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The stock status of Atlantic salmon (*Salmo salar* L.) in Big Brook (Michaels River), Labrador, 1997

by

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Abstract

The status of the Atlantic salmon (*Salmo salar* L.) stock in Big Brook (also known as Michaels River), Labrador in 1997 was determined using counting fence data, samples collected in the angling fishery, and records of angling mortalities. The stock assessment was conducted in relation to reduced Atlantic salmon commercial fisheries in Labrador due to quota restrictions and the five-year moratorium on the commercial Atlantic salmon fishery in insular Newfoundland, which entered the sixth year in 1997. Also, this is the first assessment of a northern Labrador salmon stock. In 1997, total returns to Big Brook adjusted for the early removal of counting fence were 530 small and 104 large salmon. The number of spawners adjusted for angling mortalities were 454 small and 102 large salmon. The egg deposition required for conservation for Big Brook is 5,294,160 eggs using information from a river survey conducted by Murphy (1973). In 1997, the proportion achieved of the conservation egg requirements was very low, probably less than 30%.

Résumé

L'état du stock de saumon atlantique (*Salmo salar* L.) du ruisseau Big (aussi connu sous le nom de rivière Michaels), au Labrador, en 1997 a été déterminé d'après des données recueillies à une barrière de dénombrement, des échantillons des prises sportives et des renseignements sur la mortalité par pêche sportive. L'évaluation du stock a été effectué dans le contexte d'une pêche commerciale réduite du saumon atlantique au Labrador résultant des limites de quotas et du moratoire de cinq ans de la pêche commerciale du saumon atlantique à Terre-Neuve, qui en est à sa sixième année en 1997. C'est en outre la première évaluation d'un stock de saumon du nord du Labrador. En 1997, les remontés totales dans le ruisseau Big, tenant compte de l'enlèvement précoce de la barrière de dénombrement, se situaient à 530 petits saumons et 104 gros. Le nombre de géniteurs, corrigé de la mortalité par pêche sportive, était de 454 petits et 102 gros saumons. La ponte requise pour satisfaire aux besoins de conservation dans le ruisseau Big se chiffre à 5 294 160 œufs, d'après l'information recueillie au cours d'un relevé du cours d'eau effectué par Murphy (1973). En 1997, ces besoins ont été comblés dans une très faible proportion, probablement inférieure à 30 %.

INTRODUCTION

Big Brook (also known as Michaels River) is located in northern Labrador in Salmon Fishing Area 1 (SFA 1) and flows into Byron Bay near Red Rock Point just to the north of Cape Rouge at 54^0 41' N 57^0 47' W (Anderson 1985) (Fig. 1). The mouth of the river is protected by a high, sandy beach which forms a lagoon that is approximately 1.5 km long. Big Brook has a drainage area of 793 km^2 and a total stream length (including tributaries) of 200 km (Murphy 1973). There is one sports fishing camp on the river which entertains guests for varying periods of time annually and also the river is periodically visited by fly-in anglers. The entire watershed is accessible to migrating fish. Anadromous Atlantic salmon (*Salmo salar* L.), Arctic charr (*Salvelinus alpinus* L.), and both sea-run and resident brook trout (*Salmo trutta* L.) have been reported in the system (Anderson 1985).

In 1992, several major changes were introduced to the management of Atlantic salmon in Newfoundland and Labrador. A five-year moratorium was placed on commercial salmon fishing in the island portion of the province, for the Labrador commercial fishery the quotas first introduced in 1990 were reduced, and a voluntary retirement of commercial salmon licences was instituted for all of the province. In the angling fishery, in 1992 and 1993, a quota on the number of fish that could be retained was introduced in each SFA. The quota was assigned for an entire SFA and was not administered on an individual river basis. Only hook-and-release fishing was permitted after the quota was caught. In 1994, quotas for the angling fishery were eliminated. In place of quotas, for Labrador, the season bag limit for retained salmon was lowered from eight to six fish, only two of which could be large salmon. In 1995 and 1996, the season bag limit for the angling fishery remained at six fish but only one large salmon could be retained. Also in 1997, the commercial salmon quota for SFA 1 was set at 14.5 tonnes (t), similar to 1996. The West Greenland commercial salmon fishery closed for the 1993 and 1994 fishing seasons but was open again in 1995-97. Some Big Brook multi-sea winter salmon may be caught in the Greenland fishery similar to other Labrador stocks (Pratt et al. 1974).

The main focus of this project, conducted in collaboration with Atlantic Sports Fishing Inc. (Mr. W. Bennett), was to assess the population of salmon in a northern Labrador river within the background of reduced commercial fisheries. This is the first counting facility to be installed in a river in SFA 1, in recent years. Thus, Big Brook is one of the few Atlantic salmon rivers in Labrador from which quantitative data are available. In this paper, the stock status of the Big Brook salmon population in 1997 is examined.

METHODS

Angling and commercial fisheries data

Catch and effort data from the angling fishery in Big Brook were collected by Department of Fisheries and Oceans (DFO) enforcement staff in conjunction with angling reports submitted by fishing camp operators and processed by DFO Science Branch. DFO angling statistics for Big Brook include only salmon caught at the fish camp and does not include non-camp anglers which is assumed to be minimal. In 1997, angling catches for Big Brook were assumed to have occurred all below the counting fence where the majority of salmon were reported to have been caught (pers. comm. Mr. E. White). Commercial catch data were collected by DFO enforcement staff from fish plant landing slips and estimates of local consumption and were processed by DFO Statistics and Informatics Branch. Procedures for the collection and compilation of commercial and angling fishery data are described by Ash and O'Connell (1987).

