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Status of the Atlantic Salmon (Salmo salar L.) Stock of Harry's River/Pinchgut Brook, Newfoundland, 1996

by

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ABSTRACT

The Atlantic salmon stock of Harrys River has shown signs of improvement since 1992 but the stock did not achieve it's conservation requirement in any year during this period. To increase the number of spawning salmon, the recreational fishery in the main stem of the river was closed to retention angling in 1996 and the fishery in the headwaters was closed to all angling. Anglers reported that fishing conditions were good early in the 1996 season. Water levels were low later in the season and anglers reported more sightings of salmon holding up in pools compared to previous years. This was probably due to the higher visibility of the fish in low water conditions. Recreational catch and effort statistics on Harrys River in 1996 were, for the first time, based solely on a licence stub return system, so comparison of angling statistics with previous years was impossible. The count of small salmon at the Pinchgut Brook counting fence in 1996 was less than in 1995 but greater than in 1992-94. The count of large salmon was greater than in 1992 and 1995 but less than in 1993-94. The spawning survey conducted in the fall of 1996 indicated that the Pinchgut Brook tributary system was the single most important spawning area for salmon on Harrys River. Thirty-three percent of the spawning in 1996 occurred on the Pinchgut Brook system compared to 41% in 1995. This difference may be attributable to some changes in the areas surveyed in 1996 compared to 1995 as well as annual variation in the distribution of spawning. With the retention fishery closed in 1996, the estimated total spawning escapement on Harrys River was 1,936 small and large salmon. The potential egg deposition from these spawners was only 52% of the conservation requirement for the river, raising serious concern for the conservation of this stock.

RÉSUMÉ

L'état du stock de saumon atlantique de la rivière Harrys semble s'améliorer depuis 1992, mais les besoins de conservation n'ont pas été atteints depuis lors. Afin d'accroître le nombre de géniteurs, la pêche récréative a été limitée à la pêche par remise à l'eau dans le cours principal de la rivière et la pêche a été interdite dans toutes les eaux d'amont en 1996. Les pêcheurs à la ligne ont signalé de bonnes conditions de pêche au début de la saison de 1996. Les niveaux d'eau ont cependant été faibles par la suite et les pêcheurs ont signalé avoir aperçu plus de saumons dans les fosses qu'au cours des années antérieures. Cela s'explique sans doute par une meilleure visibilité des poissons à cause de la faible profondeur des eaux. En 1996, et pour la première fois, les statistiques sur les prises et l'effort de pêche dans la Harrys reposaient uniquement sur un système de remise des talons des permis de sorte qu'il est impossible de comparer les valeurs obtenues avec celles des années antérieures. Le nombre de petits saumons dénombrés à la barrière du ruisseau Pinchgut était inférieur à celui de 1995, mais supérieur à ceux de la période de 1992-1994. Celui des gros saumons était supérieur à ceux de 1992 et 1995, mais inférieur à ceux de 1993 et 1994. L'inventaire des géniteurs réalisé à l'automne de 1996 montre que le bassin versant du ruisseau Pinchgut constituait la plus importante zone de frai du saumon de la Harrys. Au total, 33 % du frai de 1996 s'est effectué dans le bassin du Pinchgut, comparativement à 41 % en 1995. Cet écart peut être attribuable à certaines modifications des aires évaluées en 1996 par rapport à l'année précédente de même qu'à la variation annuelle du frai. Suite à l'interdiction de conserver les poissons capturés en 1996, l'échappée totale estimée des géniteurs de la rivière Harrys a atteint 1936 petits et gros saumons. La ponte de ces géniteurs ne pouvait correspondre qu'à 52 % des besoins de conservation de cette rivière, ce qui est inquiétant pour la conservation du stock.

INTRODUCTION

Harrys River is one of eight scheduled Atlantic salmon rivers flowing into Bay St. George, Salmon Fishing Area (SFA) 13 (Fig. 1). The recreational fishery on four of these rivers, including Harrys River, was under quota management until 1996. These rivers closed to retention angling in 1996.

Recreational catches on Harrys River peaked during 1953-60 when the catch-per-unit-effort (CPUE) for small and large salmon ranged from 0.31 to 2.30 (Appendix 1). In the next 10 years (1961-70), the mean angling effort on the river increased by 119%. Catches of small and large salmon did not increase to the same degree and as a result the mean CPUE decreased by 48%. Catches peaked in 1964 with a catch of 2,673 small (<63 cm) and 373 large (>=63 cm) salmon, making Harrys River the largest salmon producing river in Bay St. George. This was the largest catch ever recorded from a Bay St. George river (Mullins et al., MS 1989) and represented about 30% of the total Bay St. George catch in that year. In comparison, the catch on Harrys River in 1995 represented only 13% of the Bay St. George total catch. In 1971-77, angling effort continued to increase, but the mean catch of small salmon decreased by 24%, and the mean catch of large salmon decreased by 75% compared to the previous 10 year mean. In 1978-83, and again in 1984-89, the delayed opening dates for the commercial and recreational fisheries did not result in improvements in salmon abundance in the river (Claytor and Mullins, MS 1990). The mean catch in 1978-83 was only 524 small and 35 large salmon, suggesting that the stock was continuing to decline. This decline, particularly of large salmon, was evident in all Newfoundland rivers, and in 1985 anglers were restricted to catch and release only of large salmon. Individual river quotas, including a quota of 350 small salmon on Harrys River, were also introduced on several SFA 13 rivers in 1987. Low juvenile densities recorded in electrofishing surveys on Harrys River in 1987 and 1988 suggested that future recruitment would be low (Claytor and Mullins, MS 1989). Since 1986, the recreational fishery on Harrys River has been open for the entire season in only two years.

Recreational and commercial fishery management measures that would have affected salmon stocks on Harrys River and other rivers in SFA 13 since 1992 include:

1. 1992 -- a five year commercial salmon moratorium implemented; SFA 13 quota of 5,000 reached and river closed to retention angling on 2 August;
2. 1993 -- the daily bag limit reduced from two to one fish per day; SFA 13 quota not reached; river quota of 350 reached and river closed to retention angling on 22 August;
3. 1994 -- the recreational season bag limit reduced from eight to six small salmon (three before 31 July and three after 31 July); the daily bag limit increased from one to two per day; river quota of 350 not reached; in-season review to 24 July indicated low returns and the river closed on 8 August;
4. 1995 -- recreational season bag limit of six small salmon (three before 31 July and three after 31 July); daily limit of two per day; in-season review indicated low returns and the river closed to retention angling on 16 July;
5. 1996 -- catch and release angling only downstream from Home Pool (Fig. 2); closure of headwater areas above Home Pool to all angling.

Catches of small salmon in 1993-95 have been among the lowest on record. However, the proportion of large salmon caught and released in 1993-95 (0.13, 0.17, and 0.15 respectively) was the highest since 1967 (0.26) (Appendix 1).

This document presents the fifth assessment of the status of the Atlantic salmon stock of Harrys River since 1992. An estimate of the salmon spawning escapement in 1996 is derived from adult salmon counts at the Pinchgut Brook counting fence and a spawning survey of the whole river. The status of the stock is assessed relative to the conservation requirement which has been updated from that of previous reports.

METHODS

Spawning Escapements

a) Pinchgut Brook

The counting fence location at the mouth of Pinchgut Brook, approximately 48 km upstream from the mouth of Harrys River (Fig. 2), was the same as in 1992-95. Adult salmon were enumerated passing upstream through the fence. The spawning escapement on Pinchgut Brook was assumed to be equivalent to the number of adults enumerated because no angling occurred above the counting fence in 1996.

b) Harrys River

The total spawning escapement on Harrys River (TSE) in 1996, as in 1992-95 (Mullins et al., MS 1996), was estimated based on the spawning escapement on Pinchgut Brook and a spawning survey of the whole river in November:

$$TSE = PS / (PR / TR)$$

where:

PS = Pinchgut Brook spawners
PR = Pinchgut Brook adjusted redd count
TR = Total redd count on Harrys River

A mark-recapture experiment on Harrys River in July 1995 provided an estimate of the total spawning escapement that was equal to that derived using the combination of counting fence and spawning survey in 1995 (Mullins et al., MS 1996)

The 1996 spawning survey was conducted by six crews of two individuals each. Crews counted redds in most cases by walking downstream. Before the start of the survey, each crew surveyed a test area on Big Gull Pond Brook tributary to verify consistency of redd counts. In cases where the total tributary length was not surveyed, redd counts were adjusted upwards based on the proportion of the tributary surveyed.

