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Canadian Stock Assessment Secretariat
Research Document 99/99
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Secrétariat canadien pour l'évaluation des stocks
Document de recherche 99/99
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STATUS OF THE ATLANTIC SALMON (*Salmo salar* L.) STOCK OF HARRY'S RIVER/PINCHGUT BROOK, NEWFOUNDLAND, 1998

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ISSN 1480-4883
Ottawa, 1999

Canada

ABSTRACT

Counts of small and large salmon and the proportion of large salmon at the Pinchgut Brook counting fence in 1998 were within 10% of those in 1997. The proportion of large salmon in 1997 was the highest recorded. Spawning surveys conducted in the fall of 1995-97 indicated that 33-41% of the spawning on Harry's River system is in the Pinchgut Brook tributary. The total spawning escapement estimated for 1998 was 1,596 small and 177 large salmon. Potential egg depositions from these spawners represented 49% of the conservation requirement. The Harry's River stock has been at most 52% of the conservation requirement in the last seven years. This is alarming considering the recreational fishery has been restricted to catch and release angling since 1996 and the commercial fishery was closed in 1992. There is still reason to be concerned for the conservation of this stock and the protection of spawning and rearing areas. Increasing juvenile densities indicate that there is a potential for improvement in the status of the stock in the long term but the low water levels and high water temperatures in 1998 create continued uncertainty in the short term.

RÉSUMÉ

Le nombre de petits et de grands saumons et la proportion de grands saumons à la barrière de dénombrement du ruisseau Pinchgut en 1998 correspondaient, à 10 % près, aux valeurs de 1997. La proportion de grands saumons de 1997 était la plus élevée jamais notée. Des relevés des géniteurs effectués à l'automne des années 1995 à 1997 ont montré que de 33 à 41 % du frai du bassin de la rivière Harry's s'effectuait dans le tributaire Pinchgut. L'échappée totale de géniteurs en 1998 a été estimée à 1 596 petits et 177 grands saumons. La ponte possible de ces géniteurs correspondait à 49 % des besoins de conservation. Les besoins de conservation du stock de la rivière Harry's n'ont, au mieux, été atteints qu'à 52 % au cours des sept dernières années. Cela est inquiétant étant donné que la pêche récréative est limitée à la pêche par capture et remise à l'eau depuis 1996 et que la pêche commerciale est interdite depuis 1992. Il y a toujours lieu de s'inquiéter de la conservation de ce stock et de la protection des aires de frai et de croissance. L'accroissement des densités de juvéniles montre qu'il y a possibilité d'amélioration de l'état du stock à long terme, mais les faibles niveaux et les températures élevées des eaux en 1998 continuent d'être source d'incertitude à court terme.

INTRODUCTION

Harry's River is the most northerly of the eight scheduled Atlantic salmon rivers flowing into Bay St. George, Salmon Fishing Area (SFA) 13 (Fig. 1). The recreational fishery on this river was under quota management until 1995 and the river has been closed to retention angling since 1996.

Recreational fishing success on Harry's River peaked during 1953-60 when the mean catch-per-unit-effort (CPUE) for small and large salmon was 0.95 (Appendix 1). In the next 10 years (1961-70), the mean angling effort increased by 119% but the mean catch did not increase to the same degree resulting in a 48% decrease in CPUE. The highest catches were in 1964 (2,673 small (<63 cm) and 373 large (>=63 cm)), making Harry's 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 Harry's 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 actually 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, delaying the 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 1984 anglers were restricted to catch and release only of large salmon. In 1987, individual river quotas for small salmon were introduced on several SFA 13 rivers including a quota of 350 small salmon on Harry's River. The low juvenile densities recorded in electrofishing surveys on Harry's River in 1987 and 1988 suggested that future recruitment would be low (Claytor and Mullins, MS 1989). This turned out to be the case with the recreational fishery on Harry's River being open the entire season in only two years since 1986.

In 1993-95, after the introduction of the commercial fishery moratorium, recreational catches of small salmon remained among the lowest on record but large salmon showed signs of improvement. However, estimates of spawning escapements in those years indicate that the population size of both small and large salmon remained at a low level (Mullins et al., 1997).

This document presents the seventh assessment of the status of the Atlantic salmon stock of Harry's River since 1992. The status of the stock is assessed relative to the conservation requirement based on counts of adult salmon at the counting fence on Pinchgut Brook tributary and spawning surveys of the entire river system.

METHODS

RECREATIONAL FISHERY

Recreational catches and effort in 1996-98 were based on the licence stub return system (O'Connell et al. MS 1999). This system of collection is not directly comparable to traditional methods used by DFO River Guardians.

ADULT COUNTS - PINCHGUT BROOK

Adult salmon have been enumerated annually since 1992 at a counting fence on Pinchgut Brook. The counting fence is located at the mouth of Pinchgut Brook tributary approximately 48km upstream from the mouth of Harry's River (Fig. 2). With the exception of the addition of a second counting trap in 1997, the installation has not changed since 1992.

The spawning escapement on Pinchgut Brook tributary is assumed to be equivalent to the number of adults enumerated at the fence adjusted for angling removals above the fence and 10% mortality on hooked and released fish. In an effort to preserve the spawning stock, angling has not been permitted since 1996.

SPAWNING ESCAPEMENTS AND EGG DEPOSITIONS - HARRY'S RIVER

a) Spawning Escapements

Total spawning escapements on Harry's River (TSE), in 1998 were based on spawning escapements on Pinchgut Brook adjusted for the average proportion of spawning on Pinchgut Brook in 1992-97 (Mullins et al., 1997; Mullins et al., 1996). A spawning survey was not conducted in 1998.

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

Where:

PS = Pinchgut Brook spawners
PR = Pinchgut Brook adjusted redd count
TR = Total redd count on Harry's River

The estimated spawning escapement on Harry's River was apportioned into small and large size categories based on the proportion of small and large salmon observed at the Pinchgut Brook counting fence.

A mark-recapture experiment on Harry's 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).