In 1994, a new system, viz. the License Stub Return System was initiated for collecting angling statistics in Newfoundland and Labrador. It is based on attaching to the provincial angling licence a detachable stub upon which the angler can record details on where fished, when, and the numbers of salmon caught and released (O'Connell et al. 1998). Because of concerns over a lack of comparability of DFO angling statistics and the Stub System data, DFO data will continue to be used for Labrador.

Adult salmon counts

COUNTING TECHNIQUES

Between June 27 and July 5, 1997 a counting fence was constructed approximately 14 km upstream from the mouth of the river (Fig. 2). Upstream migrating adult salmon were enumerated from July 6 to August 30. The counting fence consisted of 35 sections (each 3 m long) which were installed according to the description in Anderson and McDonald (1978). The fence was constructed of conduit and channel iron, supported by steel posts and 5 cm x 15 cm wooden supports similar to other portable counting fences used in Newfoundland and Labrador. In order to facilitate boat passage, a wooden 1 m x 2.5 m pier was positioned in the main channel of the river with a sliding gate that could be opened to allow for boat passage. The fence was operated with every second conduit in place except two sections on both sides of the boat passage where every conduit was used.

Once the counting fence was completely installed enumeration was done by manually releasing and counting salmon through a steel and conduit fish trap. Distinction between large and small salmon was made by comparison to a known measure placed in the bottom of the fish trap. Large salmon were defined as those salmon with a fork length

equal to or greater than 63 cm and small salmon are those less than 63 cm.

ADJUSTED COUNTS

In 1997, the counting fence at Michael River operated from 6-13 of July and 20 July to 30 August. The counting fence was non-operational during the period of July 14-19 due to a high water event. During this non-operational period, salmon counts were adjusted based on average counts from two days prior to and two days after the non-operational period.

Unrecorded Mortalities

Complete understanding of all life history factors including mortalities is an important part of any stock assessment (Ricker 1975). Mortalities due to fishing, but not recorded as part of the catch statistics, have been defined as non-catch fishing mortalities by Anon. (MS 1980) and Ricker (1976). Non-catch fishing mortalities could include fish killed due to illegal and legal fishing activities. Legal fishing mortalities for salmon in Labrador include catches in native food, angling, and commercial fisheries.

Another potential source of non-catch fishing mortalities is from hook and release angling. Booth et al. (1995) and Brobbel et al (1996) have studied the effects of hook & release angling on the delayed mortality of 'bright' or returning salmon. They have indicated that the length of time spent in fresh water and water temperature at time of exhaustive exercise such as angling, have an effect on mortality rates. Fish that have spent longer periods of time in freshwater appear to have a lower mortality rate than those that have recently entered freshwater. Also, higher water temperatures increased the mortality rate. They concluded that mortality due to catch & release in a controlled environment was about 12%, although the sample size was small (n=25). A comparison between maximum water temperatures and numbers of salmon hooked and released for Big Brook have indicated that maximum water temperatures were low during fishing activities. Therefore, we have included an estimate of 10% mortality of caught and released fish in our calculations of total river returns and spawning escapement.

Exploitation rates

Exploitation rates for the angling fishery were determined as the number of salmon reported to have been retained by the angling fishery divided by the total number of salmon entering the river adjusted for salmon caught below the enumeration facility.

Biological characteristics

Biological characteristics of adult Atlantic salmon were obtained by taking samples of angling catches. These data were collected at the Big Brook (Michaels River) fishing

lodge in 1997 with the assistance of fishing guides after instruction by DFO technical staff. Information on fork length, weight, sex, and scales were collected. Fecundity values used for Big Brook salmon were from Sand Hill River the only river in Labrador where fecundity has been measured. Fecundity is determined as number of eggs per kg of whole weight. The ovaries were collected from the angling fishery on Sand Hill River in 1994 and 1995 and indicate that the mean total egg count per small salmon was 3,808 eggs (n=96) and 5,096 eggs (n=23) per large salmon. Fecundity for small salmon was 1,998 eggs per kg and for large salmon 1,094 eggs per kg.

Smolt samples were collected by angling. They were sampled for fork length to the nearest mm, whole weight to nearest 0.1 kg, sex determined visually by examination of internal organs and scales removed from the standard location as recommended by Shearer (1992).

Total river returns, spawning escapement, and egg deposition

TOTAL RIVER RETURNS

Total river returns (TRR) were calculated separately for small and large salmon as follows:

$$TRR = RC_b + C + HRM_b$$

where,

RC_b = angling catch below counting fence
C = count of fish at counting fence
HRM_b = 0.1 * catch & release fish below counting fence.

SPAWNING ESCAPEMENT

Spawning escapement (SE) was calculated as the difference between the number of fish released from the counting fence (FR) and the angling catch retained above the fence (RC_a) minus 10% of catch and release fish above the counting fence.

$$SE = (FR - RC_a) - HRM_a$$

EGG DEPOSITION

Egg deposition (ED) was calculated separately for small and large salmon and then summed as follows:

$$ED = SE \times PF \times RF \times MW$$

where,

SE = number of spawners
PF = proportion of females
RF = relative fecundity (No. of eggs per kg)
MW = mean weight of females

Accessible parr-rearing habitat

The entire watershed of Big Brook is accessible to migrating Atlantic salmon (Anderson 1985). Big Brook has a drainage area of 793 km^2 (Murphy 1973) which for descriptive purposes was divided into three sections by Peet (1971). The first section, from the mouth of the river to Lake Michael, includes the lower 40 km of the river. Channel widths in this section range from 25 to 50 m, and bottom substrates vary among boulder, rubble, and gravel. There are four tributaries with ideal juvenile salmon habitat entering the river in this section. The second section referred to by Peet (1971) stretches km 40 to km 53 and is made up of Lake Michael and its tributaries. None of the tributaries of Lake Michael were surveyed by Murphy (1973) and are not included in the habitat estimate. The river above Lake Michael, the third section referred to by Peet (1971) averages 18 m in width and meanders over flat, barren terrain. None of the small tributaries were surveyed in this section either; although, the main stem is included in habitat estimates (Fig. 2). From his survey in 1972, Murphy (1973) recorded a total of 22,059 rearing units on the main stem and lower tributaries (Anderson 1985). Lake Michael is 2,589 hectares but is not included in parr-rearing habitat as it is unknown if parr rear in lake habitat in SFA 1 rivers. The tributaries and ponds draining into and above Lake Michael on the main stem are not included in the estimate of parr-rearing habitat.

