac{1}{2}$	F	1.15	2.e2
29		81	11	F	0.94	3.2+(5)

Appendix A.

ST. JOHN HARBOUR DATA

<u>NO.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
30	July 5	87	17	M	1.17	2.2+(10)
31		73	7 $\frac{1}{2}$	M	0.87	2.2
32		77	11 $\frac{1}{2}$	F	1.14	2.2
33		78	8	F	0.72	2.2+(4)
34		95	25	F	1.32	2.2+SM+1
	July 9	80	12	F	1.06	
		76	9 $\frac{1}{2}$	F	0.98	
		76	11	F	1.13	
		83	13	F	1.03	
		85	16 $\frac{1}{2}$	M	1.22	
		78	10 $\frac{1}{2}$	M	1.00	
		78	12 $\frac{1}{2}$	F	1.19	
		78	12	F	1.15	
		87	15	F	1.03	
		81	12	M	1.02	
		79	13 $\frac{1}{2}$	F	1.24	
		80	12	F	1.06	
		80	14	F	1.24	
		79	11 $\frac{1}{2}$	F	1.05	
		80	13	M	1.15	
		81	12	F	1.02	
		83	14	M	1.11	
		85	15	M	1.11	
		83	13 $\frac{1}{2}$	F	1.07	
		83	12 $\frac{1}{2}$	F	0.99	
		80	11 $\frac{1}{2}$	F	1.01	
		88	14	F	0.93	
		87	14 $\frac{1}{2}$	F	1.00	
		78	11	F	1.05	
		85	13 $\frac{1}{2}$	M	1.00	
		81	12	M	1.02	
		77	10 $\frac{1}{2}$	M	1.04	
		89	15	M	0.97	
		79	10	F	0.92	
		77	11	F	1.09	
1	July 11	80	13	F	1.15	2.02+(t6)
2		79	12 $\frac{1}{2}$	F	1.15	2.02+(5)
3		83	14	F	1.11	2.2
4		80	12 $\frac{1}{2}$	F	1.10	2.2+(7)W
5		76	11	F	1.13	2.02+(8)
6		84	13	F	0.99	2.02e
7		82	11 $\frac{1}{2}$	F	0.94	3.2+(5)
8		83	12	F	0.95	2.02
9		75	10	F	1.07	2.2+(6)W
10		81	12 $\frac{1}{2}$	F	1.06	2.2
11		77	13	F	1.29	3.02+(6)
12		81	13	M	1.11	3.1+SM+1+(4)
13		80	11 $\frac{1}{2}$	F	1.01	3.2e
14		81	13 $\frac{1}{2}$	M	1.15	2.2'e
15		76	10 $\frac{1}{2}$	F	1.09	3.2

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
16	July 11	82	14	F	1.15	2?.s2
17		82	16	F	1.31	3.2+(t4)
18		82	12 ¹ / ₂	F	1.03	2.2+(5)
19		96	20 ¹ / ₂	M	1.05	2.s2+SM+1
20		84	13	F	0.99	2.2+(5)
21		79	11	F	1.01	2.2e
22		81	12	F	1.02	2.2e+(5)
23		85	16 ¹ / ₂	F	1.22	3.2
24		76	11	F	1.13	3.2
25		79	10 ¹ / ₂	F	0.96	2.s2
26		81	11 ¹ / ₂	F	0.98	3.2
27		79	12 ¹ / ₂	F	1.15	2.2+(4)
28		83	14	F	1.11	2.2+(7)
29		81	11 ¹ / ₂	F	0.98	2.e2
30		79	12 ¹ / ₂	F	1.15	2.2e
31		83	12	M	0.95	3.2
32		80	13 ¹ / ₂	F	1.19	3.2+(7)
33		78	13	F	1.24	3.2+(6)W
34		83	12	F	0.95	3.2+(5)
	July 15	81	13	F	1.11	
		81	12 ¹ / ₂	F	1.06	
		88	19	F	1.26	
		86	14	M	1.00	
		81	12 ¹ / ₂	F	1.06	
		81	12 ¹ / ₂	F	1.06	
		80	12	F	1.06	
		78	11	F	1.05	
		81	11	F	0.94	
		79	11 ¹ / ₂	F	1.05	
		77	10	F	0.99	
		85	14	F	1.03	
		80	13	F	1.15	
		91	13 ¹ / ₂	M	0.81	
		75	9	F	0.97	
		86	15	F	1.06	
		78	12	F	1.15	
		83	14 ¹ / ₂	F	1.15	
		90	21	F	1.31	
		87	19	F	1.31	
		86	18	M	1.28	
		87	18 ¹ / ₂	F	1.27	
		79	10	F	0.92	
		78	12 ¹ / ₂	F	1.19	
		84	14	F	1.07	
		82	13 ¹ / ₂	F	1.11	
		86	15 ¹ / ₂	M	1.10	
		82	13	F	1.07	
		77	13	F	1.29	
		83	17	F	1.35	
		87	17	M	1.17	
		91	20	F	1.20	
		90	18	F	1.12	
		71	8	F	1.01	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	July 16	86	15	F	1.06	2.2+(t6)
2		86	16	M	1.14	3.2+(t5)
3		82	13	F	1.07	2.2
4		82	14 $\frac{1}{2}$	F	1.19	2.2+(5)
5		82	13	F	1.07	2.2+(7)
6		86	15	F	1.06	3.2e+(5)
7		85	13 $\frac{1}{2}$	F	1.00	2.2
8		96	21	M	1.08	3.2+(4)
9		82	10 $\frac{1}{2}$	M	0.86	2.2+(4)
10		76	10	F	1.03	3.2
11		85	16	M	1.18	3.2
12		87	14	F	0.96	3.2e+(4)
13		77	12	F	1.19	2.2+(4)
14		80	12	F	1.06	2.2
15		87	18 $\frac{1}{2}$	F	1.27	2.2
16		83	14	F	1.11	2.2
17		81	14	F	1.19	2.2
18		86	14	F	1.00	3.2e
19		82	13	F	1.07	2.2+(8)
20		88	18	F	1.19	3.2+(4)
21		88	17	F	1.13	2.2e+(5)
22		80	13 $\frac{1}{2}$	F	1.19	3.2+(3)
23		83	14 $\frac{1}{2}$	M	1.15	2.2+(8)
24		92	20 $\frac{1}{2}$	F	1.19	2.2+SM+1
25		85	15	F	1.11	3.02
26		78	12 $\frac{1}{2}$	F	1.19	2.2
27		77	12	F	1.19	2.02
28		85	13	F	0.96	2.2+(6)
29		81	12 $\frac{1}{2}$	F	1.06	2.2+(7)
30		85	14	F	1.03	2.2+SM+(3)
	July 18	83	12 $\frac{1}{2}$	F	0.99	
		78	13	F	1.24	
		78	12	F	1.15	
		83	13 $\frac{1}{2}$	F	1.07	
		76	11	F	1.13	
		83	14 $\frac{1}{2}$	M	1.15	
		86	15	F	1.06	
		85	17 $\frac{1}{2}$	F	1.29	
		82	13	F	1.07	
		88	17	F	1.13	
		83	14 $\frac{1}{2}$	F	1.15	
		84	14	F	1.07	
		78	15	F	1.44?	
		81	12 $\frac{1}{2}$	F	1.06	
		81	12 $\frac{1}{2}$	F	1.06	
		80	12 $\frac{1}{2}$	F	1.10	
		78	12	F	1.15	
		84	13	F	0.99	
		86	15	F	1.06	
		82	13	F	1.07	
		84	13 $\frac{1}{2}$	F	1.03	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	July 18	83	14	F	1.11	
		81	12 $\frac{1}{2}$?	1.06	
		82	12	F	0.99	
		85	15	F	1.11	
		83	15 $\frac{1}{2}$	F	1.23	
		79	11 $\frac{1}{2}$	F	1.05	
		83	13	F	1.03	
		91	18	M	1.08	
		79	11 $\frac{1}{2}$	F	1.05	
		84	11 $\frac{1}{2}$	F	0.88	
		81	12	F	1.02	
		80	11	F	0.97	
		87	14 $\frac{1}{2}$	M	1.00	
1	July 19	87	15	F	1.03	3.2e+(9)W
2		98	18 $\frac{1}{2}$	M	0.89	2.2+SM+1
3		80	11	F	0.97	2.2+(6)
4		90	16	F	1.00	2.2+(5)
5		99	25	F	1.17	2.2+SM+1
6		83	13	F	1.03	2.2+(7)
7		81	12	F	1.02	3.2+(2)
8		77	10 $\frac{1}{2}$	F	1.04	2.02e+(4)W
9		80	10 $\frac{1}{2}$	F	0.93	2.2e+(t3)
10		82	12	F	0.99	2.2+(8)
11		86	12 $\frac{1}{2}$	M	0.89	2.2
12		80	12	F	1.06	2.2e+(9)W
13		78	12	M	1.15	3.2+(5)
14		83	12	F	0.95	2.2+(6)W
15		80	11 $\frac{1}{2}$	F	1.01	2.02+(4)
16		85	15	F	1.11	2.2+(4)W
17		87	13 $\frac{1}{2}$	F	0.93	2.02+(4)
18		84	14	F	1.07	3.2
19		80	10	F	0.88	2.2
20		86	13 $\frac{1}{2}$	F	0.96	2.2+(5)
21		93	15	M	0.85	2.02+SM+(11)
22		85	14 $\frac{1}{2}$	F	1.07	2.2
23		84	12 $\frac{1}{2}$	F	0.96	3.2+(8)
24		84	13	F	0.99	2.2
25		84	11 $\frac{1}{2}$	F	0.88	2.02+(4)W
26		90	15 $\frac{1}{2}$	F	0.96	3.2e+(t7)
27		85	13	F	0.96	2.2
28		90	15	F	0.93	3.2
29		87	12 $\frac{1}{2}$	M	0.86	2.3
30		104	23	M	0.93	2.02+SM+1
31		93	16 $\frac{1}{2}$	M	0.93	2.2+SM+
32		88	14	M	0.93	2.2+(10)
33		81	11	F	0.94	2.2+(4)W
34		108	24 $\frac{1}{2}$	M	0.88	2.2+SM+SM+

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	July 22	87	15½	F	1.07	2.2+(t9)
2		86	16	F	1.14	3.2+(5)
3		91	17	F	1.02	3.e2?
4		94	17½	F	0.96	2.2+(w)
5		85	12	F	0.89	2.e2?+(8)
6		87	14	F	0.96	2.e2
7		78	12	F	1.15	2.s2+(5)
8		89	15	M	0.97	3.2+SM+1
9		89	15½	F	1.00	3.2
10		87	16½	F	1.14	2.2+(t4)
11		86	14½	F	1.03	2.2+(5)
12		79	11	F	1.01	3.e2+(4)
13		81	13	F	1.11	2.2+(5)
14		81	11½	F	0.98	2?.2
15		83	12	F	0.95	3.2?
16		88	16	F	1.06	3.2e
1	July 23	83	12	F	0.95	2.2e+(9)
2		83	14	F	1.11	2.e2
3		84	13½	F	1.03	2.2+(7)
4		83	13	F	1.03	2.2+(t2)
5		86	13	M	0.93	2.2+SM+
6		89	17	F	1.09	3.2+(4)
7		85	15	F	1.00	2.2+(6)
8		87	14½	F	1.00	3.2
9		83	11	F	0.87	2.e2+(6)
10		78	11½	F	1.10	2.e2e+(4)
11		84	12	F	0.92	2.e2
12		84	13½	F	1.03	2.e2
1	July 30	82	11½	F	0.94	2.2+(4)
2		79	11	F	1.05	2.2+(8)
3		85	13½	F	1.00	3.2+(6)
4		90	16½	F	1.03	3.2
5		106	23½	F	0.90	3.3
6		83	13	M	1.03	3.2
7		80	11½	F	1.01	2.2+(3)
8		93	13½	F	0.76	3.1+SM+SM+(7)
9		84	12	F	0.92	3.e2
10		80	11	F	0.97	2.2
11		87	15	M	1.03	2.2+(6)
12		87	14½	F	1.00	2.e2
13		83	15	F	1.19	3.2+(t)
14		84	12	F	0.92	2.2+(6)
15		83	12	F	0.95	3.2+(4)

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	August 1	82	12	F	0.99	3.2
2		85	14	F	1.03	2.2+(7)
3		90	16 $\frac{1}{2}$	F	1.03	2.2
4		77	11	F	1.09	2.2+(7)W
5		88	13 $\frac{1}{2}$	F	0.90	2.e2+(6)
6		81	12	F	1.02	2.2+(5)
7		75	8	F	0.86	3.e2+(8)
8		79	11	F	1.01	2.e2
9		82	15	M	1.23	3.2+(6)
10		83	14	F	1.11	2.2+(4)
11		71	8	M	1.01	3.2+SM+(8)
12		80	14	F	1.24	2.s2+(7)
13		82	13 $\frac{1}{2}$	F	1.11	3.2+(7)W
14		79	12	F	1.10	2.2
15		82	13	F	1.07	2.2
	August 2	92	16 $\frac{1}{2}$	M	0.96	
		86	14	F	1.00	
		82	11 $\frac{1}{2}$	F	0.94	
		85	12 $\frac{1}{2}$	F	0.94	
		87	16	F	1.10	
		84	12 $\frac{1}{2}$	M	0.96	
		86	17	F	1.17	
		80	11	M	0.97	
		82	13 $\frac{1}{2}$	F	1.11	
		84	16	F	1.22	
		89	15	F	0.97	
		85	12 $\frac{1}{2}$	F	0.94	
		83	11 $\frac{1}{2}$	F	0.91	
		75	8 $\frac{1}{2}$	F	0.92	
		83	12	F	0.95	
	August 3	81	13 $\frac{1}{2}$	F	1.15	
		85	13 $\frac{1}{2}$	F	1.00	
		91	17	M	1.02	
		83	13 $\frac{1}{2}$	F	1.07	
		79	12	F	1.10	
		91	14	M	0.84	
		77	9	F	0.89	
		80	10 $\frac{1}{2}$	F	0.93	
		85	13 $\frac{1}{2}$	F	1.00	
		78	9 $\frac{1}{2}$	F	0.91	
		85	12 $\frac{1}{2}$	F	0.94	
		90	17	M	1.06	
		81	12 $\frac{1}{2}$	F	1.06	
		80	12	F	1.06	
		81	11	F	0.94	

Appendix A.

ST. JOHN HARBOUR DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	August 4	78	9	F	0.86	
		101	19 $\frac{1}{2}$	M	0.87	
		84	14	F	1.07	
		100	24	F	1.09	
		79	10 $\frac{1}{2}$	F	0.96	
		84	14 $\frac{1}{2}$	F	1.11	
		88	14	M	0.93	
		87	15	F	1.03	
		85	14	F	1.03	
		76	11 $\frac{1}{2}$	F	1.19	
		88	14 $\frac{1}{2}$	F	0.96	
		89	16	M	1.02	
		86	13 $\frac{1}{2}$	F	0.96	
		87	13 $\frac{1}{2}$	F	0.93	
		96	19	F	1.08	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	August 5	86	14	F	1.00	2.2+(8)
2		84	13 $\frac{1}{2}$	F	1.03	3.2+(5)
3		86	17	F	1.21	3.2+(t)
4		84	10 $\frac{1}{2}$	F	0.81	3.2
5		85	13 $\frac{1}{2}$	M	1.00	3.2+(5)
6		88	17	F	1.13	3.2
7		82	12	F	0.99	2.2+(6)
8		84	13 $\frac{1}{2}$	F	1.03	2.2+(4)
9		77	12	F	1.19	3.2+SM+SM+(5)
10		89	15 $\frac{1}{2}$	M	1.00	2.2+SM+(5)
11		78	11	F	1.05	2.e2
12		87	15	M	1.03	3.2+(7)W
13		84	14	F	1.07	2.2
14		76	9 $\frac{1}{2}$	F	0.98	2.2e+(6)?
15		80	11 $\frac{1}{2}$	F	1.01	2.se2+(4)
1	August 6	79	13	F	1.19	2.2+(8)W
2		81	12 $\frac{1}{2}$	M	1.06	3.2+(6)
3		87	15	F	1.11	2.2+SM+(7)
4		78	12	F	1.15	2.2
5		77	9	M	0.89	2.2+(4)
6		84	14 $\frac{1}{2}$	F	1.11	2.2+(3)
7		79	10	F	0.92	2.e2
8		77	10 $\frac{1}{2}$	F	1.04	2.2+(4)W
9		83	14	F	1.11	3.2+(3)
10		91	16	M	0.96	2.2+SM+(5)
1	August 8	84	15 $\frac{1}{2}$	F	1.19	2.e2
2		86	17	F	1.21	2.2+(7)
3		82	13	F	1.07	2.e2+e+(7)
4		88	16	M	1.06	3.2+(t12)
5		84	13	F	0.99	3.2
6		85	14 $\frac{1}{2}$	F	1.07	3.2+(5)W
7		80	12 $\frac{1}{2}$	F	1.10	2.e2+(10)W
		85	15	F	1.11	
		95	16 $\frac{1}{2}$	M	0.87	
		78	12 $\frac{1}{2}$	F	1.19	
		85	13 $\frac{1}{2}$	F	1.00	
		86	13	F	0.93	
		80	10	F	0.88	
		78	11	F	1.05	
		92	18 $\frac{1}{2}$	M	1.08	
		112	30	F	1.08	
		87	17	M	1.17	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	August 9	83	13	F	1.03	2.2+(6)
2		85	14 $\frac{1}{2}$	F	1.07	2.2
3		80	12	F	1.06	2.2+(7)
4		93	19 $\frac{1}{2}$	F	1.10	2.2+SM+1
5		84	14	F	1.07	2.2+(4)
6		79	10	M	0.92	2.1+SM+1+(3)
7		85	13 $\frac{1}{2}$	F	1.00	2.2+(5)W
8		79	11 $\frac{1}{2}$	F	1.05	2.02+(7)W
9		88	16	F	1.06	2.2+SM+(7)
10		80	11 $\frac{1}{2}$	F	1.01	2.2+(7)W
11		83	12 $\frac{1}{2}$	F	0.99	2.2+(8)
12		88	16 $\frac{1}{2}$	M	1.09	2.1+SM+1+(6)
13		97	20	M	0.99	2.02+SM+(10)
14		82	12	F	0.99	2.2+(8)
15		105	26	M	1.02	2.02+SM+1 +SM+(11)W
1	August 10	91	14	M	0.87	3.2+SM+(5)
2		84	13	F	0.99	2.2+(8)W
3		77	11	F	1.09	2.02+(5)
4		82	12 $\frac{1}{2}$	F	1.03	2.2+(6)
5		83	13	F	1.03	3.2
6		81	11	F	0.94	2.02+c+(5)
7		87	14 $\frac{1}{2}$	F	1.00	2.2+(8)
8		82	13	F	1.07	2.2+(4)
9		77	10	F	0.99	2.2+(6)
	August 11	93	15 $\frac{1}{2}$	M	0.87	
		80	12	F	1.06	
		87	15	M	1.03	
		82	13	F	1.07	
		84	13	F	0.99	
		82	12 $\frac{1}{2}$	F	1.03	
		80	11	F	0.97	
		79	10 $\frac{1}{2}$	F	0.96	
		80	10 $\frac{1}{2}$	F	0.93	
		82	11	M	0.91	
		84	13	F	0.99	
		66	7	F	1.10	
		87	14 $\frac{1}{2}$	F	1.00	
		80	12	F	1.06	
		85	13 $\frac{1}{2}$	F	1.00	
		79	11 $\frac{1}{2}$	F	1.06	
		76	11	F	1.13	
		85	13 $\frac{1}{2}$	M	1.00	
		84	13	F	0.99	
		77	10	F	0.99	
		76	11 $\frac{1}{2}$	F	1.19	
		78	12	F	1.15	
		81	11	F	0.94	
		95	20 $\frac{1}{2}$	M	1.08	
		84	13 $\frac{1}{2}$	F	1.03	
		75	9 $\frac{1}{2}$	F	1.02	
		79	10	F	0.92	

Appendix A.