In 1994-98, water temperature (C) was recorded at the counting fence a 'Hobotemp' temperature logger.

b) Spawning Surveys

The proportion of Harry's River salmon that spawn in the Pinchgut Brook tributary was derived based on three spawning surveys of the entire river system conducted in November of 1995, 1996 and 1997. Redds counted during the surveys were adjusted based on the proportion of each tributary surveyed (Mullins et al. 1996). Unproductive or inaccessible areas were not surveyed.

c) Estimation of Conservation Requirement

Lacustrine habitat available to salmon on Harry's River system is 4,068 ha based on digitised 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 tributary, available lacustrine habitat includes a portion of the area of George's Lake. This portion was equivalent to the percentage of the total tributary length flowing into George's Lake from the Pinchgut Brook system (45% or 684 ha). The surface area of George's Lake and other lakes (> 10 ha) was measured directly from digitised 1:50,000 scale topographic maps (Mullins et al., MS 1996).

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

c) Estimation of Potential Egg Deposition

Available biological information for Harry's River salmon is given in Appendices 2-4. Information for 1992-98 was based on sampling conducted at the Pinchgut Brook counting fence. The sex composition (both internal and external sexing) and mean weight of females used to estimate potential egg depositions in 1998 were based on 1992-98 means as sample sizes at the fence were small (<30). Values for 1997 were from sampling conducted at the counting fence in 1997. 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 1.59kg 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 relative fecundity value of 1,540 eggs/kg of body weight for small and large salmon is from Anon. (1978). This value has been used in previous assessments by Porter and Chadwick (MS 1983). However, it is recognized that there are differences between rivers and annual variations in this value that would affect the calculation of egg deposition.

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

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

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

JUVENILE DENSITIES

Juvenile densities (#/100 m^2) are available from three sites (Fig. 2) monitored annually on Harry's River in 1987-88 and 1992-98. Numbers of juveniles in each site were determined by electrofishing surveys using the depletion method (Zippen, 1958). Calculations are based on computer software developed by Van Deventer and Platts, 1985.

RESULTS

RECREATIONAL FISHERY

The fishery in 1998 as in 1996-97 consisted of catch and release angling only with opening and closing dates remaining the same. Angling in the headwaters upstream from Home Pool (Fig. 2) has been closed since 1996. Preliminary data from license stub returns indicate a total of 139 small and 67 large salmon hooked and released in 1998 (Appendix 1). These were the lowest catches since 1996. Effort information for 1998 was not available from the license stub return data. However, the low catches would suggest that transfer of angling effort to Harry's River as a result of the reduction in the retention limit on other rivers to one small salmon per day up to 5 July was minimal. This change in retention limit did appear to result in more effort being directed towards catch and release angling on other rivers.

Year	Season	Bag Limit	Quota	Closures
1992	20 June-7 Sept.	8 (2 per day)	5000 SFA 13; 350 river	Closed 2 August SFA quota reached
1993	12 June-6 Sept.	8 (1 per day)	5000 SFA 13; 350 river	Closed 22 August river quota reached
1994	1 July-15 Aug.	3+3 (2 per day)	350 river	Closed 8 August due to low returns
1995	10 June-4 Sept.	3+3 (2 per day)		Closed to retention 16 July due to low returns
1996	15 June-2 Sept.	No retention		Closed above Home Pool
1997	14 June-1 Sept.	No retention		Closed above Home Pool
1998	13 June-7 Sept.	No retention		Closed above Home Pool

Anglers at public consultation meetings in 1997 suggested that the high water levels early in the 1997 season resulted in lower numbers of anglers on the rivers and may have resulted in the higher spawning escapements on all Bay St. George rivers in 1997. Whatever happened in 1997 to cause the low returns in other parts of the island did not happen in Bay St. George because returns were good in 1997.

ADULT COUNTS - PINCHGUT BROOK

The counting fence was installed 12 June 1998, similar to previous years, and removed 22 September. A total of 593 small and 63 large were counted at the fence in 1998 (Table 1; Fig. 3). The number of small salmon was 3% higher than in 1997 and 9% higher than the 1992-96 mean. The number of large salmon was 7% less than the highest recorded in 1997 but 97% higher than the 1992-96 mean. The proportion of large salmon was the same as in 1997 but 66% greater than in 1996 and 100% greater than the 1992-96 mean.

The fence removal date in 1998 was earlier than in most years due to a shortage of manpower necessary to maintain it during high flow conditions. However, based on the water levels

observed in the later part of the season (Fig. 4), the run was completed before removal of the counting fence. As in previous years, peak counts of small and large salmon at the fence in 1998 coincided with peaks of water discharge (Fig. 4). Water levels and salmon counts increased after mid-August following several weeks of low water levels. Water levels remained high up to the time the counting fence was removed.

Harry's River is considered a late-run river compared to others in Bay St. George (Reddin and Mullins, MS 1996). Counts of small salmon at a counting fence operated near the mouth of the river in 1967 (Downer, MS 1968) indicated that approximately 50% of the run entered after mid-July (Mullins et al., MS 1996). In the seven years of operation at Pinchgut Brook, run timing of small salmon at the counting fence (defined as the date that 50% of the cumulative count) was mid-July or later (Fig. 5). Even in 1996, when the counting fence was installed 24 May, the first salmon was not counted until mid-June indicating that it is unlikely that salmon entered Pinchgut Brook prior to the installation of the counting fence in any year of operation. The run timing of both small and large salmon in 1998 was the second earliest in seven years of operation (Fig. 5). The earliest was in 1996 when the peak spring runoff occurred in February.

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
1997	13 June to 15 October
1998	12 June to 22 September

The timing of small salmon counts at the Pinchgut Brook counting fence has been relatively stable in the seven years of operation with the main run entering the tributary between mid-July and early August (Fig. 4). Regressions of the total counts at the fence on the cumulative weekly counts in 1992-97 were significant ($p < 0.05$) after 19 July (Fig. 6). With the exception of 1992, at least 50% of small salmon had passed through the fence by that date (Fig. 7). The regression based on counts up to 26 July 1992-97 successfully predicted the total count of small salmon in 1998 to within 10%. Assuming that the run timing and proportion of the Harry's River run entering Pinchgut Brook tributary continues to remain stable, this can be a useful means of predicting runs in-season.