Conservation Requirements

The minimum egg deposition requirement for conservation in Big Brook (SFA 1) was derived using egg deposition rates of 240 eggs per 100 m^2 for fluvial parr rearing habitat (Elson 1957; 1975). Although these values may be habitat and river specific for river systems from which they were derived, they represent the best available data and are used as a general baseline for determining stock status of Big Brook. Biological characteristics used to calculate the conservation requirements in terms of eggs are from data collected in 1997.

Environmental data

During field operations, environmental data were collected at the fence site. Water temperatures were recorded by Hugrun thermograph set at 1 m from the surface at the fence site. Cloud cover, relative water levels, weather conditions and air temperatures were also recorded.

RESULTS

Angling and commercial fisheries data

In 1997, the quota for the commercial fishery in SFA 1 was 14.5 t and 35.5 t for SFA 2. The migration of SFA 1 salmon is largely unknown; however, it is generally thought that SFA 1 salmon overwinter in the Labrador Sea and return to the river from the south along the coast of Labrador. There was no commercial fishing gear set in the immediate vicinity of Big Brook in 1997 so any commercial harvests of Big Brock salmon would have had to have taken place elsewhere in Labrador or the previous year at Greenland.

The DFO angling catch statistics for Labrador are largely based on data collected by angling camps. In SFA 1, DFO data indicated a retained catch of 73 small salmon and 2 large salmon. Also, 32 small salmon and 1 large salmon were hooked and released (Table 1). Almost all of the fishing effort for this system comes from the fishing lodge at the mouth of the river. Some effort does occur from fishers outside these lodges who fish the upper part of Big Brook. All of the salmon angled in 1997 are assumed to be below the counting fence. In 1997, the License Stub Return System indicated that the angling salmon fishery in Big Brook had a retained catch of 16 small salmon and 2 large salmon. There were also 16 small salmon and 0 large salmon released. Due to potential errors in use of the License Stub Return System catches for Labrador it is recommended that DFO statistics be used (O'Connell et al. 1998).

In 1997, a total of 388 small salmon and 84 large salmon was counted upstream through the adult fence between July 6 and August 30 (Table 2, Fig. 3). This is an underestimate of the actual number of salmon entering Big Brook due to the possibility of salmon moving upstream after the fence was removed on August 30 and due to high water damaging the fence during the period of July 14-19. During the highwater event, a small portion of the fence tipped over leaving a hole through which salmon could pass without going through the trap. The count was adjusted for salmon moving upstream during this time by adding in the average counts of small and large salmon for two days prior to July 14 and two days after July 19. The adjustment adds 66 small salmon and 18 large salmon to the count for a total of 454 small salmon and 102 large salmon. Comparison can also be made to counts at Sand Hill River for July 14-19 in years 1970-73 and 1994-96. During the non-operational time of the Big Brook counting fence 18.0% of the total number of small salmon and 14.3% of the total number of large salmon would have been counted at Sand Hill River. If the Sand Hill River information is used to adjust the Big Brook count then 85 small salmon and 14 large salmon would be added to the counts for a total of 473 small and 98 large salmon. Also, there is some concern for the number of salmon that may have entered the river after the fence was removed on August 30. At

Sand Hill River, the average number of salmon entering after August 30 is 3.5% of the small and 5.1% of the large salmon. While important overall to the spawning escapement into the river, salmon entering after August 30 are probably low in number compared to the magnitude of returns occurring in July-August period. In 1997, the total returns to Big Brook after adjustment for salmon angled below the counting fence and for the non-operational period was 530 small and 104 large salmon.

Exploitation rates

The DFO statistics for the catch in the angling fishery, above and below the fence, was 73 small and 2 large salmon retained and 32 small and 1 large salmon hooked and released. In 1997, exploitation rates in the angling fishery were 13.8% for small retained salmon and 1.9% for large retained salmon as follows:

Year	Small retained	Small released	Large retained	Large released
1997 (DFO)	13.8	6.0	1.9	1.0

Biological Sampling

In 1997, 71 adult salmon were sampled from the angling fishery. Mean fork length (FL) of the grilse was 53.9 cm (SD=2.4, n=66) and mean whole weight (WW) was 1.76 kg (SD=0.29, n=66) (Table 3). Mean fork length of two-sea winter virgin salmon was 71.7 cm (SD=3.5, n=3) and mean WW was 3.93 kg (SD=0.3, n=3). Mean WW and FL of a single repeat spawner was 1.5 kg (n=1) and 57.8 cm (n=1), respectively.

Freshwater (river) age information is available from 67 salmon and is presented along with other biological characteristics information in Table 3. It indicates that 87% of the adults have a river age of 5 and 6 years. The modal smolt age is 6 years.

Thirty-seven smolt samples were collected from the lower section of the system in 1997. The mean length was 185.0 mm and mean weight was 56.5 gm (Table 4). River age information is presented in Table 4.

The percentage of females salmon sampled from the angling fishery in 1997 was 17% (n=66) for small salmon. The large salmon were 100% female (Table 3). The mean weight for female small salmon was 1.72 kg (SD=0.41, n=11) and 3.93 kg for large (SD=0.32,n=3).