Redd counts by teams at test site, 1996.

Crew	Redd Count
1	24
2	35
3	28
4	37
5	33
6	24
Mean	30.2
STD	5.64
N	6

Salmon spawners on Harrys River were apportioned into small and large sizes based on the proportion of small and large salmon observed at the Pinchgut Brook counting fence.

Water temperature (° C) was recorded at the counting fence in 3.2 hr intervals in 1996 using a 'Hobotemp' temperature logger. Temperatures were recorded at 1.6 hr intervals in 1995 and 2.4 hr intervals in 1994.

Estimation of Conservation Egg Deposition and Requirement

The amount of lacustrine habitat available to salmon on Harrys River is 4,068 ha based on digitized 1:50,000 scale topographic maps. This is an update from 3,546 ha used in previous reports (Mullins et al., MS 1996; Reddin and Mullins, MS 1996)..

For the Pinchgut Brook system, the amount of lacustrine habitat available to juvenile salmon included a portion of the area of Georges Lake. This portion was equivalent to the percentage of the total tributary length flowing into Georges Lake from the Pinchgut system (45% or 684 ha). The surface area of Georges Lake and other lakes (> 10 ha) was measured directly from digitized 1:50,000 scale topographic maps (Mullins et al., MS 1996).

Egg deposition requirements for the accessible fluvial (Porter et al., MS 1974; Porter and Chadwick, MS 1983) and lacustrine habitat were based on a minimum egg deposition rate of 240 eggs per 100 m^2 of fluvial habitat (Elson, 1975) and 368 eggs per ha of lacustrine area (O'Connell et al., MS 1991).

Estimation of Potential Egg Depositions

The biological characteristics of Harrys River salmon used to estimate potential egg depositions are in Appendices 2-4. Small salmon biological characteristics (sex composition -- internal and external -- and mean weight of females) were from sampling conducted in the recreational fishery and at the

Pinchgut counting fence. Sample size of small salmon was low (<30) in 1995 and those sampled at the counting fence in 1996 were not sexed. Therefore, the 1992-94 mean (71.9% female and 1.59 kg mean weight of females) was used to estimate egg depositions in 1995 and 1996. Large salmon biological characteristics (86.8% female and 5.06 kg per female) were from samples collected on other rivers in Bay St. George in 1953-94 (Reddin and Mullins, MS 1996).

The percentage of the egg deposition requirement achieved in 1996 was calculated according to the formula:

$$\text{\% Conservation Requirement Achieved} = \frac{\text{Potential Egg Deposition (small + large)}}{\text{Conservation Egg Deposition}}$$

$$= \frac{(\text{\# small*\%female*mean wt.*1540}) + (\text{\#large*\%female*mean wt.*1540})}{(\text{fluvial units*240}) + (\text{lacustrine area*368})}$$

The estimated relative fecundity of 1,540 eggs/kg of body weight for small and large salmon is from Anon. (1978).

Juvenile Atlantic salmon Density

Densities of one year old salmon parr at three sites on Harrys River were determined from electrofishing surveys conducted in 1987-96. These were used as an indicator of spawner abundance two years previous as outlined in Claytor and Mullins (MS 1990).

RESULTS

Recreational Fishery

The 1996 fishery was closed to retention angling downstream from Home Pool (Fig. 2) and closed to all angling in the headwaters upstream from Home Pool. The catch and release fishery opened 15 June 1996. Recreational catch and effort statistics on Harrys River in 1996 were collected solely from a licence stub return system. This system of collection is still in the developmental stages so comparison of catches and effort in 1996 with those collected in previous years using traditional methods was impossible. However, anglers and outfitters reported good catches and sightings of salmon in 1996. Anglers also reported that fishing was good early in the season because of the very low spring runoff (Fig. 3A) compared to 1995 (Fig. 3B) and the 1992-95 mean (Fig. 3C). Water levels were extremely low in July and August.

Spawning Escapements and Potential Egg Depositions

a) Pinchgut Brook

Because of the low spring runoff in 1996, there was a potential for salmon to enter the river earlier than normal. Therefore, installation of the counting fence was 3-4 weeks earlier than in previous years but removal was about the same time as in previous years. The counting fence operated from 24 May to 17 October 1996.

Year	Date of Operation
1992	4 July to 23 September
1993	17 June to 18 October
1994	22 June to 18 October
1995	19 June to 17 October
1996	24 May to 17 October

Harrys River is a late-run river compared to others in Bay St. George (Reddin and Mullins, MS 1996). The run-timing of small salmon to a counting fence operated near the mouth of the river in 1967, indicated that approximately 50% of the run entered the river after mid-July (Downer, MS 1968; Mullins et al., MS 1996). The timing of small and large counts at the Pinchgut Brook fence indicated that the run-timing to the mouth of Harrys River in 1996 was earlier than mid-July. The run-timing at the counting fence in 1996 was 10 days earlier than in 1994 and 1995 and was the earliest in five years of operation (Table 1). Fifty percent of the small and large salmon had passed through the fence by mid-July.

Higher than normal water flow in July 1996 may have contributed to the earlier run-timing at the fence. The water flow in July was higher than in 1995 and higher than the 1992-95 mean (Figs. 3A-C). However, the flows in June and August 1996 were lower than in 1995 and compared to the 1992-95 mean.

A total of 601 small and 38 large salmon passed through the Pinchgut Brook fence in 1996 (Table 2). The count of small salmon was 20% less than in 1995 and 14% greater than the 1992-95 mean. However, the count of large salmon was 36% greater than in 1995 and 23% greater than the 1992-95 mean. The proportion of large salmon was 63% greater than in 1995 and 16% greater than the 1992-95 mean. The peak counts of small and large salmon at the fence occurred in mid-July and late-September (Fig. 4) corresponding with peak water flows (Fig. 3A).

The spawning survey carried out on 12-19 November 1996, covered 113 km of Harrys River. This was the same dates and total distance surveyed in 1995. The 1996 survey covered nearly 100% of the accessible salmon spawning habitat. The adjusted redd count in 1996 was 1,170 (Table 3) compared to 714 in 1995 (Mullins et al., MS 1996), an increase of 64%. The adjusted redd count on the Pinchgut Brook system in 1996 was 420 redds compared to 293 in 1995, an increase of 43%. This increase is not attributable entirely to an increase in the number of spawners because the number of salmon at the Pinchgut Brook fence in 1996 was about 20% less than in 1995. However, it may have been the result of an earlier spawning time in 1996 compared to 1995.

The mean daily water temperatures recorded at the Pinchgut counting fence in October indicated that conditions in 1996 were colder than for the same period in 1995. From 1-17 October 1996 there were 11 days when the water temperature was 5-10 ° C compared to only six days in 1995 and seven days in 1994 (Table 4). The stripping time for Flat Bay River, Bay St. George brood-stock was 18-19 October in the last three years (C. Bourgeois, DFO, pers. comm.). However, spawning of salmon on Brierly Brook, Nova Scotia occurred about ten days earlier in 1996 than in 1995 and was the earliest in six years of spawning surveys (C. McInnis, DFO, pers. comm.). On Brierly Brook, 53% of the total redd count in 1996 occurred on 13 November compared to 50% on 21 November 1995. The mean water flow on Pinchgut Brook in October and November 1996 was less than in 1995 (Fig. 5). However, the difference water flow alone was not enough to affect the visibility of redds and account for the large difference in counts between the two years.