Date	Count To Date	Predicted Total	%Difference
21-Jun	0	538	-10
28-Jun	10	502	-18
5-Jul	22	451	-31
12-Jul	101	503	-18
19-Jul	318	629	6
26-Jul	346	553	-7
2-Aug	354	511	-16
9-Aug	357	507	-17
16-Aug	459	563	-5

SPAWNING SURVEYS

Spawning surveys were carried out on Harry's River on 13-16 November 1995-97. Pinchgut Brook tributary which is 21.9% of the total length of accessible tributaries on Harry's River accounted for 37% of the adjusted redd counts in 1997, 33% in 1996, 41% in 1995 and 34.6% in 1967 (Table 2).

These differences indicate a relatively low annual variability in the distribution of spawning. 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 higher percentage of spawners on the Pinchgut Brook system in 1997 compared to 1996 may have been due, in part, to natural redistribution of spawners within the Harry's River system.

The adjusted redd counts on the Pinchgut Brook system represented less than one redd per female based on the percentage female of small and large salmon recorded at the fence. It is possible that some redds were missed in the survey. However, because this error would have been consistent throughout the system, it would not have affected the percentage of spawning on Pinchgut Brook. Errors in counting redds were low overall based on the test site and were assumed to be the same for all tributaries surveyed.

Redd counts by teams at test site, 1997.

Crew	No. Redds
1	32
2	44
3	45
4	45
5	45
6	70
7	49
8	49
9	55
10	62
11	53
Mean	49.9
Std	10.07

It is also possible that all spawning was not completed at the time of the survey. However, this is very unlikely given that a site on one tributary was monitored from early October until no new redds were observed. Spawning at the test site peaked at a water temperature of 7-12 C and was completed by mid-November (Fig. 8). The substrate in most of the tributaries of Harry's River is relatively stable so it is unlikely that redds would have been flattened by any change in water levels during spawning. Water levels were stable at the test site during the spawning period in 1997.

SPAWNING ESCAPEMENTS AND EGG DEPOSITIONS - HARRY'S RIVER

It was estimated that 1,596 small (min. 1,440; max. 1,789) and 177 large (min. 160; max. 199) salmon spawned on Harry's River in 1998 based on 37% (min. 33%; max. 41%) spawning on Pinchgut Brook (Table 3). This was 4% less than in 1997 but 56% more than the 1992-96 mean.

The conservation requirement for Harry's River is 7,831,584 eggs based on updated habitat information. The potential salmon egg deposition in 1998 was 3.81 million, 49% of the conservation requirement (Table 3; Fig. 9). This is 2% less than in 1997, but 53% higher than the

1992-96 mean and more than twice the percentage achieved in 1992. With less than 100 fewer spawners in 1998 compared to 1997 the difference is due to a lower mean weight of females.

JUVENILE DENSITIES

Densities of both fry (young of the year) and parr (juveniles of one or more years old) at all three sites show an increasing trend in recent years (Fig. 10) suggesting an improvement in juvenile abundance.

Water flow from mid-May to 11 August 1998 was the lowest recorded in thirty years of available information (Fig. 11). Water temperatures recorded at the counting fence were the highest since 1992 (Fig. 12) from mid-June to mid-August. Low water levels and high water temperatures can cause increased stress on juvenile salmon resulting in lower juvenile survival and decreased smolt production.

DISCUSSION

The Atlantic salmon stock of Harry's River has been at most 52% of the conservation requirement in the last seven years. Nevertheless, it is encouraging that the number of small salmon has remained fairly stable and that the numbers and proportion of large salmon have increased. However, the stock achieved only 49% of the conservation requirement in 1998 based on this assessment. This is alarming considering that there was no retention fishery on the river in the last three years and that the commercial fishery has been closed since 1992. Based on historical angling catches, the abundance of salmon in the river in 1992-98 was low compared to historic levels. This is consistent with views expressed by anglers at public consultations, that Bay St. George rivers, with some exceptions, have generally experienced poor returns in recent years. Anglers reported increased sightings of salmon on the river in 1996-97 compared to previous years. However, poaching within the river has been identified by both anglers and DFO river guardians as contributing to low spawning escapements on Harry's River. It has been suggested that poaching may 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 Harry's River in 1998 but was achieved on Pinchgut Brook and perhaps on other tributaries. There are several factors to be considered in the analysis of salmon returns to Pinchgut Brook and other tributaries relative to Harry's River as a whole. The Pinchgut Brook tributary is the uppermost headwater of Harry's River. It comprises 6% of the fluvial habitat suitable for parr rearing but spawning surveys in 1995-97 indicate that it is the primary spawning area for the Harry's River system. Pinchgut Brook contains the largest proportion of the spawning habitat and the largest spawning escapement (33-41%) 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 Harry's River, particularly the main stem. Angling activity on Pinchgut Brook and other headwater tributaries represented only 7.2% of the Harry's River total in 1984-89. All headwater tributaries should remain closed to angling in order to preserve them as sanctuaries for spawning salmon. In addition, the current restriction on retention of small salmon in the main stem should remain in effect in order to permit the highest possible spawning escapements.

The lower reaches of the main stem of Harry's 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 parr rearing area. Therefore, Pinchgut Brook, and other tributaries, likely produce juvenile salmon that must disperse downstream and rear in George's Lake which comprises

56% of the lacustrine habitat (Porter et al., MS 1974) and other parts of the main stem, particularly in the summer months. Beall et al. (1994) reported dispersal of one-year-old parr up to 2,400 m downstream from the spawning site in summer. Considering that the stock is still at an extremely low level and that juvenile salmon are utilising the entire system for rearing, any habitat alterations could potentially be harmful to the stock. It would be wise to exercise extreme caution in permitting any work to be carried out within the Harry's River system that might result in habitat alterations.