Accessible parr-rearing habitat

Murphy's estimate of 22,059 parr-rearing units for Big Brook is a minimum value as only the rearing areas of tributaries in the lower section of the river were included and pond area was not considered. Another source of error is that all linear distances were measured using 1:250,000 scale maps. Comparison of habitat measured on 1:50,000 scale maps versus the 1:250,000 scale maps indicates that some habitat will be overlooked.

Conservation requirements

The estimated conservation requirements in eggs for Big Brook are as follows:

Fluvial Rearing Units:	22,059 (100 m^2)
Lacustrine Rearing Area:	Not included

Egg Deposition Requirements for Conservation: Fluvial = 240 eggs per rearing unit

Egg Deposition Required for Conservation

= Conservation egg requirements * Accessible parr rearing area

= 240 * 22,059

= 5,294,160 eggs

Total river returns, spawning escapement, and egg deposition

In 1997, the total river returns to Big Brook were estimated at 530 small and 104 large salmon after correction for a non-operational period during July 14-19 inclusive and mortalities in the angling fishery below the fence. The retained angling catch below the counting fence in 1997 was 73 small and 2 large salmon. The spawning escapement was 454 small and 102 large salmon corrected for angling and hook and release mortalities.

Egg deposition in 1997 was as follows:

Fecundity:		Small salmon	1,998 eggs/kg
		Large salmon	1,094 eggs/kg
Small	- number in 1997		454
	- % female		17.0
	- mean weight (kg)		1.72
Large	- number		102
	- % female		100.0
	- mean weight (kg)		3.93

Egg deposition = (Small* % female* mean wt * fecundity)+(Large * % female * mean wt * fecundity)
= (454*0.170*1.72*1,998) + (102*1.0*3.93*1,094)
= 703,775 eggs or 13.3% of conservation requirements

Egg deposition was estimated at 703,775 eggs or 13.3% of the conservation requirements. This is considered to be a minimum value due to several possible sources of error. First, although adjusted for, there was a six-day period of non-operation of the counting fence and potential returns after fence removal. Second, sample sizes used to derive biological characteristics are low, especially for large salmon. Third, is the use of 1;250,000 scale charts for habitat measurements. However, the percent of conservation requirements achieved is probably still less than 30%.

Environmental data

Figure 4 shows the daily mean water temperatures at the fence on Big Brook. Also shown are the maximum and minimum water temperatures from the fence site compared to the number of hooked and released small and large salmon for the river system in 1997. It would appear from the relatively cool water and low overall number of hooked and released salmon that mortalities are low compared to the population size.

DISCUSSION

The conservation requirement of 5,294,160 eggs is the first established for a northern Labrador river continuing a process that began in 1990 (O'Connell and Dempson 1991). The calculated percentage of 13.3% of the conservation requirement achieved is very low. It is possible that in spite of adjusting the total returns for salmon entering during the non-operation of the counting fence that more salmon entered than were accounted for. If so, then the spawning escapement and percent of conservation requirement achieved would be an underestimate. However, given the low numbers of salmon entering otherwise would suggest that even if the actual number was underestimated, the percent conservation requirement achieved is still very low and is probably less than 30%. Because of the low returns in 1997 and the uncertainty in the estimates, it is recommended that the assessment be repeated in 1998. Also assessments should be conducted on other northern Labrador rivers. Some consideration should be given to verifying and if necessary refining the conservation requirements of 240 eggs per 100 m^2 for Labrador rivers. The standard conservation requirement for Atlantic Coast salmon was derived from rivers in the southern range of salmon distribution (Chaput MS 1997) and may be different for rivers in Labrador.

Murphy (1973) considers that Big Brook is capable of producing circa. 6600 salmon annually, some of which would have been taken in the commercial fishery. Although in recent years as a result of reductions in commercial fishing effort, a higher proportion of the total population would be found in freshwater. Another way of examining stock status for Big Brook is to compare the numbers of salmon returning to the river versus those at Sand Hill River. When adjusted for the difference in drainage area (Big Brook - 793 km^2, Sand Hill - 1276 km^2) gives 1,718 small and 353 large salmon for Big Brook if it were at the same

average level of production as Sand Hill River was in 1994-96. The actual returns to Big Brook of 530 small and 104 large are 31% and 29% of the adjusted Sand Hill River returns. Ranger seals (*Phoca vitulina)* are known to overwinter and breed in the lower 10 km of this river and are likely predators on fish populations. It is possible that predation by seals and exploitation by man have reduced spawners to this level of production. In addition, salmon populations are known for their high degree of annual variability and it may be that the salmon returns to Big Brook in 1997 were low due to this variability while other years were higher.

Exploitation patterns of fish stocks is an important information for a stock assessment. Because of a lack of assessments on northern and southern Labrador rivers, this information is generally lacking. For Big Brook, exploitation rates for the angling fishery were 13.8% on small retained salmon, 6.0% on small released salmon, 1.9% on large retained salmon and 1.0% on large released salmon. Exploitation rates are also available for Sand Hill River in southern Labrador (Reddin et al. 1995). In the early 1970s, average exploitation rates were 6% on small salmon and 2% on large salmon. In the 1990s, exploitation had increased to 11% on retained small salmon and 4% on retained large salmon. For released salmon, exploitation rates were 14% on small salmon and 4% on large salmon.

O'Connell and Dempson (MS 1991) reported that there is evidence (unpublished) that atresia (the non-development and reabsorption of eggs) occurs to varying degrees in insular Newfoundland salmon. This phenomenon has also been reported in Atlantic salmon in the Soviet Union (Melnikova 1964) and in France (Prouzet *et al.* 1984). Therefore, fecundity values measured from eggs in early stages of development (green eggs) should be regarded as potential values. Since calculations of conservation requirements and the percent of conservation requirements achieved were based on green eggs, the occurrence of atresia in a given year on a particular river would increase the number of spawners required and decrease the percent of the requirements achieved. Also, fecundity values used to determine egg deposition in Big Brook were derived from Sand Hill River salmon.