The total length of the Pinchgut Brook tributary system represents 18% of the total length of tributaries on Harrys River. In 1996, this tributary system accounted for 33% of the total adjusted redd count (Table 3) on Harrys River as a whole. In comparison, the Pinchgut brook system accounted for 41% of the redds counted in 1995 and 34.6% in 1967 (Mullins et al., MS 1996). These differences indicate a low annual variability in the distribution of spawning. However, the lower percentage of spawning observed on the Pinchgut system in 1996 compared to 1995 may be due, in part, to differences in the tributaries surveyed. Ahwachenjeech Brook, a tributary that flows into the main stem of Harrys River, was not surveyed in 1995 because of zero redd counts in 1967, but it was found to be quite productive in 1996. Nevertheless, a certain amount of annual variation in the distribution of spawners is to be expected because of annual differences in water levels and the effect of straying of adult salmon to other tributaries. The lower number of spawners on the Pinchgut Brook system in 1996 compared to 1995 (Table 2) may have been, in part, the result of some natural redistribution of spawners within the Harrys River system. The total number of spawners on Harrys River in 1996 increased only slightly in comparison to 1995 (Table 5). Errors in counting redds were low overall in both years and were assumed to be the same for all tributaries surveyed.

b) Harrys River

It is estimated that 1,780 (1,675 small and 105 large) salmon spawned on Harrys River in 1996 compared to 1,895 (6% less) in 1995 (Table 5).

The potential salmon egg deposition on Harrys River in 1996 was 3.73 million eggs (Table 5) which was approximately the same as in 1995. There were more total spawners in 1995, but the proportion of large salmon was lower than in 1996. Fifty-two percent of the egg deposition requirement for Harrys River was achieved in 1996 (Table 5). This is slightly higher than in 1995, 30% higher than in 1993 and more than three hundred times the percentage achieved in 1992 (Table 5; Fig. 6).

The potential egg deposition on Pinchgut Brook in 1996 was 1.34 million eggs compared to 1.54 in 1995 (Table 6). Spawners on Pinchgut Brook exceeded the egg deposition requirement again in 1996 but it was less than in 1994 and 1995 (Table 6).

Estimation of Conservation Egg Deposition Requirements

The egg deposition requirement for Harrys River is 7,831,584 eggs based on updated habitat information. This is an increase in the conservation requirement from that reported by Reddin and Mullins (MS 1996).

Juvenile Atlantic salmon Density

The results of the juvenile surveys on Harrys River in 1992-96 indicate that the highest densities of one year old salmon parr occurred in 1995 and 1996 (Fig. 7). Spawners in 1993 and 1994 produced one year old parr in 1995 and 1996. Spawning escapements on Pinchgut Brook and Harrys River in those years were more than double those in the previous year (Table 5).

DISCUSSION

Spawning escapements and potential egg depositions appear to have increased on Harrys River in the last five years. However, spawning has been at most 52% of the conservation requirement based on this assessment. This is alarming considering there was no retention of fish in the recreational fishery on the river in 1996 and the commercial fishery has been under a moratorium since 1992. The evidence of low spawning escapements in 1992-96, compared to historic levels, is consistent with estimates of the stock status based on angling exploitation rates derived during the in-season reviews in 1994 and 1995. It is also consistent with the view of anglers expressed at public consultations in 1995 that Bay St. George rivers, with the exception of Grand Codroy and Little Codroy, have generally experienced poor returns in recent years. Severe poaching is also a long standing problem on Harrys River according to both anglers and DFO river guardians. Anglers reported increased sightings of salmon on the river in 1996 compared to previous years. This increase in sightings could have been due to the high visibility of fish holding up in pools under low water conditions late in the 1996 season. It has been suggested that mortalities within the river from poaching could be as high as 50% of the run. If this is true, then it is a severe problem that needs to be addressed.

The conservation requirement was not achieved on Harrys River in 1996 but was achieved on Pinchgut Brook tributary. However, there are several factors to be considered in the analysis of salmon returns to Pinchgut Brook relative to Harrys River as a whole. Pinchgut Brook comprises only 6% of the total available fluvial rearing area and 5% of the total available spawning area on the Harrys River system. The lower reaches of the main stem of Harrys River (~3,944 fluvial parr rearing units; or 64% of the total) are considered to be unproductive in terms of spawning (Claytor and Mullins, MS 1989; Porter et al., MS 1974; Downer, MS 1968). Therefore, excluding the lower reaches (0-18 km), 84% of the accessible spawning habitat occurs in the tributaries but the tributaries have only 40% of the fluvial rearing area. Approximately 56% of the lacustrine habitat is in Georges Lake (Porter et al., MS 1974). Pinchgut Brook, as well as other tributaries, likely produces juvenile salmon that disperse downstream and rear in Georges Lake, particularly in the summer months. Beall et al. (1994), reported dispersal of one year old parr up to 2400 m downstream from the spawning site in summer. The potential for dispersal downstream makes it is difficult to derive a conservation requirement for the Pinchgut Brook tributary alone.

The Pinchgut Brook tributary is the uppermost headwater of Harrys River. Spawning surveys in 1995 and 1996 indicate that it is the primary spawning area for the river system. Pinchgut Brook contains the largest proportion of the spawning habitat and the largest spawning escapement of any of the other thirteen major tributaries. Therefore, it is not surprising that egg depositions in this part of the river would be high relative to other parts of Harrys River, particularly the main stem which is less preferred for spawning. Angling catches on Pinchgut Brook and other headwater tributaries represented only 7.2% of the Harrys River catch in 1984-1989. Considering that the stock is still at an extremely low level, this area should remained closed to all angling in order to preserve it as a spawning area. In addition, Harrys River should remain closed to retention angling to increase the spawning escapement.

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Table 1. Run timing of small salmon at the Pinchgut Brook counting fence, 1992-96.

A. Small Salmon

Year	N	Percent of Run		
		25 %	50 %	75 %
1992	222	July 16	Aug. 2	Aug. 31
1993	576	July 11	July 21	Aug. 12
1994	562	July 17	July 25	Aug. 4
1995	753	July 10	July 24	July 27
1996	601	July 5	July 15	July 24

B. Large Salmon

Year	N	Percent of Run		
		25 %	50 %	75 %
1992	5	Aug. 6	Aug. 6	Sept. 10
1993	43	July 19	Sept. 5	Sept. 15
1994	47	July 24	July 25	July 26
1995	28	July 23	July 25	July 26
1996	38	July 10	July 16	July 16

Table 2. Counts of small and large salmon at the Pinchgut Brook counting fence, 1992-96.

Year	Total Returns			Proportion	
	Small	Large	Total	Small	Large
1992	222	5	227	0.98	0.02
1993	576	43	619	0.93	0.07
1994	563	47	610	0.92	0.08
1995	752	28	780	0.96	0.04
1996	601	38	639	0.94	0.06
Mean (92-95)	528	31	559	0.95	0.05

Table 3. Counts of salmon redds for each of the major tributaries of Harrys River, 1996.

Tributary Number	Tributary Name	Total Tributary Length (km)	Tributary Length Surveyed (km)	Percentage Accessible Area Surveyed		Number Redds Counted	Adjusted Redd Count
I. Pinchgut Brook System:							
T14-1	Big Gull Pond Brook	5.0	2.6	100.0	1	153	153
T14-2	Pinchgut Brook	7.5	5.7	100.0		106	106
T15-2A	Stag Hill Brook N.	9.0	8.8	100.0		35	35
T15-2B	Stag Hill Brook S.	7.0	0.2	100.0	2	0	0
T15-1	Meadows Brook*	6.5	9.6	75.0	3	30	40
T15-3	Camp Eleven Brook	3.5	4.4	100.0	4	86	86
	Sub-Total	38.5	31.2	81.1%		410	420
	Percent of Total	18.2%	27.7%			**36.6%**	**33.0%**
II. George's Lake System:							
T13-1	Stag Lake Bk./Little Georges Bk.	3.0	3.5	100.0		152	152
T13-2-1	Stag Lake Trib. N.	4.5	0.0	.	2	.	.
T13-2-2	Stag Lake Trib. S.	7.0	3.0	81.1		6	7
T12	Beaver Brook T12	5.0	3.1	100.0	5	70	70
T11	Spruce Brook T11	25.0	12.0	100.0	6	74	74
T10	Muskrat Brook T10	3.0	1.6	100.0	6	12	12
	Hickey's Brook		0.1	100.0	6	0	0
	Sub-Total	47.5	23.4	49.2%		314	315
	Percent of Total	22.5%	20.7%			**28.0%**	**24.8%**
III. Main River System:							
T9/T9-1	North Brook	19.3	4.0	100.0		1	1
T9A	Jack Burke's Brook	1.4	1.0	100.0	6	13	13
T5	Robert's Brook	7.0	3.5	49.9	7	33	66
T5-1	Crooked Brook	8.4	3.9	46.6		14	30
T3	Black Duck Brook	4.5	6.3	100.0		95	95
T2	Long Gull Pond Brook	4.7	2.1	90.0		56	62
T1	Browmoore Brook	9.7	0.0	.	8	.	.
T4	Trout Brook	23.2	11.0	47.5		76	160
T6	Furries Brook	10.5	0.0	.	8	.	.
T8	Ahwachenjeech Brook	7.4	4.2	100.0	9	100	100
T5-S1	Rushy Pond Brook		0.0	.	8	.	.
T9	Sanders Brook		0.0	.	8	.	.
	Main Stem (Georges-Dhoon)	29.0	22.0	100.0	10	8	8
	Sub-Total	125.1	58.1	46.4%		396	535
	Percent of Total	59.3%	51.5%			**35.4%**	**42.1%**
	TOTAL	211.1	112.7	53.4%		1,120	1,270