Increasing juvenile densities at three sites suggest that there is a good potential for improvement in the Harry's River salmon stock in the long term. However, low water levels and high temperatures such as occurred in 1998 create continued uncertainty for juvenile survival and salmon production in the short term.

ACKNOWLEDGEMENTS

We thank the Salmon Preservation Association for the Waters of Newfoundland for sponsoring student assistants to help with the operation of the counting fence on Pinchgut Brook. Funding for students was provided by the Department of Human Resources Development Canada. Water flow data for Harry's River was supplied by Environment Canada, Inland Waters Directorate, Corner Brook, Nfld.

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Table 1. Counts of small and large salmon at the Pinchgut Brook counting fence, 1992-98.

Year	Fence Counts			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
1997	613	68	681	0.90	0.10
1998	593	63	656	0.90	0.10
Mean (92-96)	543	32	575	0.95	0.05

Table 2. Percentage of spawning on major sections of Harry's River, 1967-68 and 1995-97.

	# Redds		Percentage of Redds					
			Pinchgut Brook System		Georges Lake System		Main Stem	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1967			53.1		0.0		46.9	
1968			34.6		0.0		65.4	
1995	558	714	50.2	41.0	32.1	28.8	17.7	30.2
1996	1120	1270	36.6	33.0	28.0	24.8	35.4	42.2
1997	823	950	41.2	37.0	24.9	24.3	33.9	38.7
Mean	834	978	43.1	37.0	28.3	26.0	29.0	37.0
Min.	558	714	36.6	33.0	24.9	24.3	17.7	30.2
Max.	1120	1270	50.2	41.0	32.1	28.8	35.4	42.2
N	3	3	5	3	5	3	5	3
CV	33.7	28.5	19.0	10.8	55.5	9.5	60.9	16.7

Table 3. Estimated spawning escapement and potential egg deposition by Atlantic salmon on Harry's River, 1992-98.

Harry's River, 1992-98

Year	Spawning Escapement				Potential Egg Deposition (x 10^6)			Percent Conservation Egg Deposition*
	Pinchgut	Harry's						
	Total	Small	Large	Total	Small	Large	Total	
1992	217	517	12	529	0.83	0.08	0.91	12
1993	591	1,342	99	1,441	2.25	0.67	2.92	37
1994	592	1,333	111	1,444	2.88	0.75	3.63	46
1995	777	1,827	68	1,895	3.30	0.46	3.76	48
1996	639	1,820	116	1,936	3.28	0.79	4.07	52
1997	681	1,657	184	1,841	2.65	1.24	3.90	50
1998	656	1,596	177	1,773	2.61	1.20	3.81	49
Min. 1998		1,440	160	1,600	2.36	1.08	3.44	44
Max. 1998		1,789	199	1,988	2.93	1.34	4.27	55
Mean (92-96)	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.