ST. JOHN HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	August 12	88	15 $\frac{1}{2}$	M	1.03	2.2+SM+(4)
2		75	8 $\frac{1}{2}$	F	0.91	3.2+(7)W
3		77	9 $\frac{1}{2}$	F	0.94	2.e2+(t4)
4		82	12 $\frac{1}{2}$	F	1.03	2.s2 [†]
5		87	12 $\frac{1}{2}$	F	0.86	2.e2 [†]
6		77	10	F	0.99	2.e2
7		92	17	M	0.99	3.e3+(7)
8		97	21	M	1.04	2.2+SM+1
9		85	13	F	0.96	2.se2e+(10)W
10		82	13	F	1.07	2.2
11		86	13	M	0.93	2.2 [†] e
12		79	11	F	1.01	2.e2+(t6)
13		82	13 $\frac{1}{2}$	F	1.11	2.s2+(6)
14		84	12	M	0.92	2.2
15		78	10	F	0.96	2.2+(5)
16		81	10 $\frac{1}{2}$	F	0.90	2.e2+(6)
17		84	13	F	0.99	2.s2+(6)
18		82	12 $\frac{1}{2}$	F	1.03	3.2+(5)
19		90	15 $\frac{1}{2}$	M	0.96	3.2+SM+1+(5)
20		89	17	F	1.09	3.2+(t7)
21		90	16 $\frac{1}{2}$	M	1.03	3.2+SM+1+(5)
22		91	16	M	0.96	2.e3+SM+(4)
1	August 13	85	13 $\frac{1}{2}$	F	1.00	2.e2+(5)W
2		102	22	F	0.94	47.2+SM+SM+(6)W
3		90	14 $\frac{1}{2}$	M	0.90	3.2+(6)
4		89	14	M	0.91	3.2+(7)
5		83	12 $\frac{1}{2}$	F	0.99	3.2e
6		82	12	F	0.99	2.e2
7		84	13	F	0.99	2.e2+(7)W
8		79	10 $\frac{1}{2}$	M	0.96	2.s2+SM+1+(2)
9		82	13	F	1.07	2.e2+(5)
10		81	11	F	0.94	2.e2+(12)

Appendix B.

LORNEVILLE DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 1	78	11 $\frac{1}{2}$	F	1.10	3.2+(6)
2		77	9 $\frac{1}{2}$	F	0.97	3.2+(5)
3		80	9 $\frac{1}{2}$	F	0.84	3.2+(3)
4		86	12 $\frac{1}{2}$	M	0.89	3.02+(4)
5		79	11 $\frac{1}{2}$	F	1.08	2.020+(7)
6		80	11	M	0.97	2.2
7		78	9 $\frac{1}{2}$	F	0.89	2.2
8		81	11 $\frac{1}{2}$	F	0.96	3.02+(3)
9		85	11 $\frac{1}{2}$	M	0.87	3.2+SM+1+(2)
10		80	10 $\frac{1}{2}$	F	0.93	3.1+SM+1+(2)
11		84	12 $\frac{1}{2}$	F	0.94	3.02
12		80	10 $\frac{1}{2}$	F	0.95	3.2
13		83	12 $\frac{1}{2}$	F	0.99	3.2+(5)
14		81	11 $\frac{1}{2}$	F	0.96	3.02
15		86	13	M	0.93	3.2+SM+1+(2)
16		80	9 $\frac{1}{2}$	F	0.86	3.2+(2)
17		81	10 $\frac{1}{2}$	F	0.87	3.2+(4)
18		85	12 $\frac{1}{2}$	M	0.91	3.2+(5)
19		82	12	F	0.99	3.20+(5)
20		85	12 $\frac{1}{2}$	F	0.94	3.2
21		78	10	F	0.96	3.02
22		84	13 $\frac{1}{2}$	F	1.03	3.2+(4)
23		83	12 $\frac{1}{2}$	F	0.97	3.2
24		88	13 $\frac{1}{2}$	F	0.91	3.2
25		86	14 $\frac{1}{2}$	F	1.01	2.2+(3)
26		84	14	F	1.07	3.02
27		91	16	M	0.96	3.2+SM+1+(5)
28		89	15	M	0.96	3.2+(5)
29		89	14	M	0.91	2.2+SM+1+(3)
30		89	14 $\frac{1}{2}$	F	0.92	2.2+(6)
31		86	15	F	1.06	3.2
1	June 4	79	9 $\frac{1}{2}$	F	0.85	
2		75	8 $\frac{1}{2}$	F	0.89	
3		84	13 $\frac{1}{2}$	F	1.05	
4		82	12	F	0.99	
5		80	10 $\frac{1}{2}$	F	0.95	
6		82	11	F	0.91	
7		88	15 $\frac{1}{2}$	F	1.01	
8		83	11	F	0.87	
9		82	11 $\frac{1}{2}$	F	0.97	
10		83	11 $\frac{1}{2}$	M	0.93	
11		85	13 $\frac{1}{2}$	F	0.98	
12		82	12 $\frac{1}{2}$	M	1.01	
13		83	11 $\frac{1}{2}$	F	0.91	
14		84	12 $\frac{1}{2}$	F	0.96	
15		87	13	M	0.89	
16		84	11 $\frac{1}{2}$	F	0.88	
17		84	13	M	0.99	
18		83	12 $\frac{1}{2}$	F	1.01	
19		84	13 $\frac{1}{2}$	F	1.01	
20		84	14	F	1.07	
21		82	12	F	0.99	

Appendix B.

LORNEVILLE DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
22	June 4	83	12	F	0.95	
23		80	10 $\frac{1}{2}$	F	0.91	
24		85	13 $\frac{1}{2}$	F	1.02	
25		85	12	F	0.89	
26		81	12 $\frac{1}{2}$	F	1.06	
27		82	12 $\frac{1}{2}$	F	1.03	
28		84	11 $\frac{1}{2}$	F	0.90	
29		89	14 $\frac{1}{2}$	M	0.95	
30		85	13 $\frac{1}{2}$	F	1.02	
32		89	16	F	1.02	
33		85	15 $\frac{1}{2}$	F	1.00	
34		79	10 $\frac{1}{2}$	F	0.94	
35		79	9 $\frac{1}{2}$	F	0.90	
36		77	9 $\frac{1}{2}$	F	0.92	
37		88	15 $\frac{1}{2}$	F	1.01	
38		83	12 $\frac{1}{2}$	F	1.01	
39		82	11 $\frac{1}{2}$	F	0.97	
40		85	13 $\frac{1}{2}$	F	1.00	
41		81	11 $\frac{1}{2}$	F	0.96	
42		86	13 $\frac{1}{2}$	F	0.96	
43		86	13 $\frac{1}{2}$	F	0.94	
44		88	14 $\frac{1}{2}$	F	0.98	
45		89	15 $\frac{1}{2}$	F	0.98	
46		87	13 $\frac{1}{2}$	F	0.93	
1	June 7	81	11	F	0.94	2.20
2		82	12 $\frac{1}{2}$	F	0.92	2.37
3		83	13 $\frac{1}{2}$	F	1.05	3.02+(4)
4		82	10 $\frac{1}{2}$	F	0.84	3.2+(4)
5		88	14 $\frac{1}{2}$	F	0.96	3.2
6		86	14 $\frac{1}{2}$	F	1.01	2.2
7		85	13 $\frac{1}{2}$	F	1.02	3.02
8		82	13 $\frac{1}{2}$	F	1.08	2.2
9		85	15 $\frac{1}{2}$	F	1.13	3.20
10		87	13 $\frac{1}{2}$	F	0.95	3.20?
11		83	12	F	0.95	3.2+(4)
12		84	14	F	1.07	2.2
13		82	11 $\frac{1}{2}$	F	0.92	3.02
14		86	13	F	0.93	3.2+(8)
15		88	14	F	0.93	3.02
16		81	12 $\frac{1}{2}$	F	1.05	3.2+(5)
17		83	12	F	0.95	3.2+(3)
18		87	14 $\frac{1}{2}$	M	0.98	3.2+SM+1+(3)
19		76	10 $\frac{1}{2}$	F	1.06	2.02
20		87	15	M	1.03	3.02
21		85	13 $\frac{1}{2}$	F	1.00	3.2+(8)
22		82	9 $\frac{1}{2}$	F	0.80	3.02+(5)
23		80	10	F	0.88	2.2+(4)

Appendix B

LORNEVILLE DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 15	83	12		0.95	3.2
2		86	16 $\frac{1}{2}$		1.19	3.2+(3)
3		84	15 $\frac{1}{2}$		1.17	3.2
4		82	11		0.91	2.2+(4)
5		82	12 $\frac{1}{2}$		1.05	2.2
6		82	11		0.91	2.002
7		84	14 $\frac{1}{2}$		1.13	3.2+(3)
8		78	9 $\frac{1}{2}$		0.93	3.2+(6)
9		81	11		0.94	3.2
10		85	10 $\frac{1}{2}$		0.79	3.2+(4)
1	June 16	92	19		1.11	3.2+(6)
2		83	15		1.19	3.2
3		79	13 $\frac{1}{2}$		1.24	2.002
4		78	10 $\frac{1}{2}$		1.00	2.02
5		91	17		1.02	3.4
6		79	11 $\frac{1}{2}$		1.05	3.2
7		84	11		0.84	2.02+(5)
8		85	16		1.18	3.2
9		78	11		1.05	2.2+(6)
10		87	15		1.03	3.02
11		76	11		1.13	3.2+(5)
12		79	11		1.01	2.02
13		77	11		1.09	3.2e7
14		83	13		1.03	2.2
	June 17	80	12		1.06	
		82	13		1.07	
		78	10 $\frac{1}{2}$		1.00	
		81	10 $\frac{1}{2}$		0.90	
		83	15		1.19	
		81	13 $\frac{1}{2}$		1.17	
		82	12		0.99	
		84	13		0.99	
		86	14		1.00	
		79	11 $\frac{1}{2}$		1.05	
		84	12 $\frac{1}{2}$		0.96	
		79	11 $\frac{1}{2}$		1.05	
		78	10 $\frac{1}{2}$		0.98	
		82	13 $\frac{1}{2}$		1.11	
		83	11 $\frac{1}{2}$		0.93	
		75	10 $\frac{1}{2}$		1.13	
		81	14 $\frac{1}{2}$		1.21	
		79	11 $\frac{1}{2}$		1.03	
		86	15 $\frac{1}{2}$		1.08	
		82	13 $\frac{1}{2}$		1.08	
		78	11 $\frac{1}{2}$		1.10	
		89	16		1.02	
		79	11 $\frac{1}{2}$		1.05	
		84	12 $\frac{1}{2}$		0.98	
		77	10		0.99	

Appendix B

LORNEVILLE DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>K</u>	<u>History</u>
	June 17	78	11	1.05	
		78	11 $\frac{1}{2}$	1.10	
		78	9 $\frac{1}{2}$	0.91	
		81	13 $\frac{1}{2}$	1.17	
		84	14 $\frac{1}{2}$	1.09	
		82	13 $\frac{1}{2}$	1.11	
		82	13	1.07	
1	June 23	86	16	1.14	3.2 ¹⁰
2		85	14	1.03	3.2+(4)
3		80	12	1.06	2.2
4		79	12	1.10	3.2
5		82	12 $\frac{1}{2}$	1.03	3.2e
6		77	10	0.99	3.2 ¹ +(3)
7		83	12	0.95	3.2e
8		81	12	1.02	2.2+(5)
9		79	12	1.10	2.e2
10		83	12 $\frac{1}{2}$	0.99	3.2e+(5)
11		83	12	0.95	2.2+(4)
12		81	12 $\frac{1}{2}$	1.06	3.2
13		80	12 $\frac{1}{2}$	1.10	2.2
14		79	10 $\frac{1}{2}$	0.96	2.2 ¹⁰
15		80	12	1.06	3.2
16		80	12	1.06	3.2
17		81	11 $\frac{1}{2}$	0.98	3.2+(5)
18		83	12 $\frac{1}{2}$	0.99	2.2 ¹ +(4)
19		82	13	1.07	3.2+(2)
20		80	12 $\frac{1}{2}$	1.10	2.e2
21		83	14	1.11	2.2
22		79	12 $\frac{1}{2}$	1.15	2.2 ¹⁰
23		83	14	1.11	2.2+(5)
24		84	13 $\frac{1}{2}$	1.03	3.2+(4)
25		84	12 $\frac{1}{2}$	0.96	2.2
26		82	12	0.92	2.2
27		82	11	0.91	3.2
28		83	13	1.03	2.2e
29		84	12	0.92	2.2+(6)
30		77	11 $\frac{1}{2}$	1.14	2.2e
31		79	12	1.10	3.2
32		79	10 $\frac{1}{2}$	0.96	2.2
33		81	11 $\frac{1}{2}$	0.98	2.2e+(5)
34		80	12	1.06	3.2+(5)
35		85	14	1.03	2.e2e+(3)
36		83	13	1.03	3.2+(6)
37		79	13	1.19	3.2
38		79	10 $\frac{1}{2}$	0.96	2.2 ¹⁰
39		83	12 $\frac{1}{2}$	0.99	2.2
40		83	13	1.03	3.2
41		79	11	1.01	3.2
42		82	11 $\frac{1}{2}$	0.94	2.eo2+(5)
43		81	15	1.28	2.2+(3)
44		81	12 $\frac{1}{2}$	1.06	2.2e

Appendix B

LORNEVILLE DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>K</u>	<u>History</u>
45	June 23	80	12	1.06	3.2
46		83	13 ¹ / ₂	1.07	3.2
47		84	15	1.15	2.82e
48		82	12	0.99	3.2+(4)
49		85	13	0.96	2.82+(6)
50		98	20	1.03	3.2+SM+1
51		80	13	1.15	3.2
52		83	12 ¹ / ₂	0.99	2.2+(7)
53		81	11 ¹ / ₂	0.98	3.2
54		80	12	1.06	3.02
1	June 29	84	14	1.07	2.02
2		87	12 ¹ / ₂	0.86	2.02+(6)
3		83	13	1.03	2.02+(8)
4		85	15	1.11	3.3
5		87	15 ¹ / ₂	1.05	3.83
6		80	10	0.93	3.2e+(3)
7		87	16 ¹ / ₂	1.15	3.2'e+(t9)
8		74	8	0.90	3.02
9		84	12	0.92	3.2+(8)
10		86	12 ¹ / ₂	0.89	2.02+(5)
11		90	17	1.08	3.03
12		85	12 ¹ / ₂	0.94	3.2+(5)
13		83	12	0.95	2.802+(5)
14		79	10 ¹ / ₂	0.96	3.2+(3)
15		80	11	0.96	3.2+(4)
16		83	12 ¹ / ₂	1.01	3.2+(2)
17		76	9 ¹ / ₂	0.98	3.2+(6)
18		77	9 ¹ / ₂	0.97	2.802
19		83	12	0.95	3.02
20		86	14	1.00	2.2
21		85	14	1.03	2.02+(5)
22		85	13 ¹ / ₂	1.00	3.2
23		85	13 ¹ / ₂	0.98	2.2+(t)
24		86	14	1.00	3.2
25		83	13	1.03	2.1+SM+1+(4)
26		81	11 ¹ / ₂	1.00	2.02+(6)W
27		83	12 ¹ / ₂	1.01	2.2+(5)
28		79	11 ¹ / ₂	1.05	2.2+(4)
29		87	15 ¹ / ₂	1.07	3.1+SM+1+(1)
30		76	10	1.09	2.02+(3)
31		86	14 ¹ / ₂	1.03	
		83	15	1.19	
		76	9	0.93	
		84	12 ¹ / ₂	0.96	
		83	12 ¹ / ₂	0.99	
		87	13	0.89	
		83	12 ¹ / ₂	1.01	
		82	11 ¹ / ₂	0.94	
		85	13 ¹ / ₂	1.02	
		87	13 ¹ / ₂	0.93	
		85	14	1.03	
		87	13 ¹ / ₂	0.93	
		88	16 ¹ / ₂	1.09	

Appendix B

LORNEVILLE DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>K</u>	<u>History</u>
		88	17	1.13	
		89	15 $\frac{1}{2}$	1.01	
		78	12	1.15	
		88	17 $\frac{1}{2}$	1.16	
		78	11	1.05	
		85	12 $\frac{1}{2}$	0.94	
		87	15	1.03	
1	July 5	82	12	0.99	2.002
2		84	12 $\frac{1}{2}$	0.94	3.3+(4)?
3		85	14	1.03	3.2
4		88	15	1.00	2.2
5		81	9 $\frac{1}{2}$	0.79	3.2+[2]
6		87	14 $\frac{1}{2}$	0.98	3.2
7		88	15 $\frac{1}{2}$	1.03	3.02
8		82	12	0.99	2.02
9		81	11 $\frac{1}{2}$	1.00	2.2
10		82	12	0.99	3.2
11		83	13	1.03	2.2
12		82	14	1.15	2.2+(4)
13		83	13	1.03	2.2+SM+(2)
14		86	14	1.00	3.2
15		86	13 $\frac{1}{2}$	0.96	2.2
16		85	13	0.96	2.2
17		83	11 $\frac{1}{2}$	0.91	2.2+(4)
18		79	11	1.01	2.2+SM+1+(6)
19		88	13 $\frac{1}{2}$	0.88	3.2
20		83	14	1.11	2.2
21		86	14	1.00	2.02+SM+1
22		80	12	1.06	3.2
23		90	16 $\frac{1}{2}$	1.02	3.02
24		84	12	0.92	3.2+(3)
25		81	11 $\frac{1}{2}$	0.98	2.2
26		83	13	1.03	3.2
27		84	13	0.99	2.002
28		84	14 $\frac{1}{2}$	1.11	3.2+e+(4)
29		83	13 $\frac{1}{2}$	1.07	2.02
30		86	13 $\frac{1}{2}$	0.96	
31		86	13 $\frac{1}{2}$	0.96	
32		81	11 $\frac{1}{2}$	0.94	3.02
33		85	13 $\frac{1}{2}$	1.00	
34		85	13 $\frac{1}{2}$	1.00	
35		85	15	1.11	
36		82	13 $\frac{1}{2}$	1.11	
37		83	13 $\frac{1}{2}$	1.07	
38		83	13 $\frac{1}{2}$	1.07	
39		82	11	0.91	
40		84	14 $\frac{1}{2}$	1.11	
41		87	13	0.89	
42		82	12	0.99	

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>K</u>	<u>History</u>
1	July 8	84	13 $\frac{1}{2}$	1.03	3.2eo
2		79	10	0.96	3.2e
3		83	11	0.91	2.2eo
4		82	11	0.94	3.02eo
5		84	13	1.03	2.02+(6)
6		86	16	1.17	2.2+SM+1+(7)
7		82	10	0.86	2.2+(8)W
8		83	12	0.95	3.2
9		86	14 $\frac{1}{2}$	1.03	2.02e
10		84	11	0.84	3.2+(5)
11		86	13 $\frac{1}{2}$	0.96	2.2
12		82	11	0.94	2.2e
13		83	12 $\frac{1}{2}$	0.97	2.2
14		86	14	1.00	2.003
15		83	11 $\frac{1}{2}$	0.91	2.02+(4)
16		83	14	1.11	3.2+(8)W
17		85	13	0.96	3.2
18		84	11 $\frac{1}{2}$	0.86	2.02eo.
19		79	12 $\frac{1}{2}$	1.13	2.02
20		80	10 $\frac{1}{2}$	0.91	2.02
21		85	13 $\frac{1}{2}$	1.00	2.2
22		87	14	0.96	2.02
23		82	12	0.99	3.02+(7)W
24		84	13	0.99	2.2
25		91	17 $\frac{1}{2}$	1.05	3.2+(9)
26		85	14	1.03	2.2+(7)
27		83	12	0.95	2.2+(4)
28		81	11 $\frac{1}{2}$	0.98	3.02+(4)
1	July 12	86	16	1.14	3.2
2		85	14	1.03	3.2+(7)W
3		87	14	0.96	3.2eo
4		90	14 $\frac{1}{2}$	0.90	2.2e
5		78	11 $\frac{1}{2}$	1.12	2.2e
6		85	14 $\frac{1}{2}$	1.09	3.02e
7		86	14	1.00	3.2+SM+(5)
8		86	14	1.00	3.2+(7)
9		88	15	1.00	3.2
10		86	14 $\frac{1}{2}$	1.03	2.2
11		93	16	0.90	3.2
12		85	10 $\frac{1}{2}$	0.76	3.2e
13		84	13	0.99	2.2e+(4)e
14		77	10 $\frac{1}{2}$	1.02	2.2
15		80	11 $\frac{1}{2}$	1.01	2.02o
16		83	11	0.87	2.02
17		86	15	1.06	3.02

Appendix C.