* The 1996 survey included Whaleback Brook tributary from obstruction at 2,171 m from the mouth to Meadow Pond.
1. Big Gull Pond Brook flowed underground above the area surveyed.
2. Not surveyed in 1996 due to very low flow and low or nil redd counts in previous years.
3. More spawning area available in 1996 compared to 1995 because of the removal of numerous obstructions.
4. Started at complete obstruction.
5. Survey started below Beaver Pond. There may be small amount of spawning habitat above.
6. Sections not surveyed in 1996 were above impassable beaver dams or falls.
7. Roberts Brook and Crooked Brook combined.
8. Not surveyed in 1996.
9. No good spawning above this area.
10. Surveyed by canoe in 1996.

Table 4. Frequency of occurrence of mean daily water temperatures (° C) at Pinchgut Brook counting fence, 1994-96.

MEAN TEMP. RANGE (° C)		YEAR		
		1994	1995	1996
		NO. DAYS	NO. DAYS	NO. DAYS
MONTH	TEMP. (° C)			
5	5-10	.	.	8
	N	.	.	8
6	5-10	.	.	6
	10-15	9	2	21
	15-20	.	.	3
	N	9	2	30
7	10-15	9	5	9
	15-20	22	26	22
	N	31	31	31
8	10-15	1	7	1
	15-20	30	23	27
	20-25	.	1	3
	N	31	31	31
9	5-10	.	.	1
	10-15	30	27	24
	15-20	.	3	5
	N	30	30	30
10	5-10	7	5	11
	10-15	11	12	6
	N	18	17	17

Table 5. Estimated spawning escapement, and potential egg deposition by Atlantic salmon on Harrys River, 1992-96.

Harrys River, 1992-96

Year	Spawning Escapement				Potential Egg Deposition (x 10^6)			Percent Conservation Egg Deposition*
	Pinchgut	Harrys						
	Total	Small	Large	Total	Small	Large	Total	
1992	217	518	12	529	0.83	0.08	0.91	12
1993	591	1342	99	1441	2.25	0.67	2.92	37
1994	592	1333	111	1444	2.88	0.75	3.63	46
1995	777	1827	68	1895	3.30	0.46	3.76	48
1996	639	1820	116	1936	3.29	0.79	4.07	52
Mean (92-95)	544	1255	74	1138	1.99	0.50	2.49	32

* The percentage achieved in 1992-95 may have decreased slightly from the values reported in Mullins et al., (MS 1996) due to updated habitat information.

Table 6. Total returns, spawning escapement, and potential egg deposition of Atlantic salmon on Pinchgut Brook, 1992-96.

Pinchgut Brook, 1992-96

Year	Total Returns to Pinchgut Fence			Angling Removals Retained		Angling Removals Released		Spawning Escapement			Potential Egg Deposition (x 10^6)			Percent Conservation Egg Deposition
	Small	Large	Prop. Small	Small	Large	Small	Large	Small	Large	Total	Small	Large	Total	
1992	222	5	0.978	10	0	0	1	212	5	217	0.34	0.03	0.37	36
1993	576	43	0.931	28	0	1	0	548	43	591	0.92	0.29	1.21	117
1994	563	47	0.923	18	0	10	0	544	47	591	1.18	0.32	1.49	145
1995	752	28	0.964	3	0	2	0	749	28	777	1.35	0.19	1.54	150
1996	601	38	0.941	0	0	0	0	601	38	639	1.08	0.26	1.34	130
Mean (92-95)	528	31	0.949	15	0	3	0	513	31	544	0.95	0.21	1.15	112

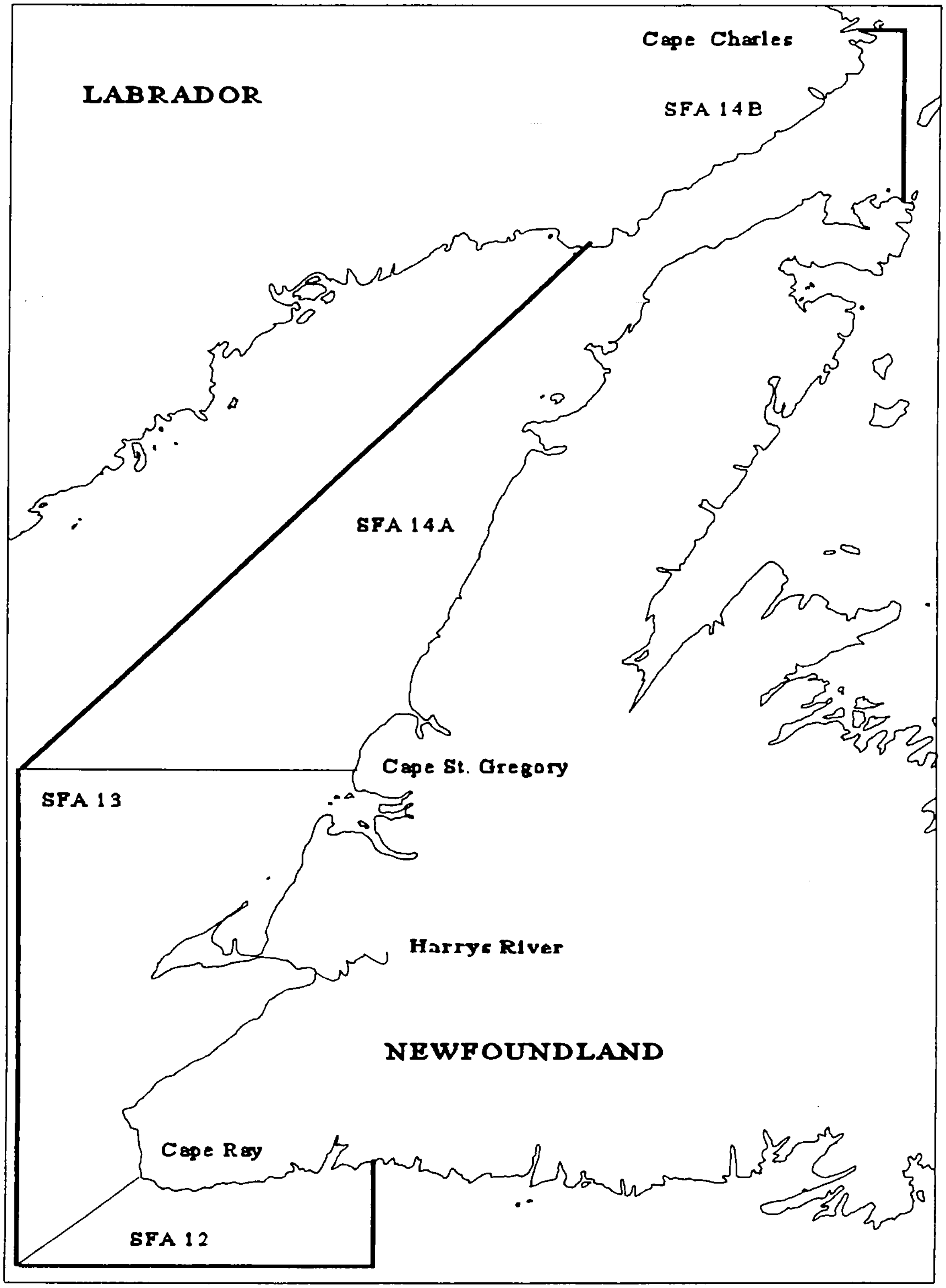


Figure 1. Salmon Fishing Areas (SFAs) of western Newfoundland and Southern Labrador.