In conclusion, this paper summarizes the stock status of the salmon population in Big Brook, Labrador. Although, there were several questions to be resolved it would appear that returns to Big Brook and the number of spawners are very low. This is the first assessment of a river in SFA 1 and should be repeated to obtain assessment information for northern Labrador rivers in future years.

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Fig. 1. Location map depicting Labrador, Salmon Fishing Areas (SFAs) and Big Brook.

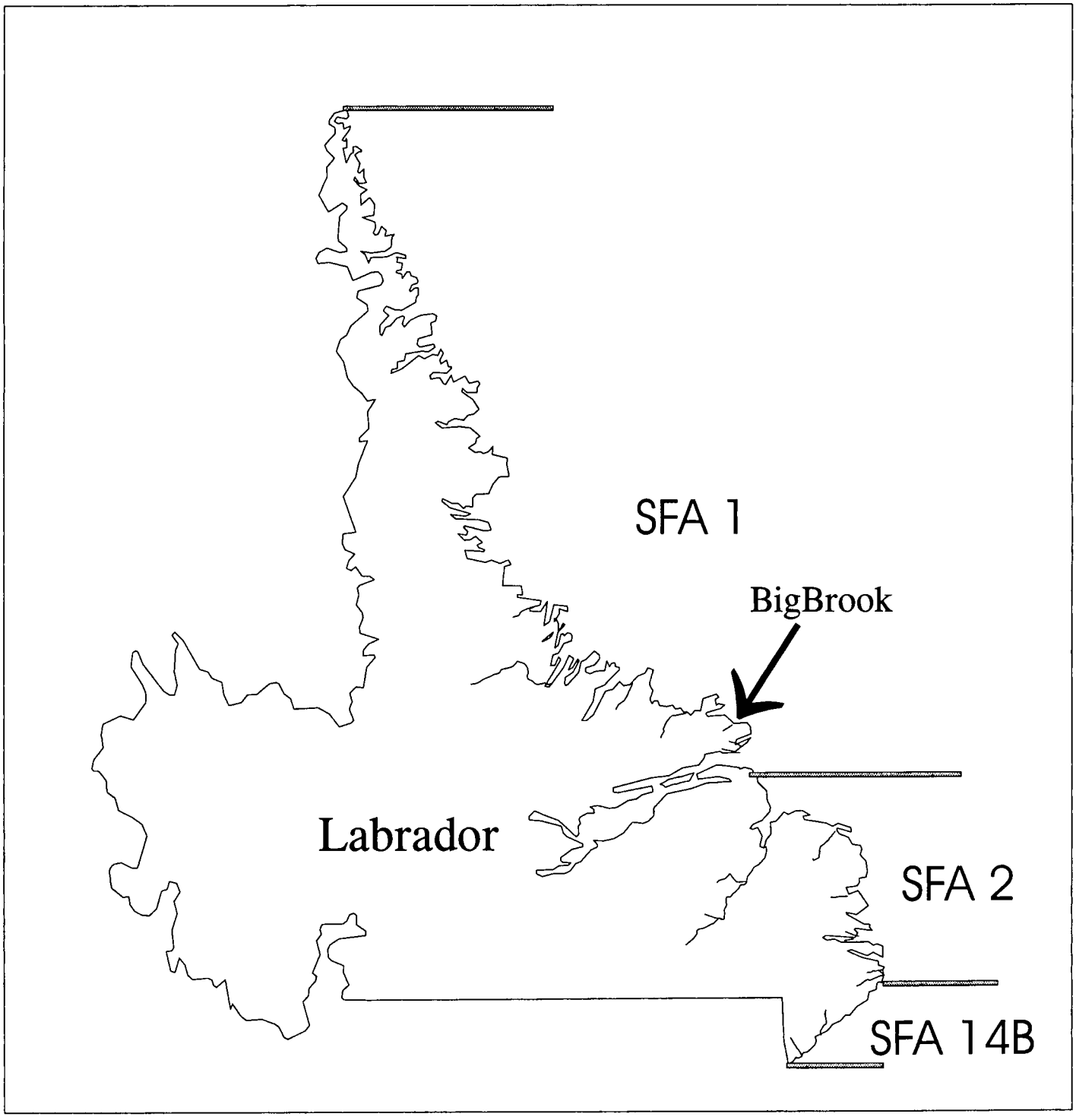

Fig. 2. Drainage basin for Big Brook, Labrador and location of fence site.