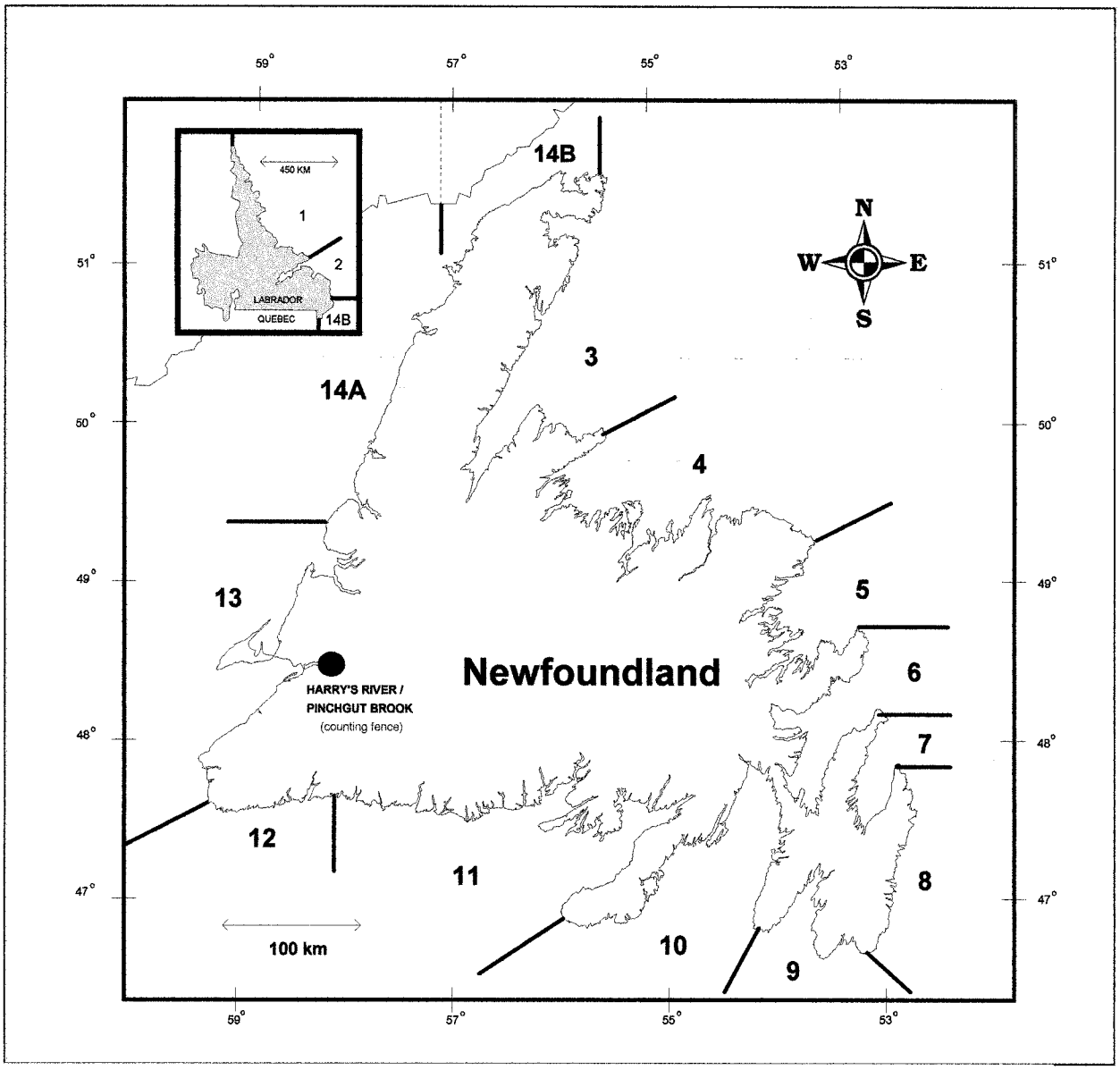


Figure 1. Salmon Fishing Areas (SFAs) of Newfoundland and Labrador.

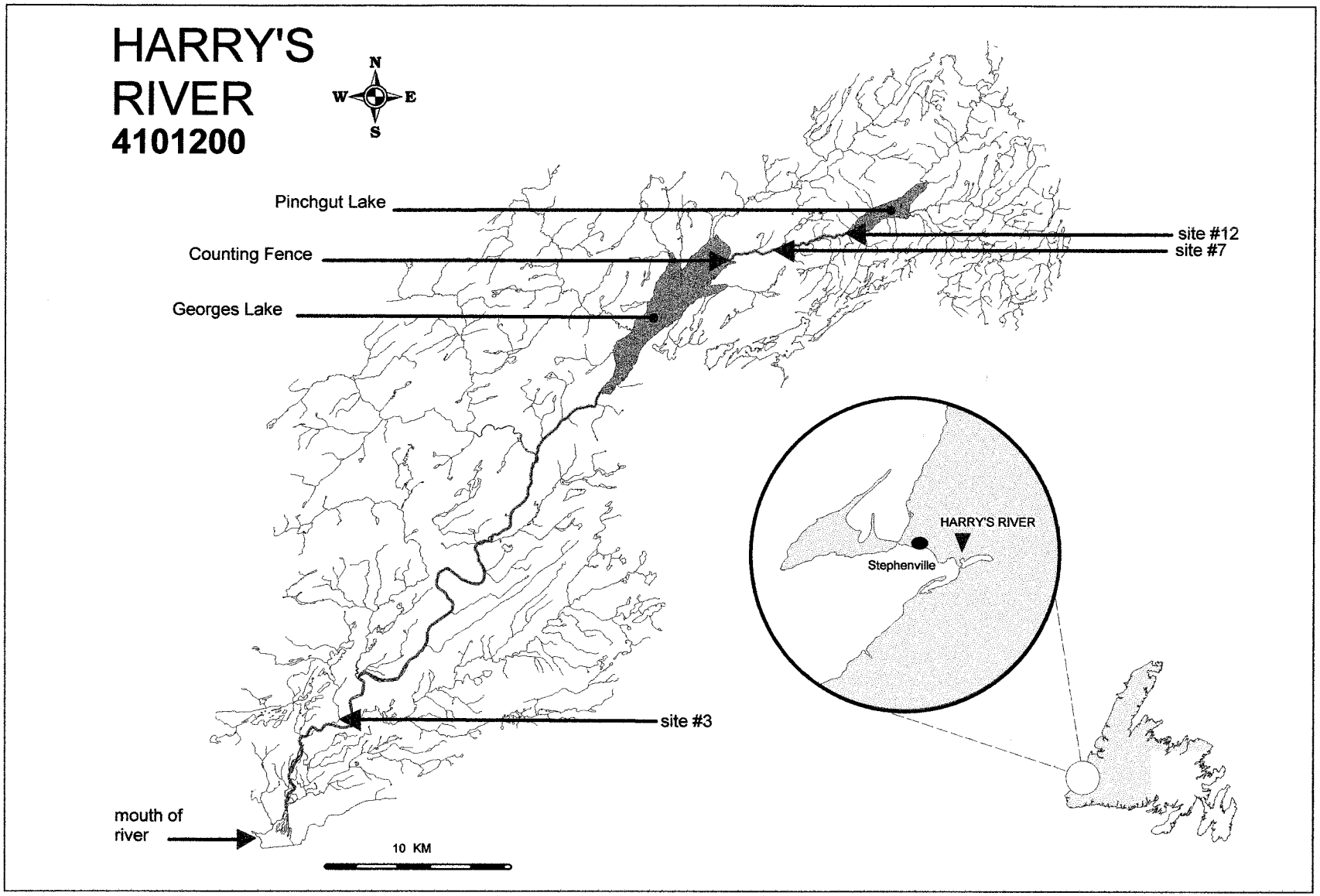
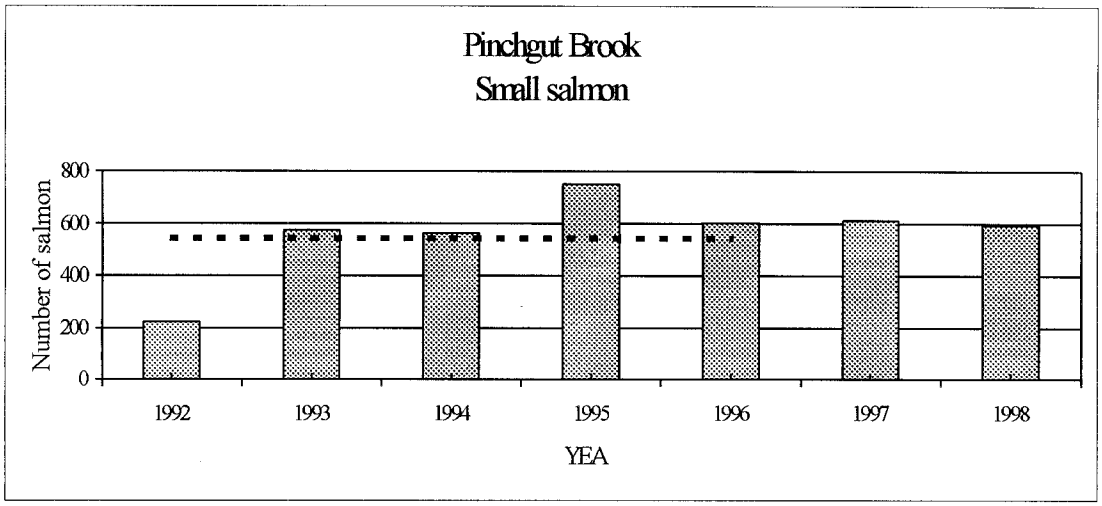


Figure 2. Location of selected features of the Harry's River system.