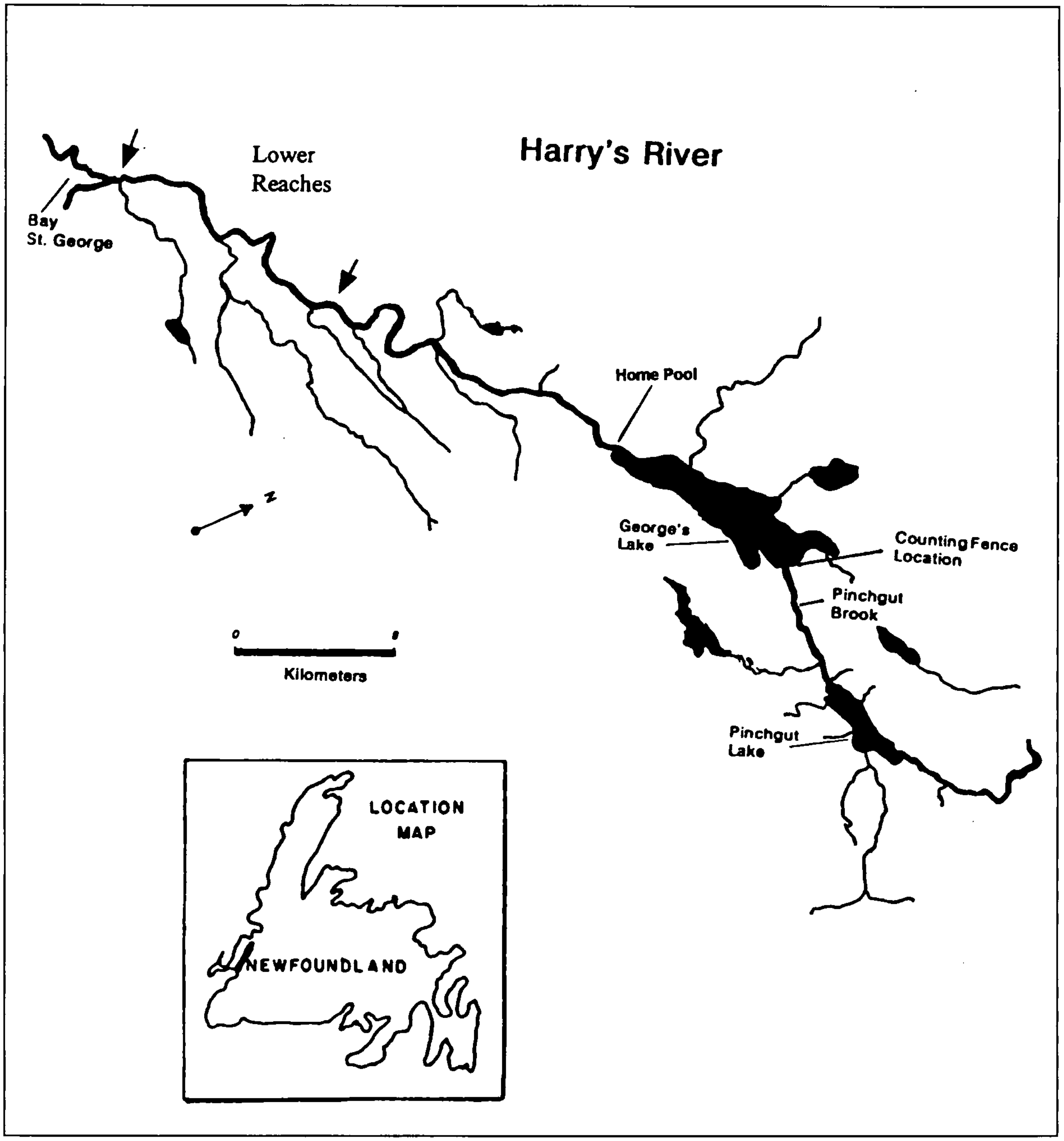


Figure 2. Location of selected features of the Harrys River system.

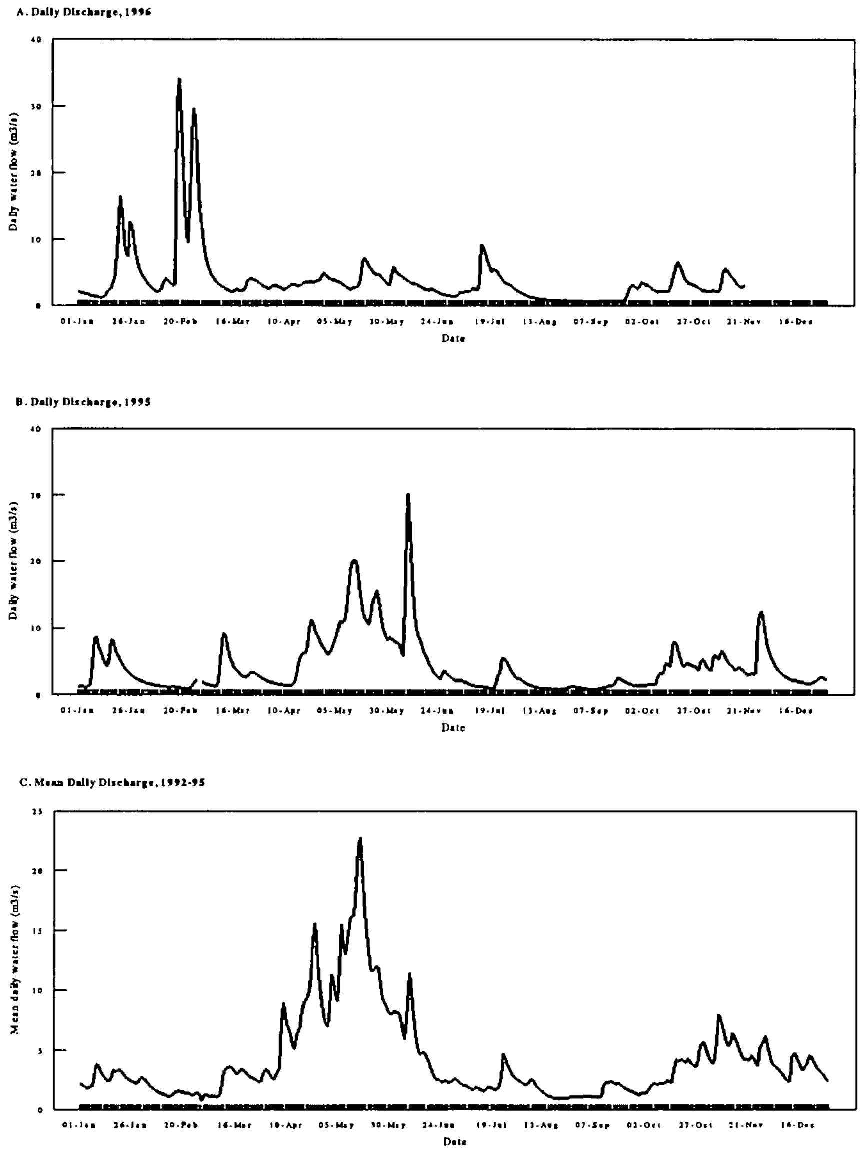


Figure 3. Daily water discharge on Pinchgut Brook, 1995, 1996 and 1992-95.