DIPPER HARBOUR DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K.</u>	<u>History</u>
1	June 2	96	190 $\frac{1}{2}$	F	1.01	3.30?
2		87	15 $\frac{1}{2}$	F	1.05	3.02+(5)
3		80	10 $\frac{1}{2}$	F	0.95	3.2e+(4)
4		85	12 $\frac{1}{2}$	F	0.94	2.2e+(4)
5		97	18	F	0.89	3.2+SM+1
6		85	14	F	1.04	3.2e+(4)
7		94	19	F	1.03	2.3
8		77	9 $\frac{1}{2}$	F	0.92	3.2
9		83	12	F	0.95	2.2e+(6)
10		88	14 $\frac{1}{2}$	F	0.96	3.2+(7)
11		85	12	F	0.89	3.02+(5)
12		83	14 $\frac{1}{2}$	F	0.97	2.2+(5)
13		87	14	F	0.96	3.02
1	June 10	82	15	F	1.23	
2		85	13	M	0.96	3.2+(5)
3		71	8	F	1.01	3.2+(5)
4		81	13	M	1.10	3.2+(4)
5		81	11	M	0.94	2.2
6		78	11	M	1.05	2.2+(4)
7		91	15	F	0.90	2.3
8		87	15	M	1.03	3.2
9		78	12	F	1.15	3.02
10		84	13	M	0.99	2.2e+(6)
11		81	15	M	1.10	2.2+(4)
12		84	12	M	0.92	3.2
13		84	13	F	0.99	3.2+(5)
14		85	13	F	0.96	2.2
15		82	13	M	1.07	2.2 ¹ +(4)
16		96	24	M	1.23	3.3
17		86	14	M	1.00	2.2e
	June 11	81	12	F	1.02	
		84	13	F	0.99	
		75	9	F	0.97	
		95	18	F	0.95	
		86	15	F	1.07	
		88	14	F	0.93	
		91	18	F	1.08	
		79	10	F	0.92	
		93	15	F	0.85	
		83	13	F	1.03	
		84	12	F	0.92	
		79	10	F	0.92	
		86	15	F	1.07	
		84	13	F	0.99	
		77	9	F	0.90	
		84	13	M	0.99	
		81	12	F	1.02	
		84	11	F	0.84	
		86	13	F	0.93	
		81	13	F	1.02	
		83	11	F	0.87	

Appendix C.

DIPPER HARBOUR DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	June 14	77	10	F	0.99	
		82	15	F	1.23	
		83	15	F	1.19	
		82	14	F	1.15	
		85	12	F	0.89	
		94	20	F	1.09	
		82	12	F	0.99	
		84	15	F	1.15	
		88	16 $\frac{1}{2}$	F	1.10	
		78	12	F	1.15	
		92	18	F	1.05	
		84	16	F	1.22	
		86	16	F	1.14	
		84	13	F	0.99	
		79	11	F	1.01	
		81	12	F	1.02	
		84	15	M	1.15	
		85	14	F	1.03	
		86	15	F	1.07	
		89	20	F	1.29	
		80	12	F	1.06	
		80	13 $\frac{1}{2}$	F	1.18	
		79	14	F	1.29	
		78	12	F	1.15	
		82	14	M	1.15	
		78	13	F	1.24	
		33	16	F	1.27	
		87	17	M	1.38	
1	June 16	81	14	F	1.19	2.02+(5)
2		84	16	F	1.22	2.2+(7)
3		82	15	F	1.23	3.2+(4)
4		82	14	F	1.15	2.2+(5)
5		83	14	F	1.11	3.2
6		78	12	F	1.15	2.2
7		80	14	F	1.24	2.2
8		84	16	F	1.22	2.2
9		84	15	F	1.19	3.2+(3)
10		82	14	F	1.11	3.2+(3)
11		82	13	F	1.07	2.2
12		80	12	F	1.06	3.2eot.?
13		87	15	M	1.03	30.2+(4)
14		82	14	F	1.15	3.2c
15		91	15	F	0.90	3.3e
16		84	16	F	1.22	29.2+(6)
17		84	15	F	1.15	3.2
18		104	26	M	1.05	3.3e+SM+1
19		78	12	F	1.15	30.2
20		81	14	F	1.19	2.02+(6)
21		84	16	F	1.22	2.2+(3)
22		84	14	F	1.07	3.02
23		86	16	F	1.14	2.3+(2)
24		82	14	F	1.15	2.2+(5)

Appendix C.

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 17	81	14	F		2.2+(4)
2		83	15	F		3.2
3		80	14	F		2.e2e
4		93	21	F	1.18	3.2+SM+1
1	June 21	82	15	F	1.23	2.3
2		94	20	M	1.09	3.3+(5)
3		81	13	M	1.11	2.2
4		84	14 $\frac{1}{2}$	F	1.11	3.2+(4)
5		97	25	F	1.24	2.2+SM+(5)
6		83	14	M	1.11	3.2+(6)
7		82	14	F	1.15	2.e2†
8		80	13	M	1.15	2.e2
9		78	12	M	1.15	2.e2+(3)
10		84	14	M	1.07	2.e2+SM+1
11		84	15	F	1.15	2.2+(5)
12		89	16	F	1.02	2.2+SM+(5)
13		80	13	F	1.15	3.e2+(3)
14		81	13	M	1.11	2.e2
15		84	13	M	0.79	2.2+SM+1
16		78	12	F	1.15	2.2e†+(5)
17		84	15	F	1.15	2.e2+(5)
18		80	14	F	1.24	3.2+(4)
19		85	15	F	1.11	2.2+(4)
20		86	14	F	1.00	2.e2+(7)W
21		77	12	F	1.19	3.e2
22		84	14	F	1.07	2.e2+(4)
23		88	17	F	1.13	3.2
1	June 22	85	15 $\frac{1}{2}$	M	1.15	2.1+SM+1+(2)
2		86	18 $\frac{1}{2}$	F	1.28	2.e2+(3)
3		80	13 $\frac{1}{2}$	F	1.19	2.e2+(5)
4		90	23	F	1.44†	2.2+SM+1
5		84	12	M	0.92	3.2+(4)
6		84	16 $\frac{1}{2}$	F	1.26	3.2
7		85	16 $\frac{1}{2}$	F	1.22	3.2+(5)W
8		79	12	F	1.10	3.2
9		87	19	F	1.31	3.2+(6)
10		78	12 $\frac{1}{2}$	F	1.19	2.e2
11		96	21	F	1.08	3.3e
12		81	15	F	1.28	3.2+(6)
13		75	10	F	1.07	3.e2
14		82	13 $\frac{1}{2}$	F	1.11	2.e2+(4)
15		79	13	F	1.19	2.e2+(3)
16		85	16	F	1.18	2.2
17		87	15	F	1.03	2.2+(5)

Appendix C.

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	June 23	78	12	F	1.15	
		81	13	F	1.11	
		84	17	M	1.30	
		77	12	F	1.19	
		83	13	F	1.03	
		89	18	F	1.16	
		78	13	F	1.24	
		82	15	F	1.23	
		82	16	F	1.31	
		80	14	F	1.24	
		84	15	F	1.15	
		78	12	M	1.15	
		80	15	F	1.32	
		83	15	F	1.19	
		78	11 $\frac{1}{2}$	F	1.10	
		76	12	F	1.24	
		80	12	F	1.06	
		77	12	F	1.19	
		78	12	F	1.15	
	June 24	81	24	F	1.06	
		77	12 $\frac{1}{2}$	F	1.24	
		82	13	F	1.06	
		81	14 $\frac{1}{2}$	F	1.23	
		82	14 $\frac{1}{2}$	F	1.19	
		81	13	M	1.10	
		75	10 $\frac{1}{2}$	F	1.13	
		87	18	F	1.24	
		80	12	F	1.06	
		81	14	F	1.19	
		84	14 $\frac{1}{2}$	F	1.11	
		80	13	F	1.15	
		81	13	F	1.11	
		94	18	F	0.98	
		81	14 $\frac{1}{2}$	F	1.23	
		88	17	F	1.13	
		83	15 $\frac{1}{2}$	M	1.23	
		87	16	F	1.10	
		86	17	F	1.21	
		76	10 $\frac{1}{2}$	F	1.08	
		74	10 $\frac{1}{2}$	F	1.15	
		80	14	F	1.23	
		92	18 $\frac{1}{2}$	F	1.08	
		83	15	M	1.19	
		84	13 $\frac{1}{2}$	M	1.03	

Appendix C.

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 25	81	12 $\frac{1}{2}$	M	1.06	3.02+(4)
2		81	12	F	1.02	2.2+(5)
3		78	11 $\frac{3}{4}$	F	1.12	2.2
4		85	17	F	1.25	2.02
5		87	18 $\frac{1}{2}$	F	1.27	3.2
6		79	14	F	1.29	2.2
7		77	10 $\frac{1}{2}$	F	1.04	2.2+(4)
8		82	13 $\frac{3}{4}$	F	1.15	2.2+(3)
9		81	14	M	1.19	2.2+(4)
10		88	19 $\frac{1}{2}$	F	1.29	2.02
11		80	15 $\frac{1}{2}$	M	1.37	3.002
12		82	14	F	1.15	3.2e+(4)
13		86	20	F	1.42?	3.03
14		81	13	M	1.11	2.2
15		79	14 $\frac{1}{2}$	F	1.33	2.2e+(3)
16		77	10 $\frac{3}{4}$	F	1.04	3.2
17		87	17	F	1.17	3.2+(5)
18		84	17	M	1.50	3.2
19		84	13 $\frac{1}{2}$	F	1.03	2.2+(4)W
20		78	11 $\frac{3}{4}$	F	1.10	3.2+(4)?
21		88	20	F	1.33	2.2+(4)
22		77	12 $\frac{1}{2}$	F	1.24	2.2+(3)
23		81	15	M	1.28	2.1+SM+1+(4)
24		90	18 $\frac{1}{2}$	F	1.15	2.3+(2)
25		102	25 $\frac{1}{2}$	M	1.09	2.2+SM+1
26		80	14	F	1.24	3.2
27		89	20	F	1.29	2.2+(4)
28		83	14 $\frac{1}{2}$	F	1.15	3.02
29		89	16 $\frac{3}{4}$	M	1.06	2.2+(5)
30		83	15 $\frac{3}{4}$	F	1.21	2.02+(6)
31		84	16	F	1.22	2.2+(4)
32		83	12	F	0.95	2.2
33		83	16 $\frac{1}{2}$	F	1.31	3.2+(5)
34		78	11 $\frac{3}{4}$	F	1.10	
35		78	12	F	1.15	
36		83	14	F	1.11	
37		79	11	F	1.01	
38		81	13	F	1.11	
39		81	14 $\frac{1}{2}$	F	1.23	
40		85	16	F	1.18	
41		79	12 $\frac{1}{2}$	F	1.15	
42		80	12	F	1.06	
43		84	16 $\frac{1}{2}$	F	1.26	
44		82	12 $\frac{3}{4}$	F	1.03	

Appendix C.

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	June 28	78	10	F	0.96	3.02+(4)
2		78	10	F	0.96	2.02+(6)
3		82	14 $\frac{1}{2}$	F	1.19	2.02+(6)
1	June 29	84	14 $\frac{1}{2}$	F	1.11	3.2
2		80	11 $\frac{1}{2}$	F	1.02	3.2+(5)
3		81	11 $\frac{1}{2}$	F	0.98	2.20
4		84	14 $\frac{1}{2}$	F	1.11	3.02+(3)
5		83	14 $\frac{1}{2}$	F	1.15	3.2+(6)
6		80	14	F	1.24	2.2
7		81	11 $\frac{1}{2}$	F	0.98	2.2+(4)
8		96	22	F	1.13	3.02+SM+1
9		79	12 $\frac{1}{2}$	F	1.15	2.02+(4)
10		81	14	F	1.19	3.02
11		82	12	F	0.99	2.02+(5)
12		87	16	F	1.10	2.2+(6)
13		83	13	M	1.03	2.2
14		80	11	F	0.97	2.2
15		80	14	F	1.24	3.2
16		77	9 $\frac{1}{2}$	F	0.94	2.02+(3)
	June 30	80	12 $\frac{1}{2}$	F	1.10	
		87	16	F	1.10	
		84	14 $\frac{1}{2}$	M	1.11	
		83	13 $\frac{1}{2}$	F	1.07	
		89	16	F	1.03	
		76	10 $\frac{1}{2}$	F	1.11	
		87	16	F	1.10	
		86	17	F	1.21	
		82	14	F	1.15	
		78	11 $\frac{1}{2}$	F	1.12	
		84	13 $\frac{1}{2}$	F	1.03	
		81	12 $\frac{1}{2}$	F	1.06	
		83	15	F	1.19	
		95	20 $\frac{1}{2}$	F	1.08	
		83	16	F	1.27	
		75	9 $\frac{1}{2}$	F	1.02	
		80	13 $\frac{1}{2}$	F	1.19	
		78	13	F	1.24	
		80	12	F	1.06	
		79	13 $\frac{1}{2}$	F	1.21	
		82	15	F	1.23	
		79	13 $\frac{1}{2}$	F	1.22	
		79	11	F	1.01	
		80	14 $\frac{1}{2}$	F	1.28	
		82	13 $\frac{1}{2}$	F	1.11	
		78	12 $\frac{1}{2}$	F	1.15	

Appendix C.

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	July 1	79	12	F	1.10	3.02
2		77	10 $\frac{1}{2}$	F	1.04	2.2+(6)
3		85	15 $\frac{1}{2}$	F	1.14	3.2+(5)
4		83	15	F	1.19	2.2+(9)
5		76	10 $\frac{1}{2}$	F	1.08	3.02
6		82	15	F	1.23	3.20+(4)
7		74	11 $\frac{1}{2}$	F	1.29	2.2+(5)
8		75	10 $\frac{1}{2}$	F	1.10	3.2+(4)
9		82	14 $\frac{1}{2}$	M	1.19	2.20
10		79	12	F	1.10	2.02
11		76	10 $\frac{1}{2}$	F	1.08	2.2
12		80	12	F	1.06	2.2+(5)
13		75	9 $\frac{3}{4}$	F	1.05	2.2
14		74	9 $\frac{1}{2}$	F	1.06	2.02
15		88	16	F	1.06	2.2+(4)
16		83	13	F	1.08	2.002
17		76	12 $\frac{1}{2}$	F	1.29	2.1+SM+(4)
18		84	14 $\frac{1}{2}$	F	1.11	3.2
19		85	16	F	1.18	2.2+(4)
20		83	15 $\frac{1}{2}$	F	1.22	3.20
21		82	13 $\frac{1}{2}$	F	1.11	3.2
22		83	13	F	1.03	2.2+(5)
23		82	15	F	1.22	3.2
24		82	13 $\frac{1}{2}$	F	1.11	2.2
25		83	14 $\frac{1}{2}$	F	1.15	2.2+(5)
26		76	10 $\frac{1}{2}$	F	1.06	2.20
27		75	9 $\frac{3}{4}$	F	1.05	3?.02+(3)
28		84	16	F	1.22	2.2
29		81	15	F	1.28	2.2
30		86	15	F	1.07	2.2+(t7)
31		85	15	F	1.11	2.2
32		86	19 $\frac{1}{2}$	F	1.39?	2.2
33		85	16 $\frac{1}{2}$	M	1.22	3.2
34		86	16	F	1.13	2.2
35		79	10 $\frac{1}{2}$	F	0.96	2.2+(3)
36		82	14 $\frac{1}{2}$	F	1.19	2.2+(6)
37		83	14	M	1.11	2.2+(5)?
38		76	10	F	1.03	2.02
39		81	13 $\frac{1}{2}$	F	1.15	2.20
40		77	10 $\frac{1}{2}$	F	1.04	2.2

Appendix C.