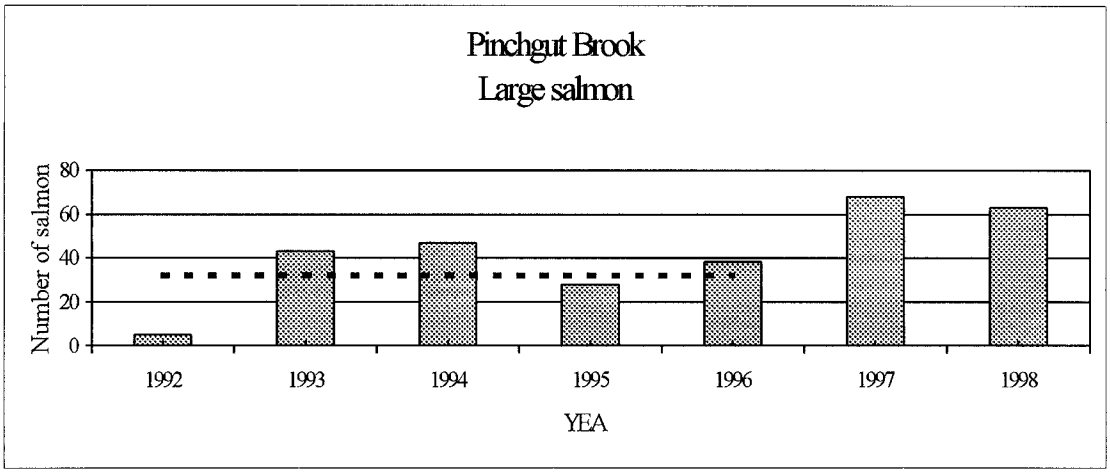
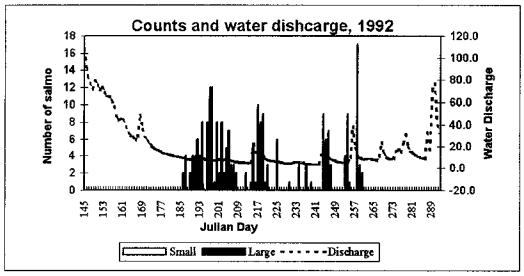
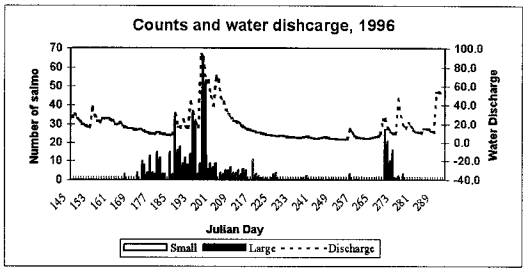
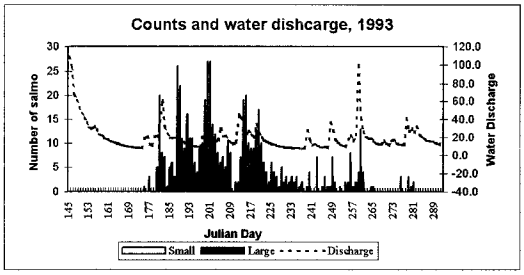
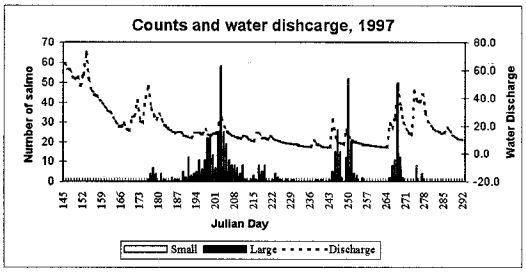


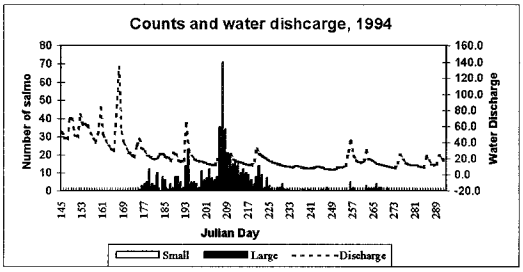
Figure 3. Counts of small and large salmon at the Pinchgut Brook counting fence, 1992-1998.

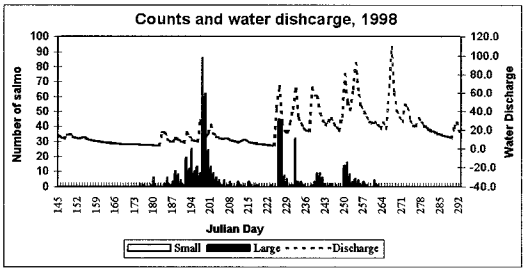












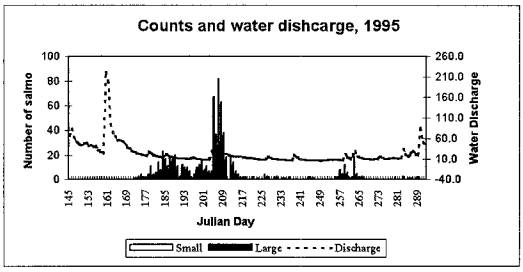


Figure 4 . The daily count of salmon at the counting fence on Pinchgut and the daily water discharge of Harrys River, 1992-98.