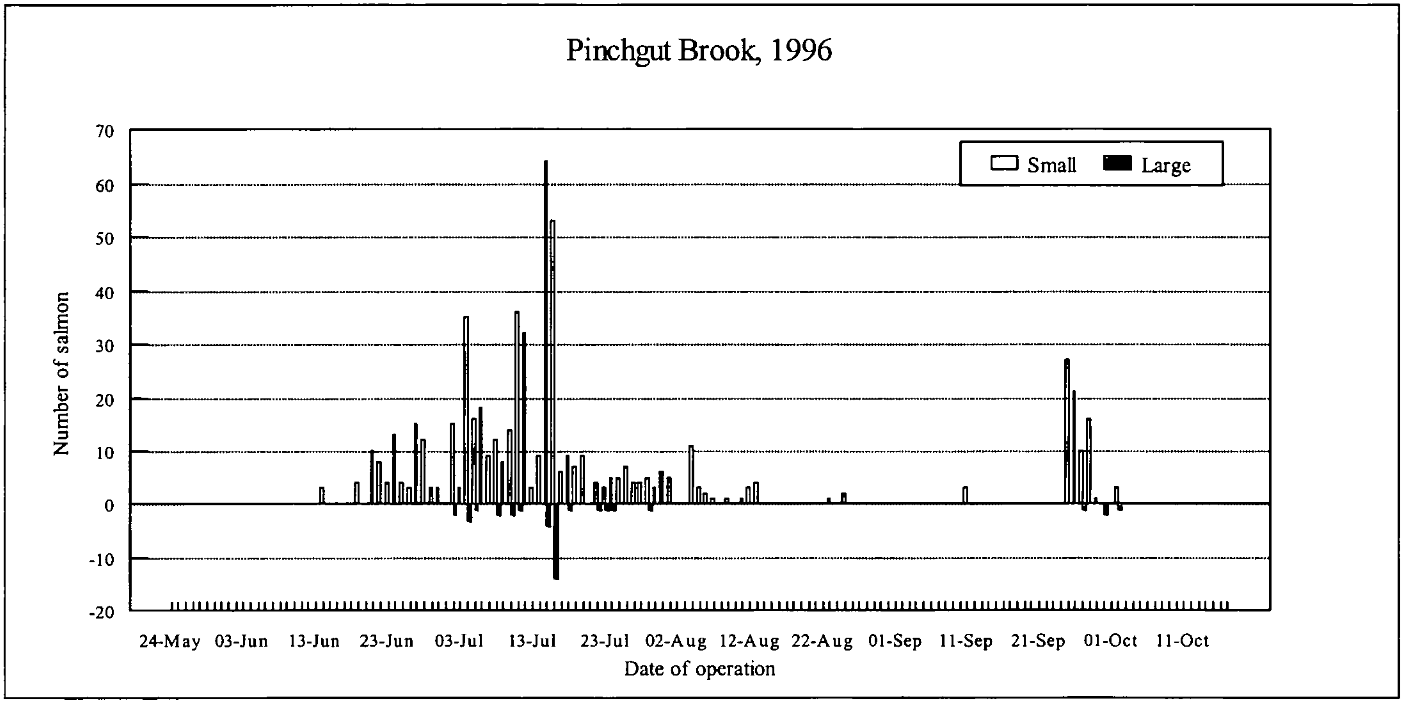


Figure 4. Daily counts of small and large Atlantic salmon at the Pinchgut Brook counting fence, 1996.

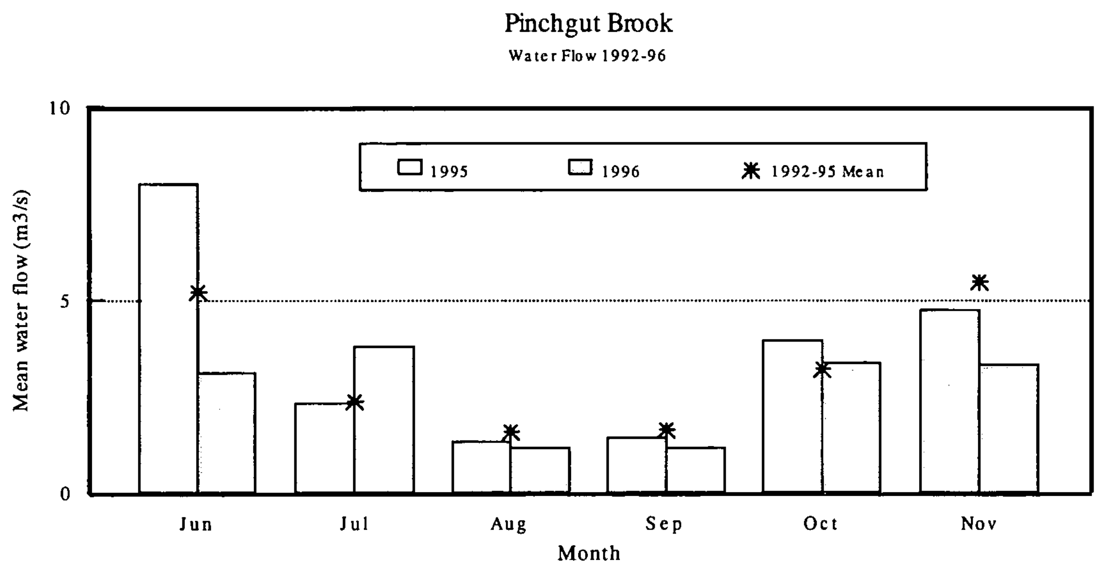
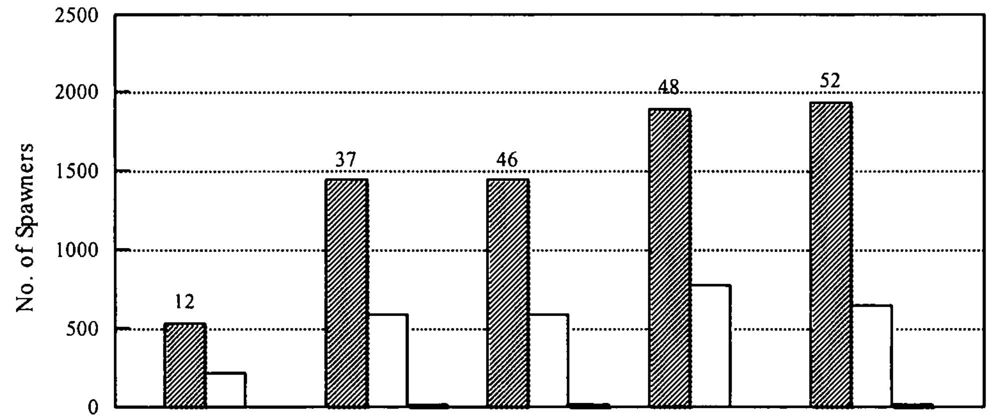


Figure 5. Mean monthly discharge on Pinchgut Brook, June 1-November 16, 1992-96.

Harry's River, 1992-96



Year	1992	1993	1994	1995	1996
Harrys	529	1441	1444	1895	1936
Pinchgut	217	591	592	777	639
Percent Large	2.2	6.9	7.7	3.6	5.9

Figure 6. Spawning escapement of Atlantic salmon on Harrys River and Pinchgut Brook and percentage of the conservation egg deposition requirement achieved in 1992-96.