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	July 2	73	10 $\frac{1}{2}$	F	1.19	2.2
2		83	14	F	1.11	2.o2+(7)
3		79	11 $\frac{1}{2}$	M	1.08	3.2+(7)
4		74	10 $\frac{1}{2}$	F	1.15	2.s2+(4)
5		79	12 $\frac{1}{2}$	F	1.15	2.o2+(5)
6		77	10 $\frac{1}{2}$	F	1.04	2.o2
7		79	11	F	1.01	2.o2+(4)
8		76	12 $\frac{1}{2}$	F	1.29	2.o2
9		75	11 $\frac{1}{2}$	F	1.21	2.s2+(6)
10		81	13 $\frac{1}{2}$	F	1.15	2.2+(4)
11		76	12	F	1.24	2.o2+(5)
12		80	13	F	1.15	3.2
1	July 5	85	16	F	1.18	2.s2+(5)
2		82	15	F	1.23	2.o2+(7)W
3		79	12 $\frac{1}{2}$	F	1.12	3.2
4		80	12	F	0.97	2.so2+(4)
5		82	10 $\frac{1}{2}$	F	0.86	3.2+(6)
6		85	16	F	1.18	2.2+(9)
7		77	10 $\frac{1}{2}$	F	1.02	2.2e+(5)
8		77	10 $\frac{1}{2}$	M	1.04	2.2e+(5)
9		81	12 $\frac{1}{2}$	F	1.04	2.o2
10		80	11 $\frac{1}{2}$	F	1.02	2.2+(4)
11		77	11 $\frac{1}{2}$	F	1.14	2.o2+(3)
12		76	11	F	1.13	2.o2
13		79	11 $\frac{1}{2}$	F	1.06	3.2e+(5)
14		85	15	F	1.11	2.o2
15		87	16 $\frac{1}{2}$	F	1.13	3.2+(7)W
16		82	15	F	1.31?	3.o2+(6)
17		79	12 $\frac{1}{2}$	F	1.15	2.o2+(5)
18		80	13	F	1.15	2.s2+(6)
19		84	16 $\frac{1}{2}$	F	1.26	2.o2+(10)
20		80	13 $\frac{1}{2}$	F	1.17	2.2+(5)
21		80	12	F	1.06	3.2+(7)
22		82	14 $\frac{1}{2}$	F	1.19	2.2
23		83	13	F	1.03	3.2+(3)
24		84	15 $\frac{1}{2}$	F	1.19	27.2
25		77	11	F	1.09	2.so2
26		79	12 $\frac{1}{2}$	F	1.14	3.2+(7)W
27		98	17 $\frac{1}{2}$	F	0.89	2.o3
28		78	12	F	1.19	2.o2+(7)
29		80	12	F	1.10	2.o2!?
30		76	11 $\frac{1}{2}$	F	1.19	3.o2+(5)
31		79	11 $\frac{1}{2}$	F	1.06	2.o2+(3)
32		80	12	F	1.06	2.o2
33		82	12	F	0.99	2.2+(5)
34		81	12	F	1.02	2.2+(6)
35		82	12 $\frac{1}{2}$	F	1.03	3.2+(4)
36		61	5 $\frac{1}{2}$	F	1.10	3.o1+(7)

Appendix C

DIPPER HARBOUR DATA

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
1	July 6	81	12½	F		2.2+SM+(4)
2		82	12	F		2.2+(3)
3		82	13	F		2.2
4		79	12½	F		2.2+(4)
5		85	13½	F		3.c2
6		77	10	F		2.s2+(4)
7		83	12½	F		2.2
8		78	11	F		2.2
9		83	11½	F		3.2+(4)
10		81	12	F	1.02	3.3
11		73	9½	F		2.s1+SM+SM +(4)
12		82	12½	F		2.c2+(6)
13		81	13½	F		2.2
14		89	17	F		2.2
15		78	11	F		2.2+(t8)
16		76	11	F		2.3?
17		77	10½	F		2.2+(3)
18		82	13½	F		2.2
19		82	14½	F		3.2?o
20		83	15½	F		2.c2+(12)W
21		84	15	M		3.2+SM+1?+(6)
22		84	11½	F		2.2+(8)
23		81	12	F		2.2
24		77	11	F		2.2
25		81	13	F		2.2+(4)
	July 8	81	12	F	1.02	
		81	11½	F	0.98	
		82	11½	F	0.94	
		83	14	F	1.11	
		80	12½	F	1.08	
		78	11½	F	1.10	
		85	13	F	0.96	
		78	12	F	1.15	
		81	13	F	1.10	
		83	13	F	1.03	
		82	12½	F	1.02	
		78	11	F	1.05	
		80	13½	F	1.19	
		85	14	F	1.03	
		77	11	F	1.09	
		77	10	F	0.99	
		86	16½	F	1.15	
		77	10½	F	1.04	
		78	12½	F	1.19	
		81	11½	F	0.98	
	82	12	F	0.98		
	78	9	F	0.86		
	81	12	F	1.02		

Appendix C

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
	July 8	71	10	F	1.27	
		75	9	F	0.97	
		78	10	F	0.96	
		82	14	F	1.15	
		81	13	F	1.11	
		76	10	F	1.03	
		81	11 $\frac{1}{2}$	F	0.98	
		83	13 $\frac{1}{2}$	F	1.07	
		71	8 $\frac{1}{2}$	F	1.12	
		78	12	F	1.15	
		79	11 $\frac{1}{2}$	F	1.05	
		77	10 $\frac{1}{2}$	F	1.04	
		78	10	F	1.00	
		81	11 $\frac{1}{2}$	F	0.96	
		80	12 $\frac{1}{2}$	F	1.10	
		79	12	F	1.10	
		75	10 $\frac{1}{2}$	F	1.13	
		79	9 $\frac{1}{2}$	F	0.87	
		80	12	F	1.06	
		72	9	F	1.09	
		82	13 $\frac{1}{2}$	F	1.09	
		77	11 $\frac{1}{2}$	F	1.14	
		80	12 $\frac{1}{2}$	F	1.11	
		80	12 $\frac{1}{2}$	F	1.11	
		78	11	F	1.05	
		81	11 $\frac{1}{2}$	F	0.96	
		78	11	F	1.05	
1	July 9	88	16 $\frac{1}{2}$	F	1.09	2.2
2		82	14 $\frac{1}{2}$	F	1.17	2.e2+(5)
3		90	18 $\frac{1}{2}$	F	1.15	3.1+SM+1
4		81	15	F	1.11	2.e2+(4)
5		78	12	F	1.15	3.2+(7)
6		79	12	F	1.10	2.2c
7		80	11 $\frac{1}{2}$	F	1.01	2.2
8		76	10 $\frac{1}{2}$	F	1.09	2.2
9		89	12 $\frac{1}{2}$	F	0.81	2.e2+(4)
10		81	15	F	1.28	3.2e+(3)
11		79	11 $\frac{1}{2}$	F	1.05	2.2
12		81	14	F	1.19	2.2
13		77	12	F	1.19	2.2
14		81	12 $\frac{1}{2}$	F	1.04	2.2
15		80	12	F	1.06	3.e2+(3)
16		78	12 $\frac{1}{2}$	F	1.17	2.s2+(6)
17		80	12 $\frac{1}{2}$	F	1.10	2.2
18		81	13	F	1.11	2.2+(6)
19		79	11 $\frac{1}{2}$	F	1.05	2.s2+(7)
20		78	12	F	1.10	3.2+(4)
21		90	16	F	1.00	3.2+(7)

Appendix C

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
22	July 9	83	15 $\frac{1}{2}$	F	1.21	2.2+(5)
23		77	9	F	0.89	2.2e+(4)
24		74	11 $\frac{1}{2}$	F	1.29	2.2e+(5)
25		78	10	F	0.96	3.2
26		83	14	F	1.11	2.m2
27		82	13 $\frac{1}{2}$	F	1.11	2.e2+(5)
28		80	11	F	0.97	2.e2+(3)
29		78	11	F	1.05	2.2+(6)
30		77	9 $\frac{1}{2}$	F	0.94	2.2+(6)
31		75	10	F	1.07	2.2
32		84	15 $\frac{1}{2}$	F	1.19	2.2
33		82	13	F	1.07	2.2
34		74	8 $\frac{1}{2}$	F	0.95	2.2
35		82	13 $\frac{1}{2}$	F	1.11	2.2
36		81	15	F	1.28	2.2e+(6)
37		84	14	F	1.07	3.2+(4)
38		78	12	F	1.15	3.2e+(4)
39		83	14 $\frac{1}{2}$	F	1.15	2.2
40		82	12	F	0.99	2.3+(4)
1	July 15	83	15 $\frac{1}{2}$	F	1.23	2?..4-(3)
2		86	13 $\frac{1}{2}$	F	0.94	2.2-(8)
3		77	11 $\frac{1}{2}$	F	1.12	2.e2-(4)
4		79	10	F	0.92	2.e2-(6)
5		84	14	F	1.07	2.e2
6		87	15 $\frac{1}{2}$	M	1.07	2.m2
7		83	14 $\frac{1}{2}$	F	1.15	2.e2-(5)
8		81	12	F	1.02	2.e2-(9)W
9		86	15 $\frac{1}{2}$	F	1.10	2.e2
10		84	15 $\frac{1}{2}$	F	1.19	2.1+SM+SM+SM +(1)
11		80	11 $\frac{1}{2}$	F	1.04	2.2+SM+(6)
12		85	15	F	1.11	3.2+(4)
13		70	8 $\frac{1}{2}$	F	1.12	2.2+SM+(5)
14		78	11 $\frac{1}{2}$	F	1.08	2.m2
15		87	15	F	1.03	3.3
16		81	12	F	1.06	3.2+(3)
17		82	12 $\frac{1}{2}$	F	1.03	2.2
18		83	13 $\frac{1}{2}$	M	1.07	2.e1+SM+1+(4)
19						
20		82	13 $\frac{1}{2}$	F	1.09	2.2+(6)
21		87	15	F	1.03	2.2+(7)
22		83	13 $\frac{1}{2}$	F	1.03	2.2+SM+(5)
23		82	13 $\frac{1}{2}$	F	1.11	2.2+(5)
24		78	11	F	1.05	2.m2+(8)
25		81	14 $\frac{1}{2}$	F	1.21	2.2+SM+(6)
26		85	15 $\frac{1}{2}$	F	1.14	3.2

Appendix C

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K</u>	<u>History</u>
27	July 15	79	12	F	1.10	2.e2+(t9)
28		78	12	F	1.15	2.s2 [†]
29		78	11	F	1.05	2.e2+(5)
30		82	12 $\frac{1}{2}$	F	1.03	2.e3 [†] +(5)
31		81	12 $\frac{1}{2}$	F	1.06	2.sc2
32		80	11 $\frac{1}{2}$	F	1.02	2.s2+(5)W
33		83	12 $\frac{1}{2}$	F	1.01	3.2
34		81	14	F	1.19	2.s2+SM+1+(7)
35		80	10 $\frac{1}{2}$	F	0.95	2.2
36		79	12 $\frac{1}{2}$	F	1.13	2.e2 [†]
37		84	14	F	1.07	3.2
38		76	21	F	1.08	2.e2+SM+1+(4)
39		82	12	F	0.99	2.e3
40		79	10	F	0.92	2.e2e
41	81	11 $\frac{1}{2}$	F	0.98	3.2+(5)	
42	80	12 $\frac{1}{2}$	F	1.10	3.e2+(4)	
43	74	9 $\frac{1}{2}$	F	1.03	2.s2	
1	July 16	86	14 $\frac{1}{2}$	F	1.03	3.2
2		88	13 $\frac{1}{2}$	F	0.90	2.e3
3		83	12 $\frac{1}{2}$	M	0.99	3.s2+SM+1
4		77	9	F	0.89	2.2
5		85	15	F	1.11	3.2+(7)W
6		86	15	F	1.06	2.3
7		79	11 $\frac{1}{2}$	F	1.03	2.2+(6)
8		79	10 $\frac{1}{2}$	F	0.96	2.2
9		84	14	F	1.07	2.2+(12)
10		86	15	F	1.06	3.2+(6)
11		83	13	F	1.03	2.2
12		89	16 $\frac{1}{2}$	F	1.06	2.2
13		87	16	F	1.10	2.s2
14		85	15	F	1.11	3.e2+(t6)
15		77	9 $\frac{1}{2}$	F	0.94	2.e2+(5)
16		69	8	F	1.10	
17		88	16	F	1.06	2.2
18		80	11	F	0.97	2.s2+(9)W
1	July 19	80	12	F	1.06	2.s2e+(3)
2		74	8 $\frac{1}{2}$	F	0.98	
3		84	16	F	1.22	3.3+(5)
4		79	11 $\frac{1}{2}$	F	1.05	2.s2e
5		87	15 $\frac{1}{2}$	M	1.07	2.2
6		82	12	F	0.99	3.e2+(5)
7		73	14	F	?	2.2+(7)

Appendix C

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K.</u>	<u>History</u>	
8	July 19	79	10 $\frac{1}{2}$	F	0.96	3.2+(5)	
9		84	13 $\frac{1}{2}$	F	1.03	2.2+(5)W	
10		87	14 $\frac{1}{2}$	F	1.00	2.2+(3)	
11		79	12	F	1.10	3.2+(3)	
12		85	14 $\frac{3}{4}$	F	1.09	2.2+(3)o	
13		83	12	F	0.95	2.2+(5)	
14		79	9 $\frac{1}{2}$	F	0.87	3.2	
15		85	14	F	1.07	2.2	
1		July 20	97	22 $\frac{1}{2}$	M	1.11	2.2+SM+1+(2)
2			82	12 $\frac{1}{2}$	F	1.01	2.2+(5)
3	83		14 $\frac{1}{2}$	F	1.15	2.2	
4	71		7 $\frac{1}{2}$	F	0.92	2.2e+(4)	
5	82		12 $\frac{1}{2}$	M	1.01	27.2	
6	87		16 $\frac{1}{2}$	F	1.14	2.2+(t)	
7	81		12 $\frac{1}{2}$	F	1.05	2.2+(6)	
8	82		12 $\frac{1}{2}$	F	1.01	2.2+(7)W	
9	80		12	F	1.06	3.02+(5)	
10	84		13 $\frac{1}{2}$	F	1.03	2.2	
11	91		21	M	1.26	3.03	
1	July 21	89	17	F	1.09	2.02+(5)W	
2		80	10 $\frac{1}{2}$	F	0.91	2.22	
3		70	9 $\frac{1}{2}$	F	1.22	3.02+SM+(8)	
4		76	10 $\frac{3}{4}$	F	1.09	2.2	
5		74	9 $\frac{1}{2}$	F	1.06	2.2	
6		88	16	F	1.06	2.22	
7		62	5 $\frac{3}{4}$	F	1.10	3.1+(7)W	
8		76	12	F	1.24	2.1+SM+SM+	
9		74	10 $\frac{3}{4}$	F	1.20	2.2	
10		85	14 $\frac{3}{4}$	F	1.07	3.2	
11		81	12 $\frac{1}{2}$	F	1.05	2.2+(5)	
12		82	12	F	0.99	2.2+(3)	
1	July 22	97	22	F	1.09	2.1+SM+2+(6)T	
2		80	11 $\frac{1}{2}$	F	1.00	2.2+(4)	
3		81	12	F	1.02	3.02	
4		79	11	F	1.01	2.2	
5		83	14 $\frac{1}{2}$	F	1.13	2.2+(4)	
6		80	11	F	0.97	2.22+(6)W	
7		82	12 $\frac{1}{2}$	F	1.03	2.02+(5)	
8		82	14	F	1.15	2.02+(4)	
9		82	14 $\frac{1}{2}$	F	1.19	2.2+(5)	
10		83	12 $\frac{1}{2}$	F	0.97	2.2+(8)W	

Appendix C

DIPPER HARBOUR DATA.

<u>No.</u>	<u>Date</u>	<u>Length</u>	<u>Weight</u>	<u>Sex</u>	<u>K.</u>	<u>History</u>
1	July 23	86	13½	F	0.96	3.2
2		92	19	M	1.11	3.3+(7)
3		65	7½	F	1.20	2.1+SM+(4)
4		75	9½	F	1.00	2.2+(5)
5		78	11	F	1.05	3.2+(4)
1	July 28	81	12½	F	1.06	2.2e
2		87	17	F	1.17	3.2+SM+(4)
3		79	12½	M	1.15	2.2+SM+(7)

ATLANTIC SALMON INVESTIGATIONS

1938

Report II. Miscellaneous Notes

By William S. Hoar

SALMON- Dipper Harbor, New Brunswick,

The Gear used in Fishing

The "gang" of nets used by the drifters at Dipper Harbor are usually about 800 fathoms long. Mr. Harkins has fished a "gang" 1000 fathoms long, but says that in general it does not pay to fish more than 800 fathoms. The nets have a 7 inch mesh and are 15 feet deep.

Record Catches

William Harkins and his father have for years been considered the top salmon drifters on this part of the coast. The following are some of the catches which Mr. Harkins remembers: 87 and 78 fish taken each in a single night by Mr. Harkins father; 74 and 61 on different sets; and 93 fish taken in two days.

Thirty-three fish was the highest single catch during this season. Fred Murrey (July 1) and Russel Janes (July) both took this number. Douglas Janes was "high boat" for that season at Dipper Harbor with a total catch of 251 salmon. This is considered extremely poor. It is said by the oldest fishermen "never to have been much worse".

Fishing Grounds

During the early part of the season the fishing is well off shore - 10 to 12 miles. Later (third week of June) the boats come in as close as possible - 4 to 6 or less miles.

At times the fish are rather plentiful to the west of Dipper Harbour. There have been years when the fishing started first to the westward and was there throughout the season. The fishermen would go west (Point Lepreau) to make their sets. In general however it does not pay to go west of Dipper Harbour or the Point. The best fishing to the westward is usually in June - and all over with by the first of July. This year was notable in that all the big catches were made to the westward and the fishing seemed to be better there even up to the end of the season.

Mr. Harkins says that reports of salmon jumping "down at the Wolves" are very frequent but that he has never been able to take many there. He says that he has tried fishing over about as much of the bay in his time as anyone and that in general it does not pay to go off the beaten track between Dipper Harbour and Lorneville.

Fishing has been tried at Grand Manan but the tides there and the fog make it rather hazardous. About four years ago two boats - one owned by L. Griffith, light house keeper - tried fishing here. They fished from Flag's Cove for two summers, and made only their expenses. Some of the Dipper Harbour men say that they were poor fishermen. Once on June 20th, Griffith took 23 fish E. SE. about 10 miles from Grand Manan. It is usually all over here by July 1st. Harkins has fished within two miles of Grand Manan and has at times made reasonable catches, but this is not the general thing.

FISHING OF THE NETS (Fishermen's Opinion)

It is said that the best fishing night is one which combines moonlight with just enough breeze to ripple the water. The light breeze is very essential, a calm moonlight night being

about as poor as any night. A star-light and clear night is supposed to be better than a cloudy one.

Dipper Harbour fishermen say that their best wind is the North East wind, while the Lorneville men desire a South Westerly one. Harkins says that he thinks it is the change of winds which is of importance. No matter what the direction, the wind looses its force if it continues to blow the same way. Easterly winds are feared most for the gear and life. A wind following a calm is as good as a change of wind.

The salmon are found further off shore after a big surf and undertow.

Very high tides are poor for salmon fishing - or any other kind of fishing for that matter. Sea weed is so plentiful at the time of high tides, and the nets get so full of it, that there is much extra work besides. No salmon are to be expected in the streaks of sea weed, and the fishermen do not expect to take fish when their nets are dirty. During the high tides the salmon seem to be more scattered. Nets are thought only to fish on the slack of the tide, both ebb and flood. The fishermen are pleased when they can get two slack tides in one set. Most fish are thought to go under the nets. A "streak" of tide is highly desired by the fishermen, although these will often wind their nets up until they are useless. The position of the nets can become completely changed in a very few minutes by one of these streaks. Often the nets are brought together into one mass until they form what is known as a "hen's nest". It indeed resembles this. Or again they may be rolled around in the form of a tight rope. We got most of our fish when the nets were tangled up with these streaks. If the nets laid out straight

we got no fish. The ebb slack is thought to be better than the flood slack.