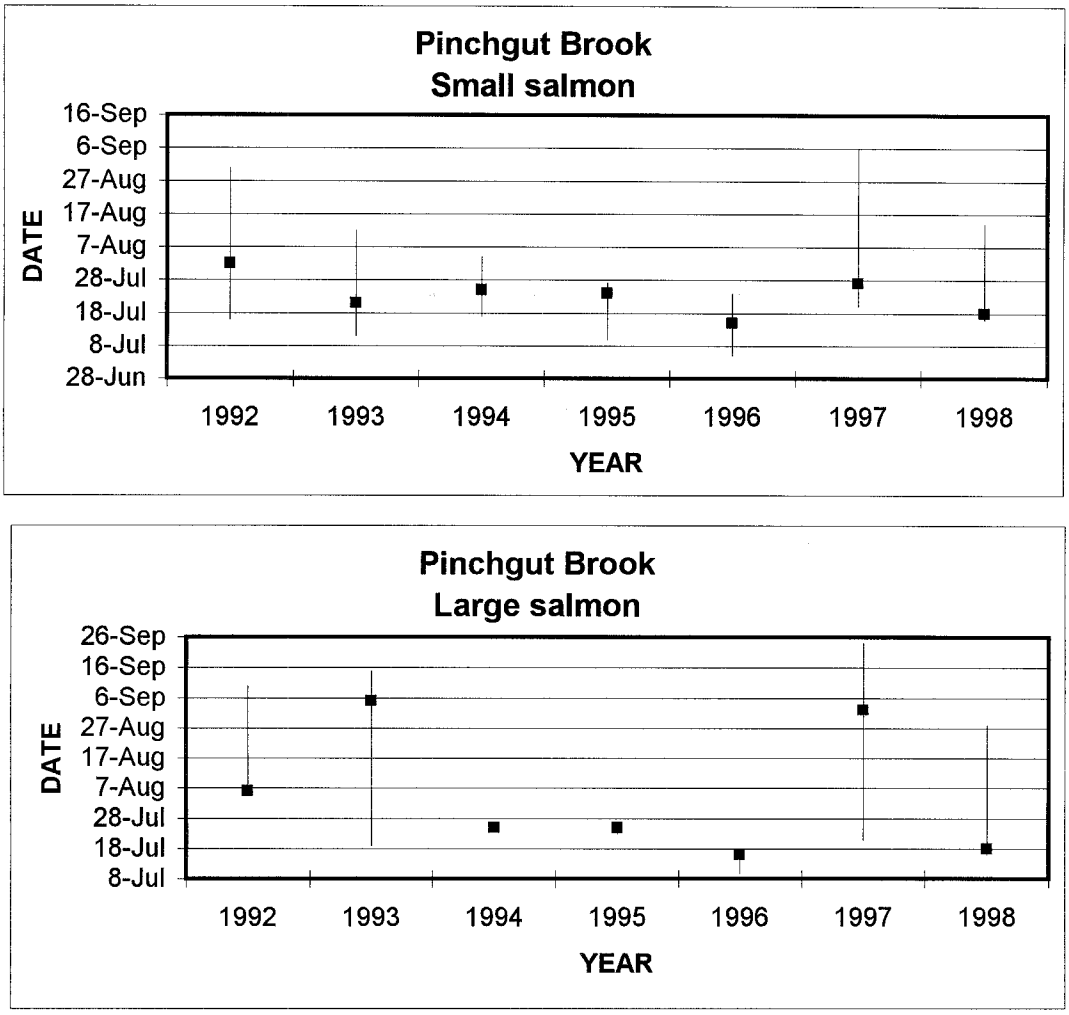


Figure 5. Run timing of small and large salmon at the Pinchgut Brook counting fence, 1992-1998.