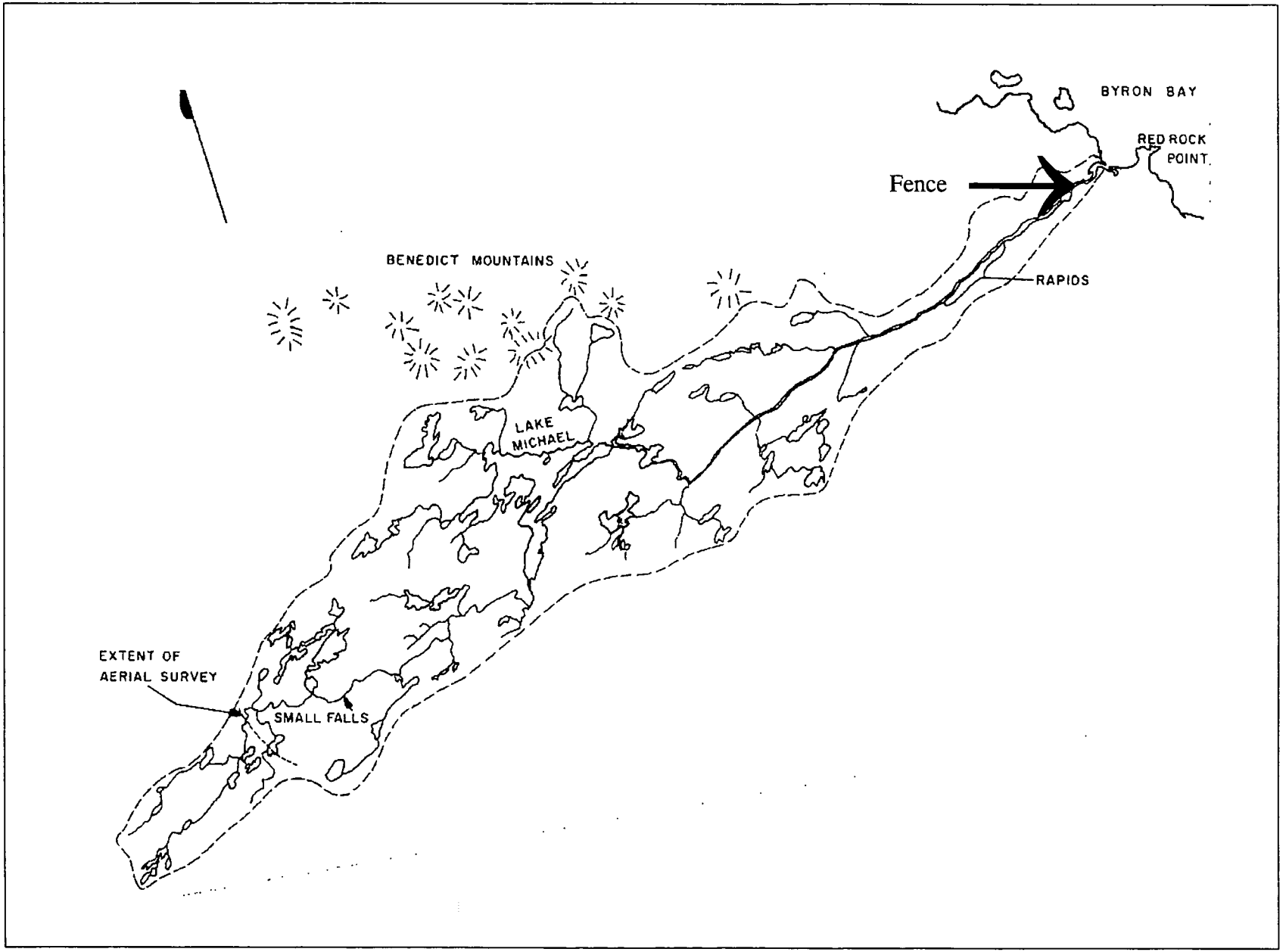

Fig. 3. Counts of small and large salmon for Big Brook, 1997.

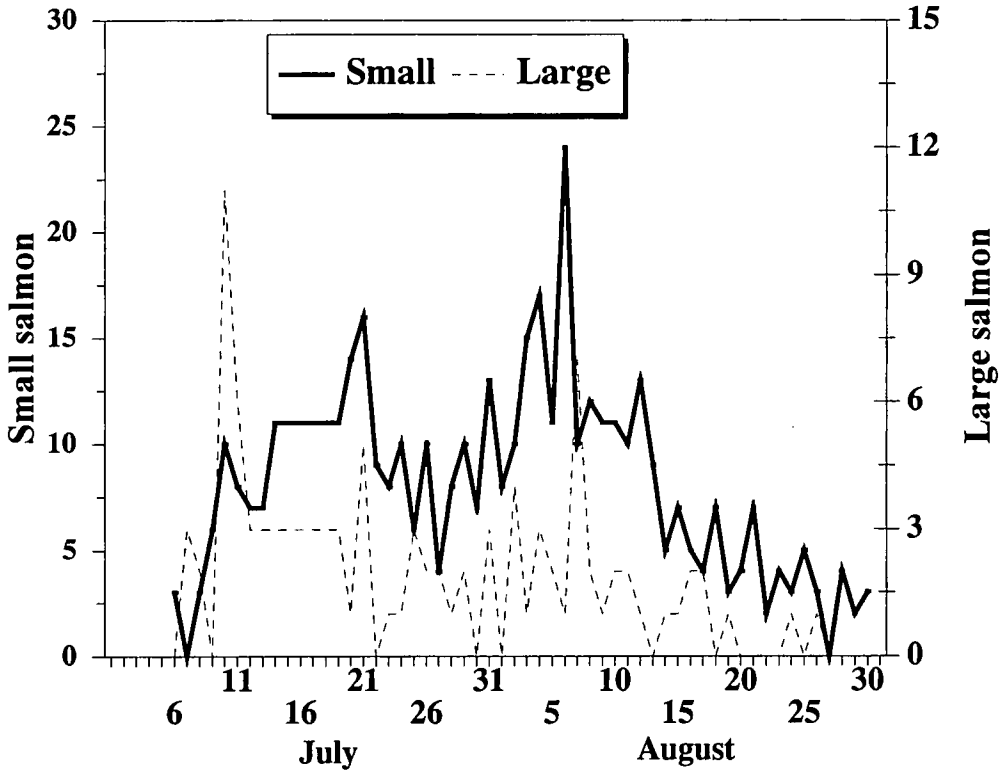

Fig. 4. Water temperature measured at the fence and hook & released salmon, 1997.