The Dipper Harbour fishermen rarely fish in the day time. It does not pay. The water is said to be too clear. The Lorneville men can fish in close shore and in the day time because of the dark water. Fishing usually begins first at Lorneville but not always (1904). All the "big years" are "big years" at Dipper Harbour; and these years the salmon usually appear early here. Harkins remembers a year when they did not strike at Lorneville until July 10th.

It is nice to see the salmon jumping but you cannot catch jumping salmon (opinion).

Good and lean years are recognized by all the older fishermen. In Harkins 40 years of fishing he can remember of a few times when the fishermen became so discouraged that many of them gave ti up saying that all the salmon had left the coast. Russel Janes' father fished at Musquash one season and did not make enought to pay the wages of his hired man.

It is a common opinion that many of the salmon out in the bay never go into any river but spend their life wandering back and forth. This year fishing was chiefly "on shore" and to the westward. Many of the men believe that these are not Saint John fish at all but belong to other rivers.

Earn. Thompson has seen salmon jumping in Musquash Harbour. He also once saw a salmon jump off Point Lepreau on January 17th.

The nets may drift 10-15 miles in one night but they do not usually go more than 6 or 7.

If the nets lie east and west it is thought that the salmon strike on both sides. If they lie across the bay, the fish will strike from the east when fishing in east of Musquash and from the west when the fishing is to the west of Musquash. I could not see this order - in fact any order.

Many a fish is driven into the nets as the fishermen "power" along them after making the set. They expect this. Quite often the fish will get away again before it can be taken from the twine, indicating that the nets are not 100% efficient.

Salmon (fish of both the adult and Post-smolt ages) are often taken in the herring weirs. As many as 30 large salmon have been taken in John Mahwinney's weir at one time. This year only two salmon were reported from the weir, one on July 33 and the other on August 14. Both were taken in Mahwinney's weir, the first weighed 13 lb. and the last 24 lb. Post-smolts are usually taken later and are said to come with the mackerel.

Other Fish seen in the Drift Nets.

Dogfish are all too numerous. They are more common when fishing "off shore". The fishermen say that you will never find salmon when these are about. They destroy them by cutting off the tail or ripping back the pectoral fin.

Pollock were very frequently taken this year. Three or four were found in almost every set. They too seem to be "off shore. The pollock is little thought of at Dipper Harbour.

Hake about as many as of pollock.

Haddock about the same number as of hake.

Shark are sometimes seen. In the five weeks we took two in our net. Harkins has seen two salmon eaten by sharks in his time. He thinks that when the salmon are jumping they are usually being chased by sharks. The shark is very destructive to the salmon nets. They often go through them. The fishermen deal with the shark by cutting off its tail.

Shad only two of these were seen in the drift in the five weeks. On July 8 there were 65 taken in Harkins sardine weir. On July 13th 80. Few were taken after this in the weirs.

Mackerel a few "tinker" mackerel were netted.

Gaspereau one specimen only.

Lumpfish one specimen.

Jelly fish are sometimes a nuisance in messing up the nets.

Porpoise These were very numerous this year. We took as many as 7 in the nets in 5 days. They were seen regularly in the evenings. No commercial use is made of them. The fishermen claim to have seen them eating salmon and so show very little mercy to them.

Whale one was seen and cut through Douglas Jones' nets.

Seals were not seen in the nets but they are fairly common and said to be quite destructive. Harkins has had as many as 30 salmon ruined by them in one night.

Flounders (not in drift nets) are fished regularly in the harbour with hand lines.

Halibut(not in drift nets). Trawls are set for these in the mouth of the harbour and nearby. Very few small ones are taken.

Smelt (not in drift nets) are seen frequently in the herring seines, and are fished locally with hand lines.

Meteorological Notes while Drifting

June 7	6:30 p.m.	wind S. W. 25 mile gale	
8	"	" W velocity 0	changing
9	"	" W	3
10	"	W	3
13	Calm	--	--
14	5:00 a.m.	E	1
	5:30 p.m.	Calm	--
	9:30 p.m.	E	1
15		Light air only	
16	6:00 p.m.	NE	1
	8:00 p.m.	E	2
17	5:00 a.m.	SE	3
	7:00 p.m.	SW	7
20	"	SE	3
21	5:00 a.m.	Calm	
	7:00 p.m.	E	1
22	6:00 p.m.	SW	30 mile gale
23	5:00 a.m.	Calm	
	7:00 p.m.	SW	5 (water temp. 8 p.m. 8.9°C)
24	"	SW	1 (water temp. 5 a.m. 10.4°C).
27	"	NW	1
28	"	SE	and died down in the night
29	"	SE	1
30	"	SW	4
July 1	5:00 a.m.	SW	2
	7:00 p.m.	SSE	4
4	"	NE	2 (water temp. 11.3°C)
5	"	W	3
6	"	NE	2
7	"	NW	2
8	"	SW	4

Note. A series of water samples on July 27th showed that the temperature of the water rose 3°C on going off shore from Dipper Harbour four miles.

ATLANTIC SALMON AND TROUT INVESTIGATIONS

1938

Report No. III. Salmon in Cape Breton Highlands National Park

By A. G. Huntsman.

Cheticamp River.

While salmon are to be taken in general along both coasts of the Park and enter all the larger accessible streams in the fall for spawning as shown by the presence of the young in those streams, angling for salmon is at present confined to the Cheticamp river in the southeast corner of the Park. This is owing to the fact that into this river alone do salmon enter sufficiently early in the season to be available for angling. The explanation of this is to be found in the nature of the river, which is subject to marked freshets and has a rather large volume of relatively cool water. There are also suitable pools in the river, where the salmon are willing to remain during the day.

For Cape Breton, the Cheticamp has the reputation of being an early river for salmon, since they are caught here early in the season more dependably than elsewhere, although not before June. The explanation is believed to be that, as a result of current action over the shoals around Cheticamp island and the rather pronounced embayment of the waters of the gulf north of the island into which the mixed water flows and into which the river empties, the water near the river mouth warms earlier than elsewhere on the west coast, arousing the salmon earlier from their winter torpidity. At the same time the high land from which the river arises is apt to have the end of the spring freshet from the melting of the winter's snow and ice delayed until the salmon have been aroused

and are actively moving about outside the river mouth.

But whatever may be the reasons, it is true that salmon are first taken on the coast in this embayment, and also the salmon angling for this river is characteristically early in the season as the following numbers reported officially as taken in the various months for the years from 1928 to 1935 clearly show

	June	July	August	September	October	Total
1928	55	18	20	28	0	121
1929	28	15	34	18	0	95
1930	90	36	8	12	0	146
1931	59	47	10	6	0	122
1932	29	22	16	0	0	62
1933	63	46	4	3	0	116
1934	0	2	1	0	0	3
1935	31	6	2	6	8	53
<hr/>						
Average	44	24	12	9	1	90

How far short these figures may be of the numbers actually taken, it is impossible to state. For the neighbouring Margaree river, there is evidence to indicate that perhaps only a quarter of the salmon taken are reported by the guardians, owing to the obvious impossibility of the guardian being in every part of his district steadily. It seems probable that the reporting of salmon for the Cheticamp is much more accurate, since the pools are to be reached only by travelling up the gorge from the second bridge,

while for the Margaree well-travelled roads run along a great length of the river where the most important pools are situated.

How fully the angling possibilities on the Cheticamp river have been utilized in the past is not clear. Since the pools are much less accessible than the majority of those on the neighbouring Margaree it is to be expected that when angling is good on the latter river the former is neglected. This may explain the fact that, while the numbers reported for the Margaree in the various months increase from June to September, those for the Cheticamp decrease, as shown. It may be, however, that, after the spring run, there is a relative failure of the salmon to enter until so late that angling is unsatisfactory. The matter needs investigation.

For the Margaree river it has been found very clearly during four seasons' investigation that angling is outstandingly dependent upon the occurrence of suitable freshets. For the periods (sometimes the greater part of a season) when suitable freshets are lacking, the only method that is seen for giving a prospect of good salmon angling is artificial control of river discharge in furnishing suitable freshets at the proper times. The experimental basis for economical application of water control toward this end has yet to be laid, but plans have been made for experiments which should provide this necessary basis. There is every reason for believing that salmon angling on the Cheticamp, which varies greatly from month to month and from season to season as shown in the above table, can be made dependable only by providing through water control suitable freshets when they are needed.

It seems likely that water control could be rather readily effected at the mouth of the river where it discharges into the gulf and that by this means the salmon could be induced to enter the rather extensive still-water region inside the mouth. If moderate water storage proved feasible some distance up the river, comparatively small freshets would doubtless be effective in causing the salmon to move from the still-water region up to the angling pools, of which there are said to be five. A somewhat detailed survey will be necessary to show what are the possibilities for water control in these two ways.

Angling in the Cheticamp river depends not only upon there being suitable freshets in the river, but also upon there being a large stock of Cheticamp salmon in the sea. This stock comes naturally from the salmon smolts that descend the river to the sea after spending two or three years in the river as parr. To ascertain the extent of the stock of young salmon in the river a survey should be made from the mouth up the river and its branches as far as the adult salmon can be supposed to ascend and as far as the young are to be found. If a reasonably large portion of the river system is found to be seeded with fry from natural spawning when examined just after the time of their emergence from the gravel, no planting of artificially hatched fry need be considered. While the stock could doubtless be increased by such planting in upper waters which the spawning fish do not reach, it is to be expected that those waters would be too difficult to reach for planting to be feasible. However, the results already evident in

an experiment on Forest Glen brook, a tributary of the Margaree river make it fairly certain that the most effective means for increasing the numbers of the smolts and therefore, of the stock of Cheticamp salmon in the sea will be to eliminate from the river the fish-eating birds, particularly the kingfishers and the mergansers. Our examinations of this river prove clearly that such birds have to depend upon young salmon and trout for food.

Other Rivers.

Young salmon are to be found also in the following rivers: On the west coast in McKenzie and Grand Anse (Pond) rivers, which empty into Plessent bay; on the east coast, in North, Middle and South Aspy rivers and Glasgow brook, which empty into Aspy bay, in Neil brook, which empties at Neil Harbour, and in Roper and Clyburn brooks which empty into North bay, Ingonish. So far as can be learned adult salmon ascend these streams only late in the season, so that they provide no angling under present conditions.

A theory has been generally accepted that there are more or less distinct races of early and late running salmon. Careful study of the pertinent facts for various rivers in eastern Canada has failed to corroborate this view, but shows clearly that early and late running of salmon are related to the physical conditions in the streams and in the sea near their mouths. A crucial experiment in the planting of Restigouche fry in the Apple river

at the head of the bay of Fundy proved that the Restigouche fish when exposed to the same conditions as Apple river salmon were indistinguishable from the latter in appearance and behaviour and, therefore, unlike their parents. For these reasons it is quite to be expected that, if the conditions in the streams of the Park that now have salmon only late in the season could be suitably altered, the salmon would ascend them early in the season and provide angling. Baddeck river, into which the salmon ordinarily enter only at the end of the season, had a run in late August in 1935 in accordance with an unusual freshet at that time.

Whether or not other streams in the Park than the Cheticamp river can be made to provide salmon angling is a matter for the future, when we will have more knowledge of the conditions that are necessary, and when there are available the results of experiments in trying to make streams suitable for the early entrance of salmon.

ATLANTIC SALMON AND TROUT INVESTIGATIONS

1938

No. IV. Salmon Poaching on the Margaree River.

By A. G. Huntsman

In investigating the Margaree salmon with a view to ensuring satisfactory angling and maintaining or increasing the stock, the possibility of poaching being a significant factor in reducing the numbers of the salmon had to be kept in mind. Some anglers maintain that it is the most important factor and that, if it were entirely prevented, there would be plenty of fish for anglers. No definite attempt has been made to investigate poaching since on the one hand it was not seen to be the most important factor and on the other hand its investigation was not believed to be our duty without a specific request from the Department of Fisheries, whose task it is to prevent poaching through a system of guardians under the local Inspector of Fisheries. This statement is, therefore, based merely on information that has come more or less incidentally.

Effect of Poaching on the Stock.

In all three years (1935 to 1937) the waters of the Margaree system generally have been found well seeded with native fry, so that poaching cannot be seen as a serious factor for the stock. When the salmon enter the river near spawning time and when the river is then reasonably high, as has been the case in the fall for each of the three years 1934 to 1936, there is little chance of poaching making much reduction in the numbers of the salmon before they have spawned. In the years with the autumn season dry it might be quite different.

Poaching may, however, have some effect on the stock and the effect may be locally very pronounced, as seemed rather definitely to be true on one branch of the river. Salt brook, a branch of Lake-o-Law brook, itself a branch of the North East Margaree river, is crossed by No. 5 Highway near its mouth and by a side road about two miles above. It passes through farming land in the vicinity of each road, and farm buildings are located beside it just below the upper road. In 1935 young salmon from the hatchery were planted in the brook near each road, but not elsewhere because of inaccessibility. On September 5th I examined the brook with a hand seine and was able to locate readily the planted young, which had spread very little from the points of planting. In addition to these, I found the larger, native salmon fry generally distributed along the brook from its mouth up as far as the farm buildings, but not beyond. Salmon parr were to be found all the way along from the mouth to perhaps a sixth of a mile above the upper road, where they gradually gave out, while trout continued to occur as far as I went. There was nothing in the character of the stream itself to explain the failure of the young salmon to occur as far up as examination was made. The facts suggest that no salmon were permitted to ascend farther than the farm buildings, and remains of an obstruction across the brook at this point gives support to this interpretation. If this is correct, a considerable stretch of the stream upward from this point has thus been largely sterilized for the production of young salmon, since the latter migrate upwards only to a limited extent.

Summer Poaching in the River.

During the summer the salmon are distributed in the various pools along the main river to the Forks and along the North East Margaree river, not only throughout the whole length of the settled valley, but also above the head of settlement up the gorge for many miles to the Last pool, where the river is formed by the junction of two brooks. The local people openly confess that formerly they poached salmon everywhere, spearing being a common method. While facts are not available, one gains the impression that there is little poaching now along the highway from the Forks to the North East Margaree settlement, which district has the principal tourist establishments and hence is more dependent upon anglers for a livelihood. Elsewhere the poaching seems to be graded in amount depending upon the extent of tourist influence. As definite evidence of its existence may be mentioned the finding of a long salmon spear near the Tingley pool above Frizzleton in the summer of 1935. A photograph of it is attached.

There were also rumours of pools being netted, and both guides and anglers using illegal methods in angling. The likelihood of such occurring is greater when the water is low and clear and the salmon readily seen, and when they fail to rise to a fly.

Poaching in the Estuary.

Previous to 1910 nets were regularly operated in the estuary. As partial recompense for the loss of this privilege, local people are engaged to operate a trap about a mile above the harbour mouth in the late summer and autumn for the capture of salmon for hatchery purposes. The five-mile long estuarial part of the river, through



which all the salmon must pass, runs through a rather rich valley, which is well settled, particularly on the north side. As the inhabitants receive very little benefit from salmon fishing and are largely out of touch and sympathy with the tourists, they constitute a potential source of poaching, with salmon readily available. The estuary is quite shallow and in its upper four miles narrow, so that poaching is not particularly difficult.

In the summer of 1935, a heavy freshet came about August 25th, and was followed by an abundance of salmon in the river. During the first week the salmon were practically all small (7 or 8 lb. in weight) and many of them were distinctly net-marked. An experienced guide (Duncan McKenzie) pronounced these marks to have been quite recently made and not attributable to the commercial nets on the coast, all of which had been taken up by August 15. I examined a number of these fish, am convinced that the marks had been made by nets, but cannot vouch for the time that had elapsed since they had been made. The fish were of the size that would be expected to escape by struggling through nets of the size of mesh (7") used in the commercial fishing. It seems probable that these fish which ascended the river during the first week after the freshet were from the estuary, and that the larger fish that came later were from the open sea, whence they would require a longer time to reach any given point in the river. In the sea, as shown by the catches of the coastal nets, there are no runs of salmon of particular sizes, but at all times and at all places there is a mixture of all sizes. That those in the estuary when the freshet occurred were practically all small seems explicable only on the basis of the larger ones having been removed. The size of

the fish that remained and the presence of net marks on them indicate that nets of the mesh of those used on the coast had removed the larger fish. There was plenty of time for this to be done to any lot of fish in the estuary during the dry period of several months' duration that preceded the freshet. Further evidence of illegal netting in 1935 was the definite report, investigated by Inspector Murphy, that fresh salmon were being peddled along the river some time after the close of commercial fishing and before there were more than a very few salmon above the head of tide.

In 1937, the salmon along the coast were to a considerable extent quite small, so much so indeed that fishermen remarked that they were losing a great many and that they would do better with nets of smaller mesh. The presence of many small salmon was demonstrated by the catches of the special nets of 4" mesh that were operated to take salmon for our tagging experiment. It so happened that about July 6 we were getting many salmon in these nets that were situated near the harbour mouth. During the night of July 6-7 there were very heavy showers over the estuary, following which much discoloured "land" water flowed out of the estuary. Fishing experiments on the coast of Scotland have shown that under such conditions the catch of coastal nets drops and the salmon enter the rivers. In this instance the catch of the nets did drop temporarily, but the angling catch was scarcely improved. This is explained by the fact that there was no freshet in the river to take them above the estuary. With no legal fishing in the estuary, it can merely be surmised that the very local downpour resulted in numbers of salmon entering the estuary but going no farther for the time being.

That this did happen is evidenced by the fact that the tagged salmon recaptured by anglers in the river were chiefly those tagged near the river mouth about July 6. As most of them were not recaptured until the freshets came after the middle of September, it must be presumed that they were in the estuary in the interim. The numbers of salmon of different lengths from those tagged from July 5 to 8, and recaptured by nets on the coast and anglers in the river respectively are as follows:

Length (cm.)	52-66	67	68	69	70	71	72	73	74	75	76	77-97
Tagged	10	4	2	2	5	7	8	8	10	6	6	24
Recap. Nets	-	-	-	-	-	-	-	1	2	-	2	9
Recap. Anglers	-	1	1	-	2	1	2	2	-	-	-	-

The marked difference in the sizes taken by the nets and anglers respectively is very evident. It is easily understood that the commercial nets would not be able to take the smaller salmon. But the anglers are quite as well able to take the larger salmon as the smaller, and yet they took only those of sizes that the nets could not well take. The deduction seems inevitable that the larger fish had been removed by nets. Since the evidence points to these salmon having been in the estuary from about July 7th on, the inference is that the larger fish were removed by nets of the mesh used commercially on the coast, and while the lot of salmon was in the estuary subsequent to July 7th.

A. G. Huntsman,

February 1, 1938.

ATLANTIC SALMON AND TROUT INVESTIGATIONS

Report No. V. The Trout of Trout Brook, Lake Ainslie, N. S.,
and Neighbouring Streams.

Summary Report, with Recommendations.

By A. G. Huntsman.

For generations the trout pool just inside the mouth of Trout brook has been famous for the very large numbers of trout to be found in it in summer. The neighbouring streams that empty into the east side and south end of lake Ainslie, namely Glenmore or Ronald brook, McKay brook, Head Lake brook, McMillan or McSween brook, and McInnis brook (see accompanying map), show a similar but less pronounced condition. On June 30, 1936, thousands of trout were congregated in Trout brook just inside its mouth, hundreds in McKay brook and tens in Glenmore brook.