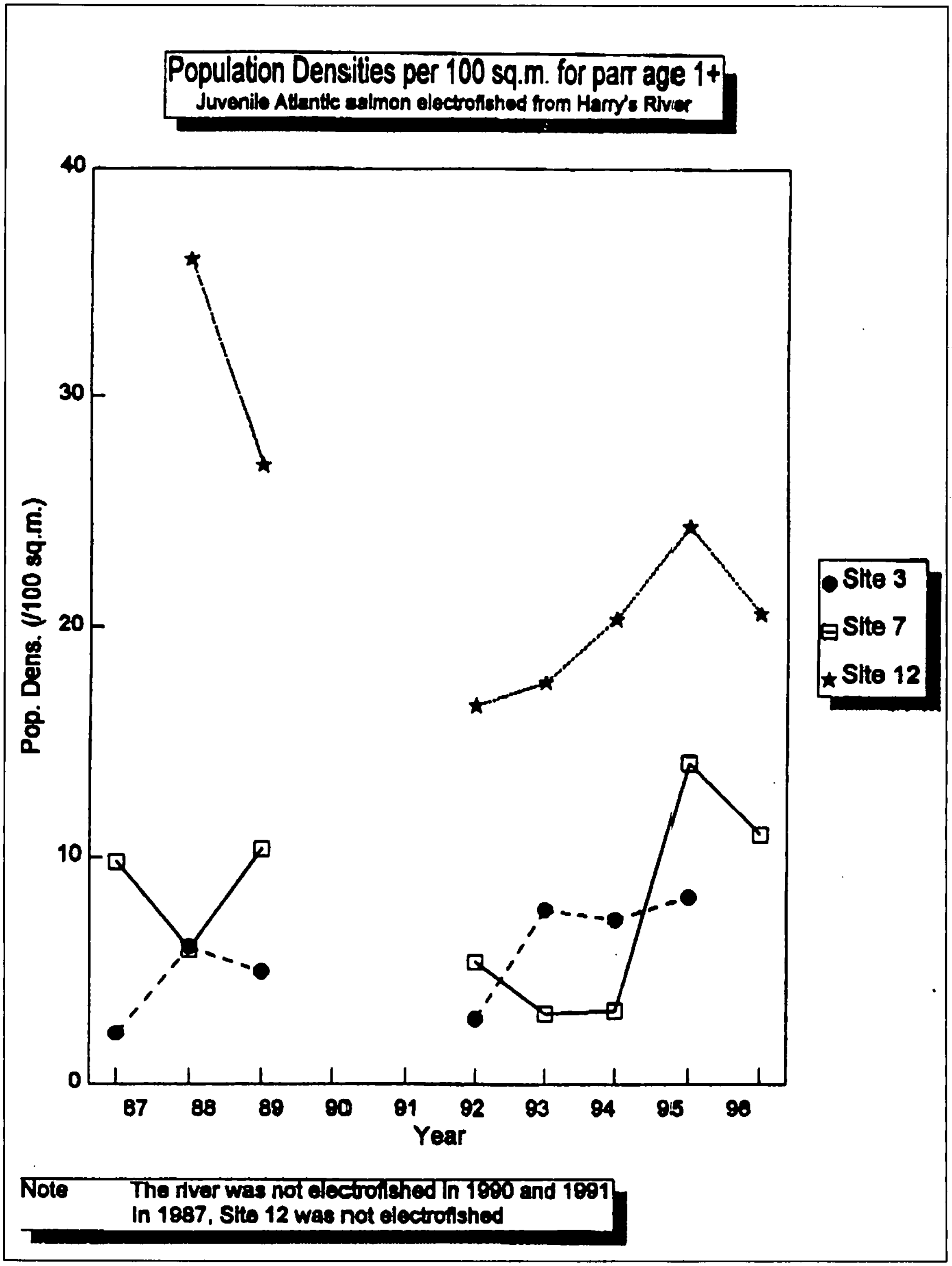


Figure 7. Densities of one year old Atlantic salmon parr at three electrofishing sites on Harrys River in 1987-96.

Appendix 1. Recreational catches of retained and released Atlantic salmon on Harry's River, 1953-95.
Means are for years with similar management plans.

Year	Effort (Rod days)	Small salmon Ret.	Small salmon Rel.	Small salmon Total	Large salmon Ret.	Large salmon Rel.	Large salmon Total	Total Catch Ret.	Total Catch Rel.	Total Catch Total	CPUE	Prop. Large
1953	3458	935	.	935	146	.	146	1081	0	1081	0.31	0.14
1954	800	244	.	244	18	.	18	262	0	262	0.33	0.07
1955	1464	499	.	499	61	.	61	560	0	560	0.38	0.11
1956	2211	668	.	668	206	.	206	874	0	874	0.40	0.24
1957	1689	1418	.	1418	493	.	493	1911	0	1911	1.13	0.26
1958	537	984	.	984	218	.	218	1202	0	1202	2.24	0.18
1959	1466	604	.	604	95	.	95	699	0	699	0.48	0.14
1960	302	603	.	603	91	.	91	694	0	694	2.30	0.13
1961	1676	734	.	734	119	.	119	853	0	853	0.51	0.14
1962	3316	1488	.	1488	226	.	226	1714	0	1714	0.52	0.13
1963	4354	2467	.	2467	457	.	457	2924	0	2924	0.67	0.16
1964	3933	2673	.	2673	373	.	373	3046	0	3046	0.77	0.12
1965	3338	1175	.	1175	262	.	262	1437	0	1437	0.43	0.18
1966	2113	620	.	620	316	.	316	936	0	936	0.44	0.34
1967	2630	706	.	706	248	.	248	954	0	954	0.36	0.26
1968	2640	863	.	863	85	.	85	948	0	948	0.36	0.09
1969	3360	1491	.	1491	181	.	181	1672	0	1672	0.50	0.11
1970	5288	1662	.	1662	207	.	207	1869	0	1869	0.35	0.11
1971	5146	1435	.	1435	47	.	47	1482	0	1482	0.29	0.03
1972	3632	782	.	782	32	.	32	814	0	814	0.22	0.04
1973	4748	1583	.	1583	196	.	196	1779	0	1779	0.37	0.11
1974	4218	941	.	941	34	.	34	975	0	975	0.23	0.03
1975	2180	704	.	704	16	.	16	720	0	720	0.33	0.02
1976	2893	902	.	902	40	.	40	942	0	942	0.33	0.04
1977	3853	1008	.	1008	68	.	68	1076	0	1076	0.28	0.06
1978	3142	713	.	713	65	.	65	778	0	778	0.25	0.08
1979	755	148	.	148	1	.	1	149	0	149	0.20	0.01
1980	1602	518	.	518	65	.	65	583	0	583	0.36	0.11
1981	2082	659	.	659	18	.	18	677	0	677	0.33	0.03
1982	2141	570	.	570	31	.	31	601	0	601	0.28	0.05
1983	2439	533	.	533	30	.	30	563	0	563	0.23	0.05
1984	2543	720	.	720	.	11	11	720	11	731	0.29	0.02
1985	1686	173	.	173	.	0	0	173	0	173	0.10	0.00
1986	2628	382 (3)	.	382	.	8	8	382	8	390	0.15	0.02
1987	1643	378 (4)	.	378	.	8	8	378	8	386	0.23	0.02
1988	2077	434 (1)	.	434	.	11	11	434	11	445	0.21	0.02
1989	1961	324 (3)	.	324	.	3	3	324	3	327	0.17	0.01
1990	2182	706 (1)	.	706	.	22	22	706	22	728	0.33	0.03
1991	1456	370 (1)	.	370	.	4	4	370	4	374	0.26	0.01
1992	2094	346 (2)	0	346	.	28	28	346	28	374	0.18	0.07
1993	1870	319 (1)	23	342	.	50	50	319	73	392	0.21	0.13
1994	1518	153 (5)	84	237	.	50	50	153	134	287	0.19	0.17
1995	1252	149 (5)	60	209		44	44	193	104	297	0.24	0.15
1996	.	.	.	.	.	.	.	.	.	.	.	.
Mean(92-95)	1684	242	42	284	0	43	43	253	85	338	0.20	0.13
Mean(84-91)	2022	436	0	436	0	8	8	436	8	444	0.22	0.02
Mean(78-83)	2027	524	0	524	35	0	35	559	0	559	0.27	0.06
Mean(71-77)	3810	1051	0	1051	62	0	62	1113	0	1113	0.29	0.05
Mean(61-70)	3265	1388	0	1388	247	0	247	1635	0	1635	0.49	0.16
Mean(53-60)	1491	744	0	744	166	0	166	910	0	910	0.95	0.16
% Change in 1992-95 from:												
Mean(84-91)	-17	-45	.	-35	.	413	413	-42	912	-24	-7	701

Appendix 2. Mean fork length, weight and sex composition of small and large female Atlantic salmon on Harrys River, 1975-96.
Note: Sex determined by internal and external examination. Samples from recreational fishery and counting fence.
The whole weight given for 1996 is for males and females combined.