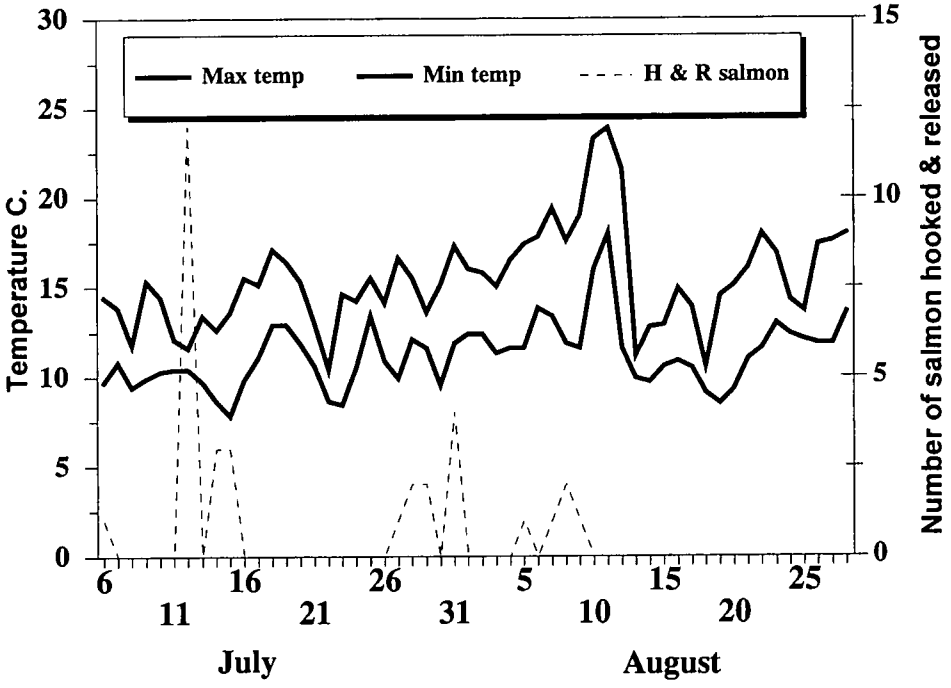

Table 1. DFO angling catch statistics for Big Brook, Labrador.

Code: 5714280

	Effort	Small (<63 cm)			Large (>=63 cm)			Total (Small + Large)			
Year	Rod Days	Ret.	Rel.	Tot.	Ret.	Rel.	Tot.	Ret.	Rel.	Tot.	CPUE
1974	332	246	.	246	43	.	43	289	.	289	0.87
1975	0	0	.	0	0	.	0	0	.	0	.
1976	0	0	.	0	0	.	0	0	.	0	.
1977	0	0	.	0	0	.	0	0	.	0	.
1978	.	.	.	.	.	.	.	.	.	.	.
1979	266	310	.	310	107	.	107	417	.	417	1.57
1980	69	27	.	27	1	.	1	28	.	28	0.41
1981	.	.	.	.	.	.	.	.	.	.	.
1982	89	50	.	50	16	.	16	66	.	66	0.74
1983	69	20	.	20	1	.	1	21	.	21	0.30
1984	242	21	.	21	10	.	10	31	.	31	0.13
1985	.	.	.	.	.	.	.	.	.	.	.
1986	173	52	.	52	4	.	4	56	.	56	0.32
1987	56	37	.	37	6	.	6	43	.	43	0.77
1988	221	363	.	363	35	.	35	398	.	398	1.80
1989	298	412	.	412	46	.	46	458	.	458	1.54
1990	217	251	.	251	20	.	20	271	.	271	1.25
1991	455	79	.	79	7	.	7	86	.	86	0.19
1992	298	33	0	33	172	0	172	205	0	205	0.69
1993	.	.	.	.	.	.	.	.	.	.	.
1994	242	62	22	84	10	1	11	72	23	95	0.39
1995	152	92	21	113	5	0	5	97	21	118	0.78
1996	183	36	12	48	5	0	5	41	12	53	0.29
1997**	427	73	32	105	2	1	3	75	33	108	0.25
84-89 $\bar{X}$	198.0	177.0	.	177.0	20.2	.	20.2	197.2	.	197.2	1.00
95% CL	113.2	239.9	.	239.9	23.7	.	23.7	263.1	.	263.1	1.07
N	5	5	0	5	5	0	5	5	0	5	5
86-91 $\bar{X}$	236.7	199.0	.	199.0	19.7	.	19.7	218.7	.	218.7	0.92
95% CL	139.8	173.9	.	173.9	18.3	.	18.3	191.9	.	191.9	0.88
N	6	6	0	6	6	0	6	6	0	6	6
92-96 $\bar{X}$	218.8	55.8	13.8	69.5	48.0	0.3	48.3	103.8	14.0	117.8	0.54
95% CL	160.7	68.2	25.4	89.5	205.5	1.2	205.1	177.1	26.1	159.2	0.54
N	3	3	3	3	3	3	3	3	3	3	3

IN THE ABOVE TABLE A PERIOD INDICATES NO DATA FOR THAT YEAR.
CPUE IS BASED ON RETAINED + RELEASED FISH FOR 1992 - 1996 AND ON RETAINED FISH ONLY PRIOR TO 1992.
**PRELIMINARY

Table 2. Daily counts of upstream migrating Atlantic salmon at Big Brook (Michaels River),Labrador in 1997. Fence was non-functional from 2100 hours on July 14 to 1300 hours on July 19. Numbers in bold italics are estimates. On July 14, 4 small and 3 large salmon were counted and on 19 July 2 small and 0 large were counted during the period of the day the counting fence was operational.