They enter these brooks from the lake and are quite irregular in the time of their entrance, and in some seasons, e.g. 1935, they may be very few. In certain years (1923, 1934 and 1936) they have been in very poor condition and such numbers have been found to be more or less covered with fungus and dying as to provoke sharp complaint and a demand that a remedy be found. It is quite obvious that weak and moribund fish tend to repel rather than attract the angler. The angling is considered so important that during the season the Department maintains a guardian on McKay brook and both day and night guardians on Trout brook.

Dr. Leim investigated the condition in 1923, Dr. Corkill studied it throughout the season of 1935, and I myself gave it incidental attention in 1934, 1935, 1936 and 1937, particularly in 1936, when it was possible to follow through the course of a

heavy mortality. The cause of the condition seems to be sufficiently well established to warrant a definite attempt to apply remedial measures. This attempt should be considered experimental.

The Physical Background.

Lake Ainslie is irregular in shape and about twelve miles long. For its size it is quite shallow, since most of it is about 25 feet deep. It is shallower on the west side and to the north, Loch Ben, the bay at the northwest being only about 10 feet deep at most. The streams of this portion discharge relatively little water in the summer, and the larger ones, such as Black and Hay rivers have extensive stretches of sluggish water inside their mouths, so that their waters are comparatively warm.

As a contrast, the east side and south end of the lake are deeper, depths of as much as 34 feet being found. The streams, whose names have been given, and of which Trout brook is the chief, come from high land through gorges and discharge quite a considerable amount of water, which remains relatively cool in summer. The quiet water inside their mouths is not very extensive.

Because of the shallowness of lake Ainslie, its water is kept so well mixed by the wind as to be almost as warm at the bottom as at the top. The greater depth and the discharge of a larger amount of colder water along the east side and at the south end ensure cooler conditions here as the summer season develops than along the west side and at the north end.

Distribution and Movements of the Trout.

While trout are very generally distributed at one time or another throughout lake Ainslie and its tributary waters, there are pronounced local differences. The young are quite abundant in all the brooks and in the upper waters of the "rivers". While some of these young quite evidently remain in the streams throughout life, a considerable number reach the lake, but under what conditions we do not know. There seems no likelihood of there being any spawning in the lake.

It would seem that at least at certain times there is very good feeding for them in the lake. While popularly the silvery trout that enter the brooks from the lake in summer are considered to be from the sea, I have failed to get evidence to indicate that they have ever left the lake, and in average character they seem to differ from those found in the sea, the estuary and the river. Also these trout are reported to be in lake Ainslie during the winter and procurable through the ice. In the spring they first take the hook on the west side and at the north end of the lake where the water will become warm first. With development of the season the angling shifts to the south end. It is to be expected that, the bottom being approximately level, the trout will, as the lake warms up, move toward the south end where the water is somewhat deeper and where there is a greater discharge of brook water, which is colder than that of the lake. Finally, the trout are to be taken congregated in comparatively shallow water outside the bars that occur off the mouths of the brooks on the east side and at the south end of the lake, particularly Trout brook.

No trout whatever are to be found in summer elsewhere in the lake or in the still-water portions of the large streams emptying into its north western part. Silvery trout are then wholly confined to the lower portions of the brooks of the east side and south end and to the parts of the lake adjacent to their mouths.

Under certain conditions the trout enter from the lake into these cool brooks. Dr. Corkill states "Trout tend to enter the brook when the influence of the cold water of the brook may be traced for some distance out in the lake. A greater factor influencing the migration is a condition of flood water in the brook". A very considerable body of facts concerning the movements of salmon and trout create a strong belief that the entrance of trout into the brook will be found dependent upon marked influence of the brook out in the lake, changing rate of discharge of the brook and changing light conditions. There is evidence that under certain conditions these trout will ascend from the still water of the brook through rapids to upper pools, which will extend the area over which they may be caught.

Weakness and Death of the Trout.

As already stated, in some years quite a large proportion of the trout congregated in the still-water of the brooks, are not only quite sluggish but more or less covered with fungus, and many may die. The fungus, whose spores are practically omnipresent, attacks any fish that is sufficiently weak and injured, so that it is to be considered only as a secondary or tertiary cause of death. Practically all the trout have from few to many lice (Argulus) attached to the skin, chiefly near the fins. These lice feed upon the skin, and the portions of the surface that are so injured are

those where the fungus gets a start.

Neither when the trout are first taken in the spring nor when they first appear near the mouths of the brooks is there evidence of this condition. It appears only when summer conditions are well advanced. It definitely develops in the lake, since in 1936 trout in this state appeared practically simultaneously in all these brooks, the extreme ones being about seven miles apart. It lasts for a week or two, the badly affected trout either dying, recovering, being caught, or going back into the lake. In 1934, the condition appeared about July 10 and in 1936 about June 30. Apparently it does not occur a second time in the same season, but no very large numbers of trout enter the brook later in the summer.

The lice are to be found on trout in other parts of the Margaree system,- the South West Margaree river near its source at lake Ainslie, the main Margaree river at the head of tide, and the North East Margaree river at Island brooks. They are, however, on the trout in larger numbers at Trout brook and the neighbouring brooks.

The local conditions toward the head of lake Ainslie^s must be considered as in some way responsible for the weakness and death of trout there. Three possibilities are seen: (1) That the trout, when congregated at the south end of the shallow lake outside the mouths of the brooks, may be somewhat injured by a northerly storm, which would put the lake in commotion to the very bottom; (2) that the trout are somewhat weakened by exposure to high temperature, since the lake water warms to the bottom and will not cool at night like the water of a stream; and (3)

that the trout are primarily affected by large numbers of lice, which reach them from other fishes as they are congregated near the mouths of the brooks. Since the trout appear to be quite sluggish apart from heavy infestation with lice, it seems likely that the lice are merely associated with a primary condition of weakness. Special experiments are needed to determine to what extent each of the factors mentioned may affect the vitality of the fish.

Remedial Measures.

Since the condition develops in the lake, no means are apparent for preventing it so long as the trout remain in the lake. There is fair evidence that unless badly affected the trout improve in condition after entering the brook. Experiments with individual fish would be necessary to prove this. Certainly in 1937 there were no moribund or dead trout to be observed when they entered the brook in large numbers before the middle of June as a result of heavy local rains and the condition failed to develop that year. Since (1) the condition definitely develops in the lake, (2) it coincides with the onset of summer conditions in the lake, (3) the trout will not be exposed to those conditions if they enter the brook, and (4) the condition does not appear when the trout enter the brook sufficiently early as in 1937, it may be safely concluded that the remedy is to bring the trout into the brook early and keep them there.

To accomplish this, I make the following proposal. At the present time the water of Trout brook passes into the lake through three rather shallow channels so that it is diffused over a wide area without having any marked influence. Doubtless much of it

percolates through the gravel bars between the channels. Two of the channels should be closed and the remaining one narrowed so that there will be a very pronounced outflow extending well out into the lake. This could probably be accomplished most effectively by driving planking into the gravel and then banking the wall so made. If the level of the still-water of the brook be raised definitely above that of the water in the lake, and the head of water so produced made use of to vary the outflow at will, it would be possible to make artificial freshets similar to those that seem so effective in causing the trout to enter the brook. It would be a very simple matter to install a trap at the entrance so that the trout entering during any given period could be held for examination. At the same time the trout already in the brook would be prevented from returning to the lake.

While the above action seems essential if we are to make use of the work already done, it should not be thought that the matter is yet past the experimental stage. Also the results of such an experiment will need to be very accurately followed, if we are to properly benefit from it (1) in developing the best procedure for Trout brook itself, (2) in working out principles to be possibly applied to the neighbouring brooks, where conditions are more or less different, and (3) in laying the scientific basis for knowledge of trout movement, which may have very wide applications. For these reasons it is very necessary that a capable investigator should be in charge of the experiment.



S.W. Margaree River

Koch Ban

River

Glenmore Br.

Hay River

Trout Br.

McInnis Br.

McMillan Br.
Head Br.
S. Kay Br.



LAKE AINSLIE C.B.

ATLANTIC SALMON AND TROUT INVESTIGATIONS

1938

No. VI. Preliminary Report on a Survey of Streams to
Select one for Experimental Water Control in
Distributing Salmon.

By A. G. Huntsmen

The main object has been to find a stream, on which it would be possible without great expense to carry out experiments in controlling the discharge of water so as to bring up the salmon from the sea and distribute them suitably throughout the part of the stream where they would be caught by angling. It had to be kept in mind that the mode of action (from the physiological standpoint) of freshets on the salmon is uncertain, that there are very many possibilities in varying the water discharge, and that other factors than water discharge affect the movements of salmon and these must be taken into consideration.

It seemed possible to narrow down the group of streams to be examined by leaving out the large ones, of which control would be costly, and also those, whose salmon enter only late in the season, whatever may be the reason. On this basis, all the streams of New Brunswick, Prince Edward Island and the inner part of Nova Scotia, between Digby gut and the Margaree were omitted from further consideration.

This left the rivers from the Margaree around Cape Breton, along the outer coast of Nova Scotia and around its western extremity to the Ahnspolis river. The following were considered: Cheticamp, North (St. Ann), Salmon (Mira), Grand (Richmond Co.), Larry, Guysborough, Salmon (Guysborough Co.), Country Harbour, St. Mary, Gaspereau, Liscomb, Ecum Secum, Moser, Quoddy, Salmon (Port Dufferin), Sheet

Harbour, Tangier, Musquodoboit, Sackville, Ingram, Hubbards, East (Chester), Middle (Chester), Gold, Mushamush, Lehave, Petite, Medway, Mersey, Broad, Jordan, Roseway, Birchtown, Clyde, Barrington, Tusket, Salmon (Digby Co.), Lequille, Round Hill, and Annapolis.

I consulted Chief Supervisor Major D. H. Sutherland, and also Supervisor McLeod for Cape Breton island, Supervisor Fraser for the eastern Nova Scotia mainland and Supervisor Marshall for western Nova Scotia. Also I obtained detailed information from the following Inspectors, a number of whom assisted me in examining particular rivers: J. M. O'Toole (Victoria), R. F. Sampson (Richmond), M. M. Manson (Guysborough), E. G. Beaver (Halifax), A. C. Day (Halifax), S. J. Homans (Halifax), C. L. Manning (Lunenburg), W. J. Ness, (Lunenburg), J. P. Buchanan (Queens), H. G. Locke (Shelburne), A. S. Kenney (Shelburne), J. G. d'Entremont (Yarmouth), and B. Hunter (Annapolis).

The following rivers were particularly suggested as offering good possibilities: Cheticamp, North (St. Ann), St. Mary, Moser, Ingram, Lehave, Medway, Clyde, Barrington, Salmon (Digby Co.), and Round Hill. No river more suitable than some of these was found, so that we may limit present consideration to these.

The Cheticamp river (1) has salmon available from June on, (2) could be readily controlled as being almost wholly in the new National Park, (3) has its pools accessible only along one route permitting easy assessment of catch, (4) permits control of discharge from the estuary (not essential), and (5) has a net fishery to show the presence of salmon in the sea. However, it (1) is of considerable size and subject to very heavy freshets, and (2) is without accessible lakes that might be dammed for water control.

The North (St. Ann) river (1) has salmon from June on, (2) has its pools accessible only along one route (3) does not run through arable land, (4) has a good series of pools well distributed, (5) is of moderate size, and (6) has a net fishery in the sea. However, it (1) is remote and somewhat difficult of access, (2) has rather severe freshets, and (3) is without accessible lakes.

The St. Mary river (1) has salmon from May (or April) on, (2) has a good series of pools well distributed, (3) has a considerable number of accessible lakes, which might be dammed, and (4) has a net fishery all along the estuary to show the presence and movement of the salmon. However, it (1) is of considerable size and subject to rather marked freshets, (2) runs through cultivated land, which might involve claims for damages, (3) has its pools so freely accessible that assessment of the angling catch would be apt to be incomplete.

The Moser river (1) has salmon from May or June on, (2) has many accessible lakes, which might be dammed, (3) has driving dams on some of these that may make little construction necessary, (4) has pools accessible only along one route, (5) does not run through cultivated land, (6) is of moderate size and not subject to severe freshets, and (7) has a net fishery in the estuary.

The Ingram river (1) has salmon from April on, (2) has accessible lakes that can be dammed, (3) has old driving dams, that might be repaired, (4) has many well distributed pools, (5) has pools accessible along only one route, (6) does not run through cultivated land, (7) is of small size and little subject to freshets, and (8) has a net fishery in the estuary.

The Lahave river (1) has salmon from April on, (2) has accessible lakes, which can be dammed, (3) has an old dam at Sherbrooke lake that might be repaired, (4) has a fair number of pools well

distributed on the North branch, and (5) has a net fishery in the estuary. However, it (1) has its pools too freely accessible for complete assessment of catch, (2) runs through cultivated land, (3) is of considerable size, and (4) has mill dams along its course that might interfere with water control in producing freshets.

The "Petite Riviere" has dams for power purposes that effectively prevent its use for our purposes: one at tide head for water power mills; one up stream one mile for water power; one up stream three miles for water power for shingle mill; one at Crousetown for water power for sawing and planing; one at Conquerall Mills to serve two mills and to be used for hydroelectric power; and one at the foot of Hebb lake, being used for hydroelectric power.

The Medway river similarly has a power dam near Charleston at Salter's falls and is of considerable size, so that it is believed to be unsuitable.

The Clyde river (1) has salmon in June and July, (2) has somewhat accessible lakes, (3) had dams formerly, which might be put in again, (4) has a fair number of well distributed pools, and (5) is of moderate size. However, it (1) has pools that are too accessible for following the angling catch, (2) runs through cultivated land to some extent, and (3) has too few fish for successful net operation in the sea.

The Barrington river is not fished for salmon and is not a likely river, although with more knowledge it may prove to have possibilities.

The Salmon river of Digby county has no net fishery and few salmon and runs through cultivated land, so that its control would probably interfere with activities of the resident population.

The Round Hill river (Evan brook) (1) has salmon from April on, (2) has some reasonably accessible lakes that might be dammed, (3) has a fair number of well distributed pools, (4) has most of the pools accessible along only one route, (5) runs only in part through cultivated land, and (6) is of small size. However there is no net fishery in the estuary.

It developed during the survey that the demand for water control in the western part of Nova Scotia was based upon a need that is seen for storing the water so that there will be a river in dry seasons. This is a different thing from the matter of water storage for artificial freshets that will properly distribute the salmon. The two have been confused in the public mind owing to the common belief that the ascent of salmon depends only upon there being high enough water in the river. The power dams in western Nova Scotia are redistributing the water, not only in giving a steady flow throughout the year and thus tending to eliminate freshets, but also in diverting water from some rivers, e.g., the Jordan, which practically become dry in the summer. Undoubtedly dams will be very useful in giving the best distribution of water for the fish, but the control for hydroelectric power may be far from the best for the fish. For the experiments that are planned dams for driving logs make suitable conditions; but power dams are apt to make unsuitable conditions.

The three most promising rivers for our purpose are the Moser, the Ingram, and the Round Hill. The last is definitely inferior to the other two in a number of respects, - no net fishery, probability of interference with activities of residents, less satisfactory lakes, and present dams negligible. The Ingram would at first sight seem

superior to the Moser, but I believe it is not and for these reasons. The Moser has dams that are in operation and that are said by the owner to be available for our use after the logs are driven in the spring. The dams on the Ingram river would have to be rebuilt or extensively repaired. While the Moser has fewer pools than the Ingram, they should be adequate for our purpose and they are well placed, one a short distance above the head of tide, the second about a mile up, the third (salmon hold) three miles up, and the fourth (John Low still) a mile farther. There are also others. A rather important feature is the presence of "portage" roads for carting supplies to the lumber camps on the Moser river. On the Ingram river, there are only trails, and these far from level.

While water control would clearly be beneficial to most rivers, and while the proposed experiments could be conceivably tried on any one of them, I believe for the reasons given that the Moser river is most suitable for our work with its present limitations. The owner of the driving dams, Mr. D. J. Turner, states that he has at times operated these to provide salmon for the anglers. Persons living alongside the estuary state that not infrequently the salmon are at its head and do not ascend, through the river not being in condition.

When it appeared likely that the Moser river would be most suitable, Mr. H. M. Rogers, who has been studying estuaries, was asked to examine and report upon its estuary. His report is now available.

ATLANTIC SALMON AND TROUT INVESTIGATIONS

1938

Report No. VII. Preliminary Report on a Survey to Select Streams
for Experimental Production of Salmon Smolts.

By A. G. Huntsman.

It was desired to find two streams of suitable size and permanence, offering extreme contrast as regards rapidity and nature of bottom, so that the variables to be met with generally in the streams of the Maritime provinces would come into consideration. These should be near each other to permit simultaneous handling by one person, and preferably they should be readily accessible and centrally placed. It was thought that these might be found somewhere in the district from St. Andrews, N. B., to Antigonish county, N. S., and requests were made to both the Fish Culture service and the Inspectorate for suggestions.

Supervisor Catt proposed Crooked creek, Albert Co., N. B., and an unnamed stream about forty miles distant by road. The former was examined and proved to be moderately suitable as the rapid type, but without any suitable sluggish stream in the vicinity. As the other was considered a sluggish stream and no rapid stream was known in its vicinity, it was not visited.

Inspector Barton of Albert Co., N. B., proposed the Petitodias and Pollett rivers near their junction. These were examined, but proved too large, too difficult of control and not sufficiently contrasted.

Superintendent J. W. Heatley of the Cobequid Hatchery, proposed Burntland creek, Cumberland Co., N. S. as the sluggish stream, with various rapid, gravelled streams in the same district. This creek on examination proved to be sluggish, but not sufficiently permanent to warrant its use.

Superintendent K. G. Shillington of the Antigonish Hatchery failed to propose any streams in the area designated as desirable, but did suggest the Guysborough and Salmon rivers, which were studied during the summer by Dr. Richardson, and are in the area to which we finally gave particular attention as providing streams near together with the desired contrast in conditions.

Discussion of the matter with Mr. White made it probable that he would be able to find two streams near the edge of the high land that traverses Cumberland and Colchester counties. He made a search in these and in Albert county, but failed to find anything suitable. Later, we together examined conditions in Antigonish and Pictou counties with the same results. From our knowledge of Charlotte and Saint John counties, N. B., there seemed no prospect of finding there anything very suitable.

Mr. White accompanied me on a survey to locate a suitable stream for experiments in water control, which covered Nova Scotia from Guysborough county westward to Digby and Yarmouth. This permitted incidentally a search for streams suitable for the experiment in smolt production. The most promising region was Guysborough county and the adjacent eastern part of Halifax county, where there tends to be a mixture of the types of country that characterize the inner or northern and the outer or southern parts of the mainland of Nova Scotia.

The former is arable, with very few lakes, and for the most part with rapid, gravelled, spring-fed streams. The latter is quite rocky, with very many lakes, and the streams are lake-fed, often sluggish and with little or no gravel in evidence.