HARRYS RIVER

		FORK LENGTH (cm)					WHOLE WEIGHT (kg)					WHOLE WEIGHT FEMALES (kg)					NO.	PERCENT FEMALE	
		N	MEAN	MIN	MAX	STD	N	MEAN	MIN	MAX	STD	N	MEAN	MIN	MAX	STD	SEXED	N	%
LARGE	YEAR																		
	77	0	.	.	.	.	1	4.80	4.8	4.8	.	1	4.80	4.8	4.8	.	1	1	100.0
	93	5	70.70	67.5	73.0	2.08	2	3.70	3.4	4.0	0.42	2	3.70	3.4	4.0	0.42	5	5	100.0
	95	8	74.57	63.3	81.5	5.35	2	4.28	4.3	4.3	0.04	1	4.30	4.3	4.3	.	1	1	100.0
	96	4	67.00	63.0	70.1	3.61	4	3.33	2.5	4.0	0.70	4	3.33	2.5	4.0	0.70	0	0	.
	.	0	.	.	.	.	1	4.80	4.8	4.8	.	1	4.80	4.8	4.8	.	1	1	100.0
	POST-M	17	71.65	63.0	81.5	5.10	8	3.66	2.5	4.3	0.64	7	3.57	2.5	4.3	0.64	6	6	100.0
	Total	17	71.65	63.0	81.5	5.10	9	3.78	2.5	4.8	0.71	8	3.73	2.5	4.8	0.73	7	7	100.0
SMALL	YEAR																		
	75	1	49.60	49.6	49.6	.	26	1.33	0.9	1.8	0.23	18	1.32	0.9	1.8	0.23	26	18	69.2
	77	0	.	.	.	.	18	1.34	0.9	2.1	0.27	7	1.33	1.1	2.1	0.35	18	7	38.9
	79	16	50.16	45.7	55.9	2.78	3	1.44	1.4	1.6	0.13	2	1.36	1.4	1.4	0.00	16	8	50.0
	89	2	55.90	50.8	61.0	7.21	0	.	.	.	.	0	.	.	.	.	0	0	.
	90	11	55.32	51.0	59.0	2.65	1	1.80	1.8	1.8	.	0	.	.	.	.	11	5	45.5
	91	2	54.50	54.0	55.0	0.71	1	1.70	1.7	1.7	.	1	1.70	1.7	1.7	.	2	2	100.0
	92	63	51.65	42.5	60.0	3.48	1	2.00	2.0	2.0	.	1	2.00	2.0	2.0	.	63	41	65.1
	93	52	51.17	43.0	62.0	4.05	44	1.45	0.8	2.2	0.33	36	1.42	0.8	2.2	0.33	52	40	76.9
	94	50	51.85	46.5	58.5	2.71	48	1.86	1.0	2.5	0.34	37	1.81	1.0	2.5	0.35	50	39	78.0
	95	130	51.37	44.0	61.0	3.34	92	1.48	0.8	2.5	0.33	32	1.49	0.8	2.5	0.38	45	32	71.1
	96	67	52.14	43.0	62.2	3.75	67	1.60	0.8	2.8	0.43	67	1.60	0.8	2.8	0.43	0	0	.
	.	17	50.12	45.7	55.9	2.69	47	1.34	0.9	2.1	0.24	27	1.33	0.9	2.1	0.25	60	33	55.0
	PRE-M	15	55.29	50.8	61.0	2.98	2	1.75	1.7	1.8	0.07	1	1.70	1.7	1.7	.	13	7	53.8
	POST-M	362	51.60	42.5	62.2	3.47	252	1.58	0.8	2.8	0.39	173	1.59	0.8	2.8	0.41	210	152	72.4
	Total	394	51.68	42.5	62.2	3.51	301	1.54	0.8	2.8	0.38	201	1.55	0.8	2.8	0.40	283	192	67.8

Appendix 3. Sea age distribution of small and large Atlantic salmon on Harrys River 1975-96.

HARRYS RIVER

		SEA AGE										Total	
		1SW		CS 1SW		AS 1SW		CS 2SW		2SW			
		N	%	N	%	N	%	N	%	N	%	N	%
LARGE	YEAR												
	77	.	.	.	.	.	.	.	.	1	100.0	1	100.0
	93	.	.	.	.	4	80.0	1	20.0	.	.	5	100.0
	95	.	.	1	12.5	.	.	2	25.0	5	62.5	8	100.0
	96	.	.	.	.	.	.	2	50.0	2	50.0	4	100.0
	.	.	.	.	.	.	.	.	.	1	100.0	1	100.0
	POST-M	.	.	1	5.9	4	23.5	5	29.4	7	41.2	17	100.0
	Total	.	.	1	5.6	4	22.2	5	27.8	8	44.4	18	100.0
SMALL	YEAR												
	75	27	100.0	.	.	.	.	.	.	.	.	27	100.0
	77	17	94.4	1	5.6	.	.	.	.	.	.	18	100.0
	79	16	100.0	.	.	.	.	.	.	.	.	16	100.0
	89	2	66.7	1	33.3	.	.	.	.	.	.	3	100.0
	90	11	100.0	.	.	.	.	.	.	.	.	11	100.0
	91	1	50.0	1	50.0	.	.	.	.	.	.	2	100.0
	92	45	71.4	18	28.6	.	.	.	.	.	.	63	100.0
	93	43	82.7	9	17.3	.	.	.	.	.	.	52	100.0
	94	41	89.1	5	10.9	.	.	.	.	.	.	46	100.0
	95	116	89.9	13	10.1	.	.	.	.	.	.	129	100.0
	96	54	80.6	13	19.4	.	.	.	.	.	.	67	100.0
	.	60	98.4	1	1.6	.	.	.	.	.	.	61	100.0
	PRE-M	14	87.5	2	12.5	.	.	.	.	.	.	16	100.0
	POST-M	299	83.8	58	16.2	.	.	.	.	.	.	357	100.0
	Total	373	85.9	61	14.1	.	.	.	.	.	.	434	100.0

Appendix 4. Smolt age distribution of small and large Atlantic salmon on Harrys River, 1975-96. Virgin spawners only.

HARRYS RIVER

		SMOLT AGE												Total		
		2			3			4			5					
		N	%	MEAN	N	%	MEAN	N	%	MEAN	N	%	MEAN	N	%	MEAN
SMALL	YEAR															
	75	.	.	.	22	81.5	3.0	5	18.5	4.0	.	.	.	27	100.0	3.2
	77	.	.	.	11	64.7	3.0	6	35.3	4.0	.	.	.	17	100.0	3.4
	79	1	6.3	2.0	10	62.5	3.0	5	31.3	4.0	.	.	.	16	100.0	3.3
	89	.	.	.	2	100.0	3.0	.	.	.	.	.	.	2	100.0	3.0
	90	.	.	.	10	90.9	3.0	1	9.1	4.0	.	.	.	11	100.0	3.1
	91	.	.	.	1	100.0	3.0	.	.	.	.	.	.	1	100.0	3.0
	92	2	4.5	2.0	40	90.9	3.0	2	4.5	4.0	.	.	.	44	100.0	3.0
	93	.	.	.	34	81.0	3.0	7	16.7	4.0	1	2.4	5.0	42	100.0	3.2
	94	.	.	.	26	66.7	3.0	13	33.3	4.0	.	.	.	39	100.0	3.3
	95	2	1.7	2.0	82	70.7	3.0	32	27.6	4.0	.	.	.	116	100.0	3.3
	96	.	.	.	37	68.5	3.0	16	29.6	4.0	1	1.9	5.0	54	100.0	3.3
	.	1	1.7	2.0	43	71.7	3.0	16	26.7	4.0	.	.	.	60	100.0	3.3
	PRE-M	.	.	.	13	92.9	3.0	1	7.1	4.0	.	.	.	14	100.0	3.1
	POST-M	4	1.4	2.0	219	74.2	3.0	70	23.7	4.0	2	0.7	5.0	295	100.0	3.2
	Total	5	1.4	2.0	275	74.5	3.0	87	23.6	4.0	2	0.5	5.0	369	100.0	3.2