	Number of fish		Cumulative			Percentages			% large
DATE	GRILSE	SALMON	GRILSE	SALMON	TOTAL	GRILSE	SALMON	TOTAL	salmon
6 July	3	0	3	0	3	0.7	0.0	0.5	0
7 July	0	3	3	3	6	0.7	2.9	1.1	50
8 July	3	2	6	5	11	1.3	4.9	2.0	45
9 July	6	0	12	5	17	2.6	4.9	3.1	29
10 July	10	11	22	16	38	4.8	15.7	6.8	42
11 July	8	6	30	22	52	6.6	21.6	9.4	42
12 July	7	3	37	25	62	8.1	24.5	11.2	40
13 July	7	3	44	28	72	9.7	27.5	12.9	39
14 July	***11***	***3***	55	31	86	12.1	30.4	15.5	36
15 July	***11***	***3***	66	34	100	14.5	33.3	18.0	34
16 July	***11***	***3***	77	37	114	17.0	36.3	20.5	32
17 July	***11***	***3***	88	40	128	19.4	39.2	23.0	31
18 July	***11***	***3***	99	43	142	21.8	42.2	25.5	30
19 July	***11***	***3***	110	46	156	24.2	45.1	28.1	29
20 July	14	1	124	47	171	27.3	46.1	30.8	27
21 July	16	5	140	52	192	30.8	51.0	34.5	27
22 July	9	0	149	52	201	32.8	51.0	36.2	26
23 July	8	1	157	53	210	34.6	52.0	37.8	25
24 July	10	1	167	54	221	36.8	52.9	39.7	24
25 July	6	3	173	57	230	38.1	55.9	41.4	25
26 July	10	2	183	59	242	40.3	57.8	43.5	24
27 July	4	2	187	61	248	41.2	59.8	44.6	25
28 July	8	1	195	62	257	43.0	60.8	46.2	24
29 July	10	2	205	64	269	45.2	62.7	48.4	24
30 July	7	0	212	64	276	46.7	62.7	49.6	23
31 July	13	3	225	67	292	49.6	65.7	52.5	23
1 August	8	0	233	67	300	51.3	65.7	54.0	22
2 August	10	4	243	71	314	53.5	69.6	56.5	23
3 August	15	1	258	72	330	56.8	70.6	59.4	22
4 August	17	3	275	75	350	60.6	73.5	62.9	21
5 August	11	2	286	77	363	63.0	75.5	65.3	21
6 August	24	1	310	78	388	68.3	76.5	69.8	20
7 August	10	7	320	85	405	70.5	83.3	72.8	21
8 August	12	2	332	87	419	73.1	85.3	75.4	21
9 August	11	1	343	88	431	75.6	86.3	77.5	20
10 August	11	2	354	90	444	78.0	88.2	79.9	20
11 August	10	2	364	92	456	80.2	90.2	82.0	20
12 August	13	1	377	93	470	83.0	91.2	84.5	20
13 August	9	0	386	93	479	85.0	91.2	86.2	19
14 August	5	1	391	94	485	86.1	92.2	87.2	19
15 August	7	1	398	95	493	87.7	93.1	88.7	19
16 August	5	2	403	97	500	88.8	95.1	89.9	19
17 August	4	2	407	99	506	89.6	97.1	91.0	20
18 August	7	0	414	99	513	91.2	97.1	92.3	19
19 August	3	1	417	100	517	91.9	98.0	93.0	19
20 August	4	0	421	100	521	92.7	98.0	93.7	19
21 August	7	0	428	100	528	94.3	98.0	95.0	19
22 August	2	0	430	100	530	94.7	98.0	95.3	19
23 August	4	0	434	100	534	95.6	98.0	96.0	19
24 August	3	1	437	101	538	96.3	99.0	96.8	19
25 August	5	0	442	101	543	97.4	99.0	97.7	19
26 August	3	1	445	102	547	98.0	100.0	98.4	19
27 August	0	0	445	102	547	98.0	100.0	98.4	19
28 August	4	0	449	102	551	98.9	100.0	99.1	19
29 August	2	0	451	102	553	99.3	100.0	99.5	18
30 August	3	0	454	102	556	100.0	100.0	100.0	18
31 August			454	102	556	100.0	100.0	100.0	18

Table 3. Biological characteristic data for Big Brook (Michaels River), Labrador, 1997.

Class	Type	Fork length (cm)	Whole weight (kg)	Percent female	Number sampled		River age distribution 1	2	3	4	5	6	7	Total
Small salmon	Mean	53.9	1.75	17	66	Number	0	0	2	7	21	33	0	63
	SD	2.4	0.29			Percent	0	0	3	11	33	52	0	100
Large salmon	Mean	71.7	3.93	100	3	Number	0	0	0	0	2	1	0	3
	SD	3.5	0.32			Percent	0	0	0	0	67	33	0	100
Grilse	Mean	53.9	1.76	15	66	Number	0	0	2	6	21	33	0	62
	SD	2.4	0.29			Percent	0	0	3	10	34	53	0	100
2SW	Mean	71.7	3.93	100	3	Number	0	0	0	0	2	1	0	3
	SD	3.5	0.3			Percent	0	0	0	0	67	33	0	100
Repeat spawners	Mean	57.8	1.50	100	1	Number	0	0	0	1	0	0	0	1
	SD					Percent	0	0	0	100	0	0	0	100
All salmon*		54.7	1.8	50	70	Number	0	0	2	7	24	34	0	67
		4.4	0.5			Percent	0	0	3	10	36	51	0	100

* river ages includes 1 salmon that was not included in remainder of analysis

Table 4. Biological characteristics of smolt sampled from Big Brook (Michaels River), Labrador, 1997. Samples collected on July 26, 1997.

	Fork Length (cm)	Whole Weight (g)	River age distribution								Smolt age
				1	2	3	4	5	6	7 Total	
Mean	18.5	56.5	Number	0	0	0	18	11	5	3 37	4.8
Standard Deviation	1.3	11.5	Percent	0	0	0	49	30	14	8 100	