Since it seemed likely that the most suitable stream for the experiments in water control would prove to be the Moser river, which is in this region, at the eastern end of Halifax county, rather thorough consideration was given to the possibility of having the streams for experiments in smolt production on the same river system or close to it. This plan has manifest advantages in economy of operation, the two sets of experiments requiring to quite an extent the same background of knowledge and in some respects actually fitting into each other. To adopt this plan would seem to be the best course if as suitable streams for smolt production were found here as elsewhere.

This location is neither as central nor as accessible as had been desired and expected. It is, however, centrally placed in the length of Nova Scotia and in relation to the two principal types of country. It is on the highway that runs along the south shore of Nova Scotia, being 90 miles east of Halifax. From the central part of the Maritimes it is more easily reached via highways from New Glasgow and from Antigonish, the distances being around 80 and 70 miles respectively. The region, in which there is this mixture of the two types of country, extends from Guysborough to Musquodoboit. The upper parts of the Musquodoboit and St. Mary rivers, which, being well inland, are more accessible from the interior, the former from

Truro and the latter from New Glasgow and Antigonish, were examined but nothing very suitable was found.

Moser river extends inland about 18 miles, has a number of branches and over thirty lakes. Its drainage basin is shown by the Geological Survey maps (Nos. 37 and 38, 1895) to consist of a mixture of barrens, bogs, marshes, meadows and hardwood hills. None of it is under cultivation except a small area at the mouth, which tends to make experimental control easy and the experiments not liable to interference. Logging for pulp wood is being carried on and "portage" roads for carting supplies are maintained to reach the principal parts of the basin.

The river is representative of a large series of rivers that seem to be definitely deficient in smolt production and likely to be benefitted in this respect by fish cultural procedure of one or another sort. So far as can be judged from the numbers of salmon taken in and in relation to the neighbouring St. Mary river, the sea off the mouth of the Moser river could well support a much larger number of salmon, if the river provided the necessary number of smolts.

The main river was examined at different points to a distance inland of about seven miles, and as well five tributary streams were examined. In accordance with the presence of deep beds of relatively clean gravel, young salmon were found only in the North and East brooks. This illustrates the contrasted nature of the streams available and the possibilities for increased smolt production. Owing to the character of the coast and the relations of the various salmon rivers to the coastal waters, there is a sea fishery for

salmon related to the Moser river and separated from those fisheries related to the neighbouring salmon rivers, the Ecum Secum, four miles to the east and the Quoddy, five and a half miles to the west. This should permit a ready assessment of any beneficial effect on the commercial fishing with nets in the sea of any significant increase in smolt production in the Moser river that might be attempted. At the same time the Moser is becoming of fair importance for angling, and the effect of increased smolt production could be determined for that, and also by the trapping of the fish when they enter the river, which will probably be advisable for the experiments in water control, if this river should be selected for such.

While experiments in smolt production could be carried out on any one of a great many rivers, the Moser river seems to be the one to be preferred, if it should be selected for the experiments in water control.

ATLANTIC SALMON AND TROUT INVESTIGATIONS

1938

Report No. VIII. Report on Pomquet River, Antigonish
County, N. S.

By A. G. Huntsman.

The Fish and Game Protective Association of Antigonish requested the closing of Pomquet river to angling for three years with a view to improving trout fishing therein. The matter was referred by the Department of Fisheries to the Fisheries Research Board, suggesting that an examination be made of the river to determine whether a useful purpose would be served by such closure. At its meeting of April 9, 1938, the Executive Committee of the Board agreed that I should make this examination in the course of my work on salmon during the season and report thereon.

On July 30 I called upon Supervisor E. D. Fraser at Pictou and discussed the matter, he providing me with information and suitable maps of the region. At the conclusion of a survey in Nova Scotia in August for selection of streams for experimental purposes, I was able on the 30th of the month with the assistance of Mr. H. C. White, who had accompanied me on the survey, and who was of great help, to examine the river and its branches. Owing to the network of roads over its drainage basin, it was possible in the one day to reach eighteen different points on the river system from near the junction of the Pomquet river with the Black river to its headwaters. Incidentally local information was obtained from James Chisholm, Meadow Green; Colin Bowles, Caledonia Mills; Augustus McDonald, Vernal; and James McPherson, Springfield.

In the evening I called upon Superintendent K. C. Shillington of the Antigonish Hatchery at Fraser's Mills on the neighbouring South river, and he gave me information concerning the fish that have been planted in recent years in the Pomquet river. On the morning of the 31st, I called upon Inspector W. G. Harris of Antigonish, who gave me information concerning the river and undertook to provide me with details as to the dams that have been on the river in the last forty years and as to the salmon fishery. He took me to see Mr. Courtney Henry, the President of the local Fish and Game Protective Association that had requested the closing of the river.

Since only a very brief study of the river has been possible, and since we lack much of the pertinent knowledge that is basic to the problem, only an approximate answer can be given to the question raised as to the usefulness of closing the river to angling. There seems no possibility of securing data for accurate comparison of conditions now with what they are said to have been in a favourable period twenty or thirty years ago, either as to number of anglers, intensity of fishing, number of trout taken, numbers of trout and other forms in the waters, or the physical conditions in the waters. The angling which it is desired to improve is for sea-run trout, and, although some have maintained that such trout form a different race (that is, differ in behaviour, such difference being heritable) from the trout that remain in fresh-water streams and ponds throughout life, this has never been demonstrated. If the sea-going behaviour is heritable, the trout distributed from the Antigonish hatchery may or may not have this behaviour. Also we do not know at what stage the sea-run trout leave the river for the sea. In view of the import-

ance placed upon the sea-run trout in our Maritime provinces owing to their larger size and better condition, it would seem very desirable to arrange at an early date for a detailed study of the sea-going behaviour and for a precise experiment to determine whether or not it is heritable.

Physical Conditions

The main part of the river is about three miles long. Near the highway bridge where we examined it, it is freshet-swept and open, with rather rapid, shallow water, the bottom being of shingly stones and gravel. While there are no good pools here, the best pools of the river system are stated to be situated (1) at the lower end of this part, where it joins the Black river, (2) at its upper end, where it divides to form the Glenroy (west) and Meadow Green (east) branches, and (3) scattered along its course near the upper end. The water is quite clear.

A small tributary of this main part, entering a half-mile below its upper end, was examined where it crosses the road. It is for the most part a series of deep, still waters, chiefly with clay bottom, and fringed with alder bushes, and traverses meadow land. The water is dark brown and contains water plants, such as the yellow pond lily.

A tributary of the Glenroy branch, entering about half-a-mile above its lower end, was found to be somewhat similar, although not in meadow land, and with more stones and gravel. The Glenroy branch itself is over seven miles long, arising in small lakes on rather high land to the south. It has a falls about four miles up that is said to have a sheer drop of fifteen feet. Its lower part is freshet

swept with very abundant shingly gravel, frequent rapids, and fairly deep pools. Ascending, the gravel becomes replaced by stones. Above the falls there are more or less extensive still waters between slight rapids, and the bottom varies with stones, gravel, sand and mud.

The Meadow Green branch is about eight miles long, arising in a small lake to the south. It is freshet-swept and with gravel bottom for a considerable distance up from its mouth. About six miles up, near Caledonia Mills, it becomes rather sluggish, and contains an abundance of water plants, traversing meadows above this point, that were formerly flooded by a dam, forming a small lake.

The tributary streams vary greatly in character, having mud, gravel or stones on the bottom, and running through cleared land or through the forest. In the one stream, as that paralleling the Roman Valley highway just west of Caledonia Mills, there may be rather sudden transition from one type to another, as regards nature of the bottom, occurrence of rapids or still water, and presence or absence of fringing bushes and trees.

The temperature of the water varied greatly, and owing to the observations in the various places being made at different times in the day, proper comparison is not readily made. The readings made at the various places, as shown by the numbers in figure 1, were as follows.

	<u>Temperature</u>	<u>Time</u>
1. Main river at highway	15.3°C.	9.00 a.m.
2. Western tributary of main river	18.5°C.	10.20 a.m.
3. Lowest tributary (from west) of Glenroy branch	14.4°C.	10.45 a.m.
4. Glenroy branch at Glenroy	15.5°C.	11.15 a.m.
5. Lowest tributary (from west) of Meadow Green branch	16.4°C.	11.45 a.m.
6. Meadow Green branch at Meadow Green	19.8°C.	12.15 p.m.
7. Glenroy branch (at Roman Valley highway)	18.4°C.	2.10 p.m.
8. Meadow Green branch at Beaulieu	21.2°C.	2.45 p.m.
9. Tributary (from west) on Meadow Green branch above Beaulieu	17.1°C.	3.15 p.m.
10. Tributary of Meadow Green Branch - below Caledonia Mills	17.0°C.	3.35 p.m.
11. Meadow Green branch at Caledonia Mills	19.0°C.	3.50 p.m.
14. Head water of eastern tributary of Glenroy branch	16.2°C.	5.25 p.m.
15. Head water of highest tributary (from west) of Meadow Green branch	13.0°C.	5.40 p.m.
16. Highest tributary (from east) of Glenroy branch	15.5°C.	5.55 p.m.
17. Glenroy branch at Vernal	15.0°C.	6.30 p.m.

As the lakes of the system are few and quite small, flow has to be maintained largely by underground water, which is evident from the comparatively low temperature found even at midday. The sluggish stream in farm land (no. 2) and the Meadow Green branch (not its tributaries) form exceptions to this. The Meadow Green

branch seems to become distinctly warmer than the Glenroy branch. However, the lowest temperature of all was observed in the very head water of this branch, evidently fed by a cold spring.

There seem to have been about seven dams at various points on the system at the end of the last century, but now there are practically none. There is no evidence that these dams at any time held back very much water, the most considerable amount being at Caledonia Mills. The only falls impassible for fish seems to be that well up the Glenroy branch.

The flow of water in all parts of the system on August 30th was moderate but not large. We were informed that in the dry summer of 1937 the water stopped running at certain points in the lower part of the Meadow Green branch, although the pools remained.

Trout (*Salvelinus fontinalis*)

Trout of various sizes were found on August 30th, sometimes in considerable abundance, in the head waters of the system, and upper tributaries, ^{and} as well in the Glenroy branch to the lowest point examined, although in reduced numbers in the lower part (see figure 2.). In the head waters and in the Glenroy branch above the falls, no fish were found other than trout, and local information confirms this as being the condition that exists. This corresponds with what is usually found, - that trout occur in the upper waters, in spring-fed brooks and are absent from lowland, sluggish and warm parts, at least during the summer season. The relation seems definitely to be to the spring-fed and cool parts of the system, in which presumably successful spawning can occur.

According to Superintendent Shillington, trout of various sizes from the Antigonish Hatchery have in recent years (including the present one) been planted at various points along the main river, in the lower parts of both Glenroy and Meadow Green branches, and some in the upper waters of the Glenroy branch. It is not apparent that these plantings have determined the picture of the distribution of the trout as found by us, since where the main plantings were made we found either no trout (main river and Meadow Green branch) or very few (lower part of Glenroy branch). There is the possibility that the abundance of small trout in the upper waters of the Glenroy branch may be due to hatchery planting, although somewhat similar abundance in tributaries where no plantings were made, but where similar conditions obtain, leaves this in doubt.

None of the trout obtained were in the silvery sea-run condition, but all would be classed as speckled or brook trout. Inspector Harris states that now there are only a few speckled trout, whereas formerly they were throughout the whole river, mostly in May and June, and up to a pound or a pound and a half in weight. Our finding corroborate this statement as to the condition at the present time.

According to Inspector Harris, the silvery sea trout are taken by anglers (perhaps ten to fifteen in number) using worms as bait, in April, May and June in Pomquet harbour near the head of tide. From the first of June on, they are taken by anglers in the river, the best fishing being from the middle of June to the latter part of July, and in the pools of the main river. They are as much as three or four pounds in weight. Fifteen years ago one weighing six pounds was taken in a salmon net at Graham's head, east of the

mouth of the harbour. They are taken for several miles up both the Glenroy and Meadow Green branches of the river, in the latter branch as high up as Beuly. They have small heads (this indicates rapid growth) and well-developed reproductive organs. The harbour fishing for sea trout has been keeping up, having been good this year, fair last year, and good the year before, and it is just as good as it was twenty-five years ago. The river fishing for sea trout has been going down. These trout are as large as ever, but very few.

Salmon (*Salmo salar*)

In the survey of August 30 young salmon were found in small numbers in the freshet-swept, gravelled parts of the system, that is, in the main river, in the lower parts of both Glenroy and Meadow Green branches, and in the lower parts of certain tributaries (see figure 3). They occurred at Caledonia Mills, not in the Meadow Green branch, but in its tributary from the west, a brook so small that it could readily be straddled with a foot on each bank. They were taken, however, only in the lower gravelled portion of this brook. According to James Chisholm of Meadow Green, there are many salmon in the river in the fall, in October. Colin Bowles states that a few reach nearly to Caledonia Mills on the Meadow Green branch. James McPherson states that salmon sometimes get as far as the falls on the Glenroy branch.

No young salmon have been planted in the Pomquet river, Superintendent Shillington states; therefore, the distribution found on the survey represents the results of natural spawning and agrees with the reported distribution of the large fish at spawning time.

According to Inspector Harris, the salmon nets, which are of five-inch mesh, are located on the coast outside the mouth of the harbour, those presumably related to Pomquet river being shown in figure 4 together with the catches for the individual nets in 1937 and 1938. There have never been any salmon nets in the harbour or in the river, and none have been nearer than 1,000 yd. to the mouth of the harbour. Salmon enter the river only during October and November, and sometimes in early December, and their capture is forbidden. The spent fish come down in April, May and sometimes as late as June 10, and are inadvertently taken in the estuary and upper harbour in fishing for trout.

Gaspereux (*Pomolobus pseudoharengus*)

No gaspereux were found in the survey. The spawning fish ascend the river and its branches in the spring, reaching within half-a-mile of Caledonia Mills on the Meadow Green branch (Colin Bowles). They apparently do not reach the lake on this branch, and are definitely unable to reach the lakes on the Glenroy branch owing to the falls below Springfield. They must spawn in the still waters of the lower parts of the river system, and the young doubtless descend to the tidal water in the summer.

Inspector Harris states that twenty barrels or so of the adult fish are taken each year in spring in the harbour and about the same quantity in the river and its branches, making fifty barrels in all. They are taken with gill nets in the harbour and before

the year 1936 there was some netting in the river (not more than three nets). At the present time, netting in the river is prohibited, but the gasperesux can be taken anywhere with dip nets.

Smelt (*Osmerus mordax*)

Even more than the gasperesux, the smelt is related to the river for only a short season, ascending the river a short distance in spring to spawn. The extent of this is not likely to be known and no enquiry was made. According to Inspector Harris, smelt gill nets of 1-1/4" or 1-1/8" mesh, usually about 60 feet in length and numbering perhaps forty, are set in Pomquet harbour during the period from October to February 28, as they have been for very many years in the past. A net may take possibly three or four trout, about half-a-pound in weight during the course of the season.

Approximately 2,000 lb. of smelt were taken in 1937-38, and 3,000 lb. in 1936-37. Smelt enter Pomquet harbour during April and May and ascend the Pomquet river a short distance to spawn in its tributary brooks, returning to the sea in June.

Eel (*Anguilla rostrata*)

Eels doubtless occur somewhat generally throughout the river system unless above the falls on the Glenroy branch, where it is stated that no fish other than trout are taken. Inspector Harris informs me that there is no fishing for eels in the Pomquet River, but that they are to be found some five or six miles up, but the majority not more than 2½ miles from tidal water.

They are, however, comparatively rare, since only one was taken in our survey, and this corresponds with expectations from the position of this river, which is relatively remote from the Atlantic coast of Nova Scotia, which the elvers approach first coming from the ocean. The single eel taken was from the Meadow Green branch at Besuly (six miles or so above tidal water) and was nearly two feet in length. It was on a stretch of rapid water with stones sufficiently large to afford it protection from the light during the day. It is perhaps significant that no young salmon were found in this stretch, although using the same method of capture (the hand seine) I took a fair number of salmon fry and parr, on each of the similar rapids next above and next below.

Other Fishes

The suckers (Catostomus commersonii), although running up the stream in the spring to spawn, as do the gaspereaux and smelt, show a strong tendency to remain in the streams, particularly in the less rapid portions. Their fry and also somewhat older, but immature fish, were taken in the survey in the main river, in the Meadow Green branch and in some of their tributaries (see figure 5). At Meadow Green, one of a pound in weight was taken. The fry were taken as far up as Caledonia Mills.

Sticklebacks (Gasterosteus aculeatus) were taken only in the lower parts of the system (see figure 5). They were small or half grown, no large ones were found, and in no place were they numerous.

Minnows (Semotilus atromaculatus), both small and large, were taken in the lower parts of the system and also in the waters near Caledonia Mills of the Meadow Green branch. (see figure 5.). In the freshet-swept, gravelled and stony parts they were like the suckers and sticklebacks in occurring in the less rapid water, with the protection of weeds. They were also in deep pools frequented by young salmon, but kept more than did the latter to the protection of snags or roots.

Only one specimen of the killifish (Fundulus diaphanus) was taken, and that in the quiet water of the Meadow Green branch at Caledonia Mills. It is distinctly a fish of the still waters, and few of these were examined.

Fish-eating Birds

Mr. White found a kingfisher pellet along the main river at the highway bridge. This he states consisted of the bones of salmon fry and parr. Also he found two pellets on the Meadow Green branch at Meadow Green, one consisting of the bones of salmon fry and the other of sucker bones. This corresponds with the fish found locally in each case.

Inspector Harris states that mergansers have been particularly abundant in the district both this year and last year.

The broader, more open waters of the system contained very few fish, exhibiting the condition that is characteristic of streams frequented by fish-eating birds - the fish population so low that the birds cannot readily obtain food. The birds were not seen,

and had probably moved to better feeding grounds when the young were sufficiently developed, this being their habit.

Contrasted with this, the upper, narrow waters with the protection afforded by trees and bushes along and over the water, and weeds and large stones in the water, contained quite considerable numbers of fish. While in the lower broad open waters most of the seine hauls would yield no fish and two or three fish formed a good haul, in the upper, narrow, covered waters, blank hauls were few and the good hauls yielded from half-a-dozen to three dozen fish.

Interrelationships of the River Fishes

As yet we know too little of the relations between the various fishes to be able to speak with any confidence as to how they affect each other. The desired fishes that live in the river throughout the year are trout and salmon. As observed, the feeding individuals of these two species overlap only partly in their distribution. Between them they occupy almost the entire river system, and they come into competition to only a moderate extent. Of the other fishes, only the eel can be considered seriously detrimental to trout and salmon. Its numbers are few, and it is to be expected to be absent from the waters in which the trout are found, or at least less abundant than in other parts, such as the warmer, lower and more sluggish parts of the river system.

There is no indication that undesired species, such as suckers, sticklebacks and minnows, have replaced the trout or largely occupied the waters that they might use. At least the young of these species should serve, when available, as food for the trout, but their distri-

bution overlaps that of the trout to but a small extent. The young of the gasperesaux and smelt will probably also serve as food of trout, but in the harbour rather than in the river, since they seem likely to be only in the lower parts of the river and for a short time.

Changed Conditions

The basis for the request that the river be closed to improve the angling is the experience of poor angling in comparison with what obtained two or three decades ago. The natural changes in physical conditions are largely those of climate, and, while these have very definite effects on the abundance of the fish, there is no evidence of any long term decline. The salmon fisheries of eastern Nova Scotia show a decline in the last five years to about a third of what they were, due probably to the comparatively dry summers that occurred; but this is a short term phenomenon, which will doubtless shortly be reversed. In part, the reported scarcity of trout may be due to this same factor, and, in so far as this is the case, early automatic recovery is to be expected.

The very definite and progressive changes that have occurred in recent decades, and that will doubtless not readily be reversed, have to do with man's activities. The stopping of mills, the removal of dams, the abandonment of farms, and the closing of roads have affected principally the upper parts of the river system. What effect these may have had on the abundance of the fish, we as yet scarcely know. There are indications, however, that the reversion to natural conditions and the removal of obstruction in the streams

may result in less fish rather than in more fish. Probably there are more fish when the streams are open to the sun, which starts the food-chain in the water as on land, when the neighbouring land is kept fertile and changing by being cultivated, and when man merely by being more or less constantly along the streams or by active measures keeps them comparatively free from the enemies of fish. The forest stream may well be as comparatively barren of life as the ground beneath the trees.

The very definite change that is generally appreciated is the increased intensity in angling. Mr. Henry of Antigonish states that, where there was one person fishing thirty years ago, there are now a hundred and that very many come to the district from the neighbouring county of Pictou with its large centres of population. Whatever the proportion may be it is undoubtedly large. Although some back roads have become closed, the highways have been greatly improved to accommodate the ever increasing volume of motor traffic. It has become increasingly easier for anglers from distant points to reach fishing places close to the roads, and the lower parts of the Pomquet river system, where the sea-run trout are to be found, are particularly easy of access. With such greatly changed conditions there are no grounds for expectation that the river can be made to furnish for the individual angler what it did thirty years ago. It is merely a matter of making the best of the new situation. Doubling or even trebling the number of fish will not make a great difference. Those first on the spot will get the fish (unless made very difficult to catch) and the late comers will find fish only by taking the trouble to reach the less accessible waters, if any such containing fish are available.

Discussion of the Proposal

Partial or complete cessation of fishing may be expected to alter the fish population by permitting more to reach a large size or by permitting more to attain the spawning condition and so provide more young. Facts of the past are not available which would show what changes, if any, have taken place in the total numbers and proportionate numbers of the various sizes of trout in the Pomquet river. Also it would not seem to be feasible to obtain for this river the necessary facts for the future to show whether any given change in the regulation of the fishery was having the desired effect. Without such facts we are largely working in the dark and can never hope to have any assurance as to the effects of closing the river for fishing.

So far as the brook or speckled trout are concerned, the population at the present time consists principally of quite small fish. If their capture were stopped, there would undoubtedly be an increase in the number of large fish, but there would almost surely be fewer to be caught, since they are cannibals, and it is doubtful whether the number of pounds taken would be increased.

The sea-run trout are stated to be of as large size as formerly and the angling for them in the tidal waters to be as good as ever. This should mean not that they have decreased in numbers, but merely that with increased intensity of fishing, they are taken in larger proportion than previously where and when they are first available,

and that very, very few now reach the upper limit of their distribution in the river system where they arrive late. There may, however, well be a decrease in their numbers, but evidence to show this is lacking. There is no way to determine whether the number of these fish to reach suitable spawning grounds in the river is as great as, or less than formerly. We do not know whether or not they are required for spawning, since the trout that remain in the river, if not distinct racially, may be sufficient to provide all the young for which there is room and food in the upper waters. Whether or not the lower waters that we found devoid of young trout would be utilized if there were more spawning fish we do not know.

Recommendations

From the biological standpoint there is no objection to closing the Pomquet river to angling for three years, since there is at least some prospect of improvement to the stock of trout and this might be recognized by means of a survey even if satisfactory data could not be obtained to show whether or not there was any subsequent improvement in the angling. The situation does not, however, warrant any expectation that the stoppage of angling for sea-run trout in the river would have any particular effect. How feasible it is to prevent the capture of trout in the river and what the cost would be of assuring such

prevention, I do not know. The great accessibility of the various parts of the river makes the matter very difficult.

I would definitely recommend (1) the early investigation of the matter of the possible hereditary nature of the sea-going behaviour of trout, and (2) study through a period of years of the effects of various methods of regulating the trout fishery in a river system where it would be possible to obtain accurate data of the fish that are taken.

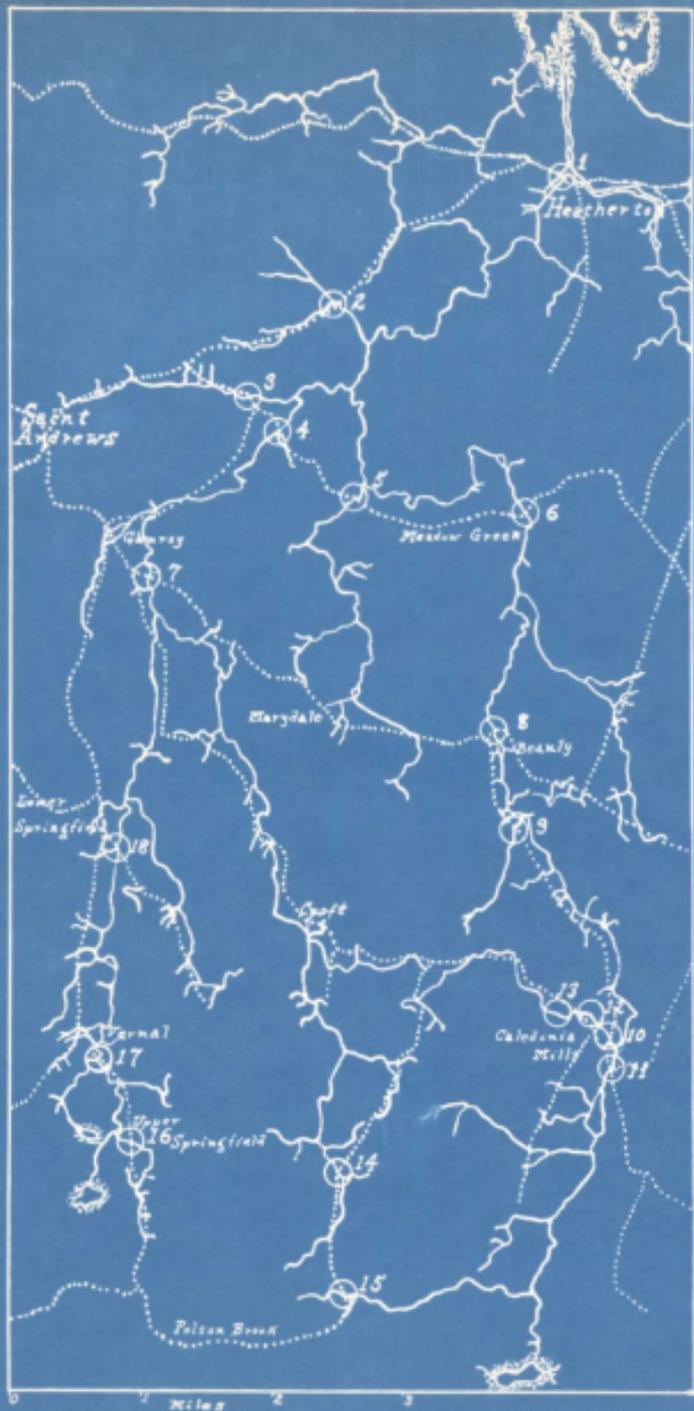


Figure 1. Comquist River System, showing place names, roads (dotted lines), and points where examinations were made (No. 1 to 18).

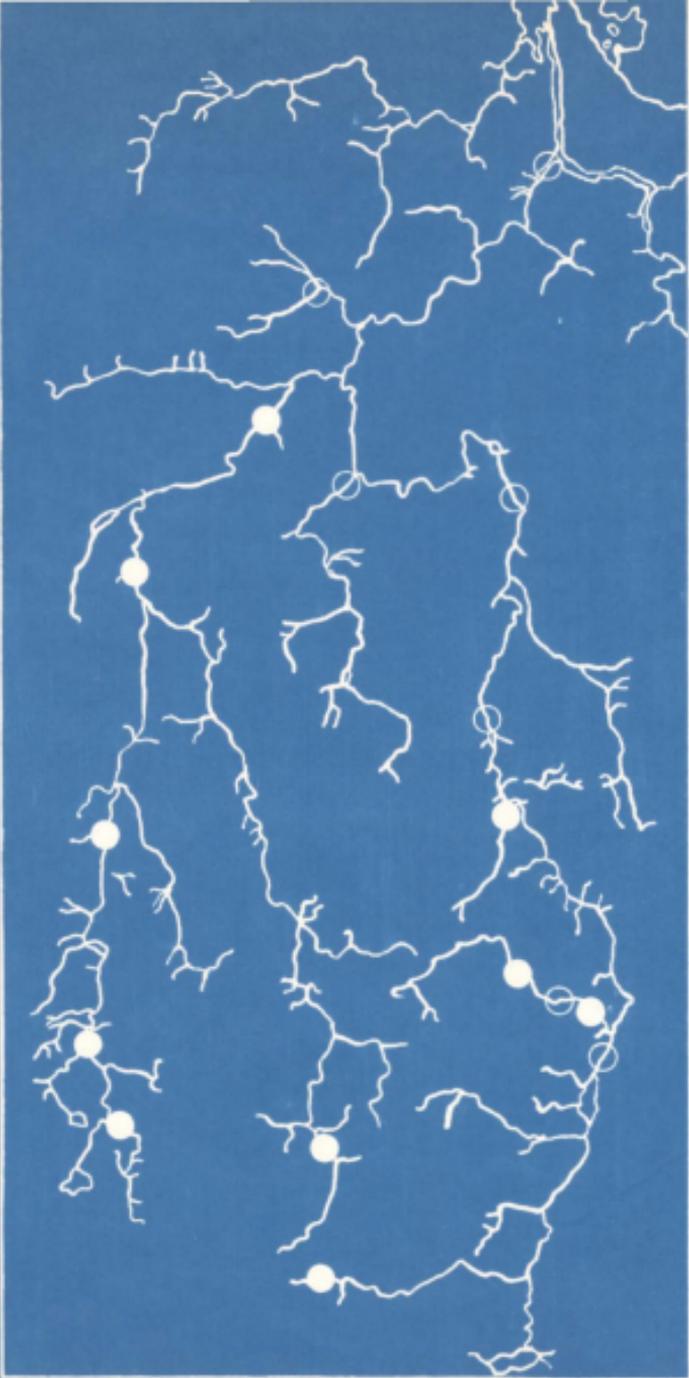


Figure 2. Pomquet River System, showing observed distribution of trout.

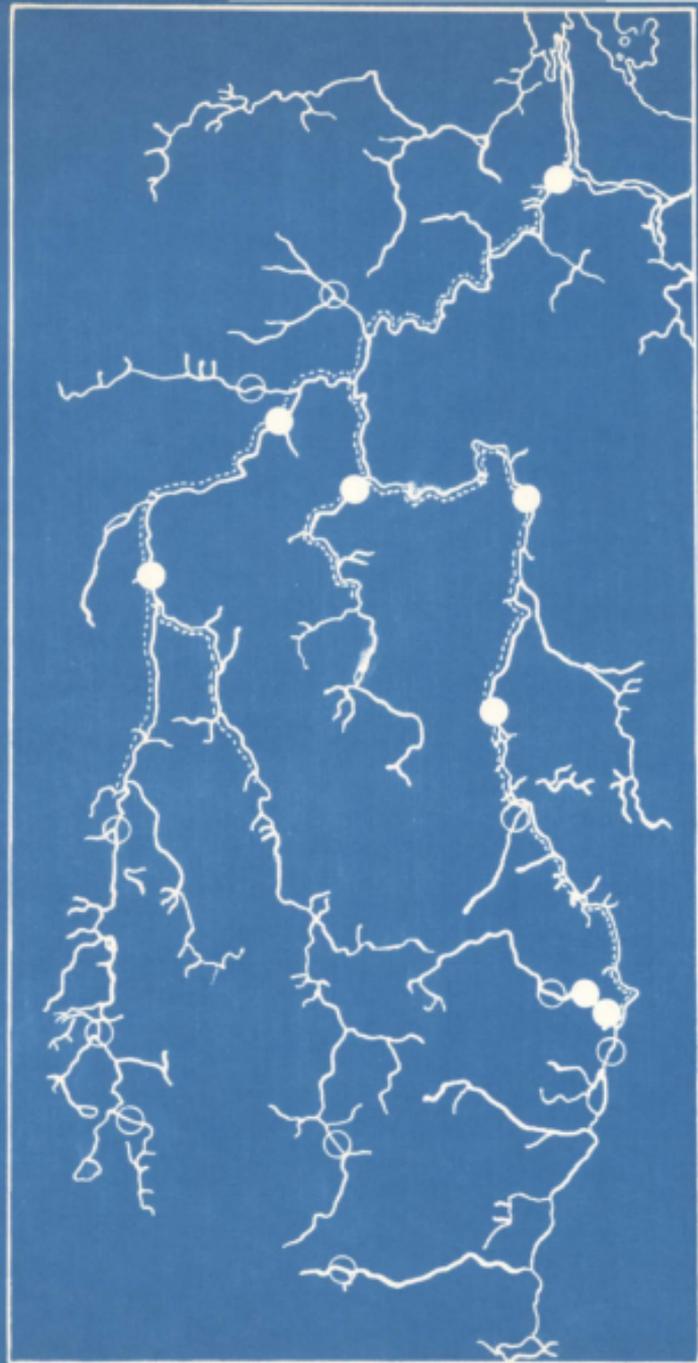


Figure 3. Ponguit River system, showing observed distribution of young salmon and inferred complete distribution.

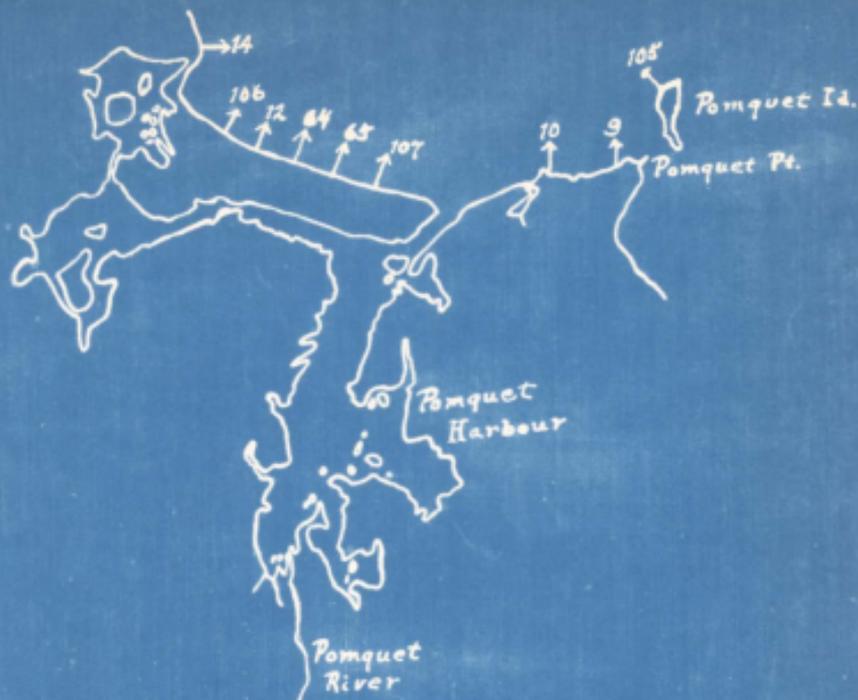


Fig. 4. Pomquet harbour and outside coast, with locations of salmon nets and their numbers. Below are details of the salmon catch for 1937 and 1938, in lb.

Booth No:	1937	1938
14	1,800	300
106	450	500
12	600	400
64	600	450
65	700	—
107	1,100	2,000
10	400	350
9		
	<hr/> 7,050	<hr/> 4,900

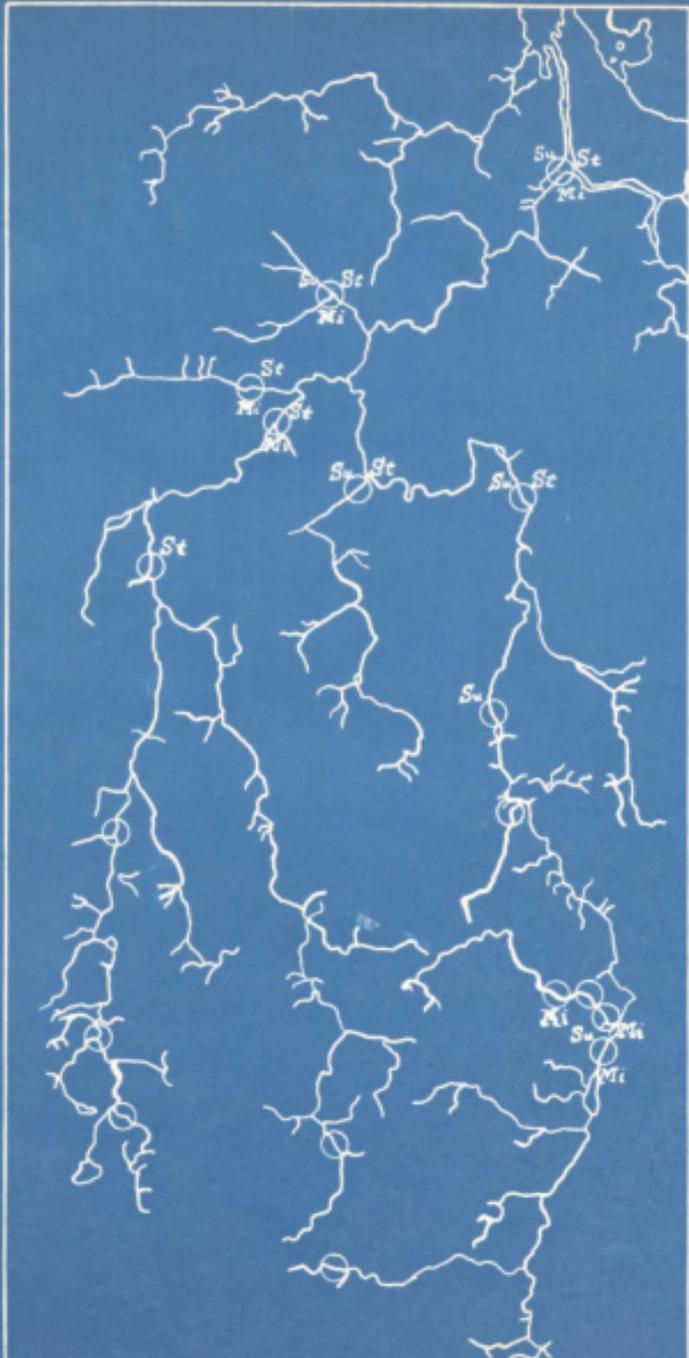


Figure 8. Pom-
quet River Sys-
tem, showing
observed dis-
tribution of sucker
(Su), stickleback
(St), and minnow
(Mi).