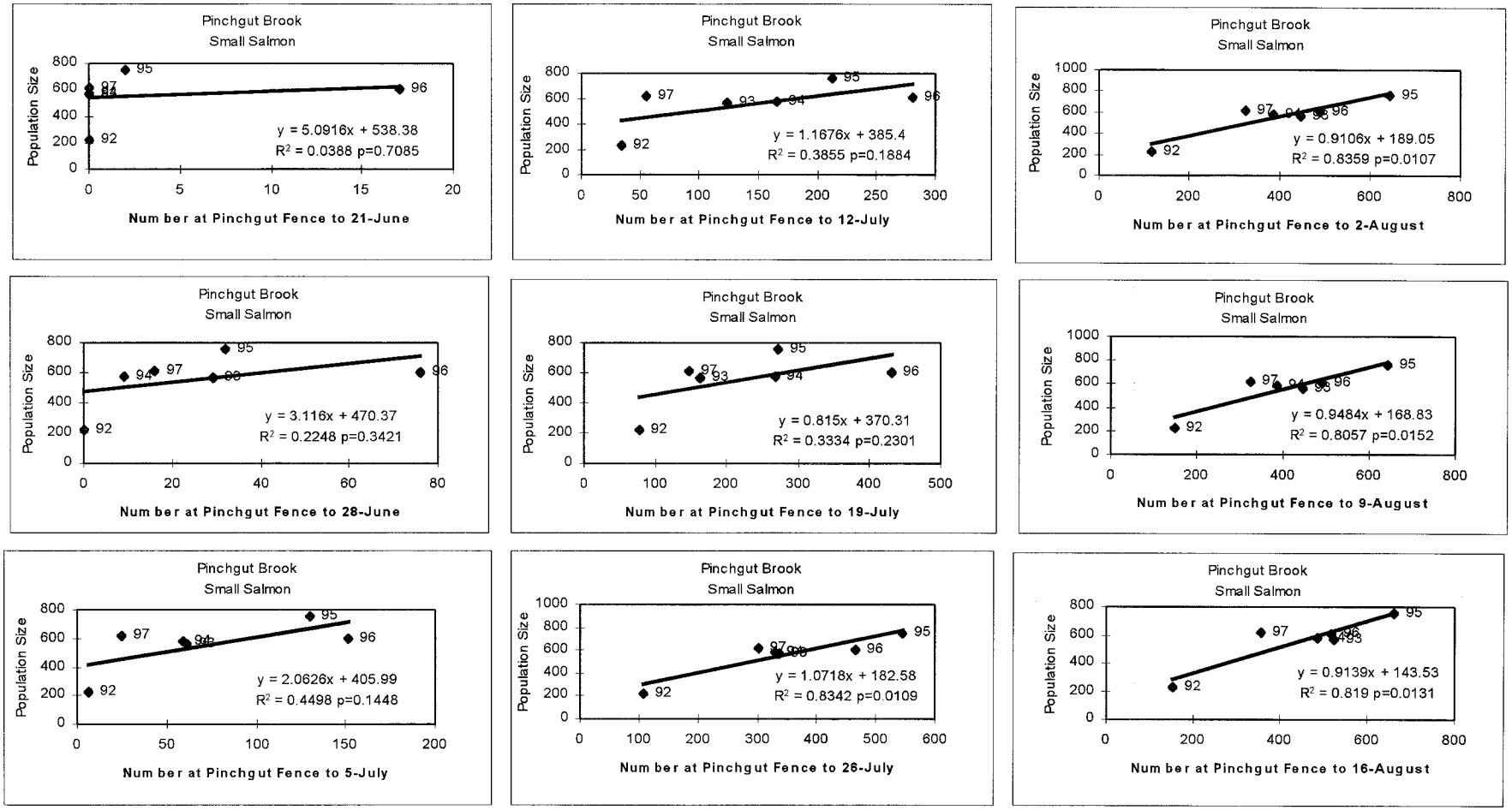


Figure 6. Regressions of total number of small salmon and counts to date at Pinchgut Brook counting fence, 1992-98.

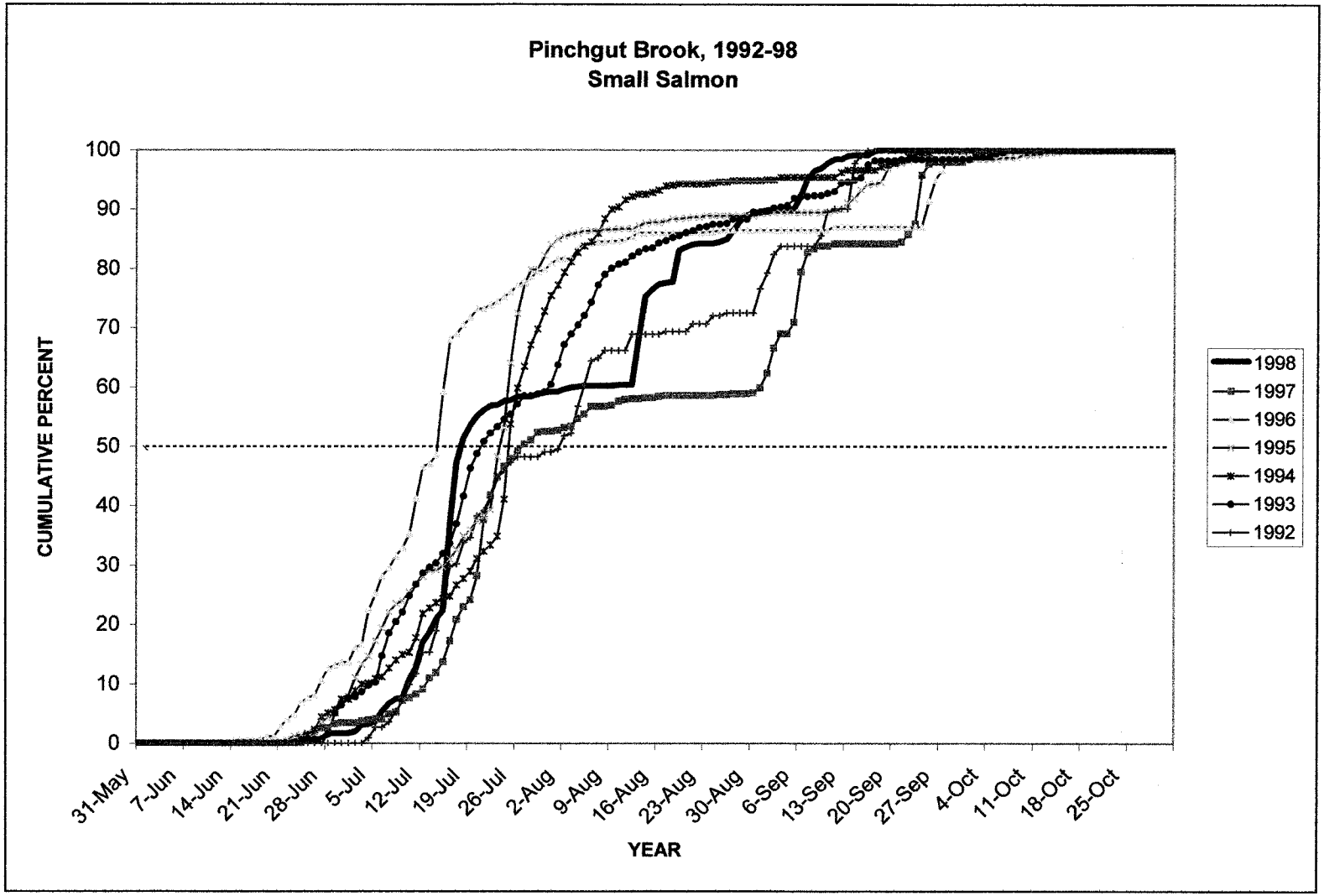


Figure 7. Cumulative percentage of counts of small salmon at the Pinchgut Brook counting fence, 1992-98. Horizontal line represents 50% of the cumulative count.

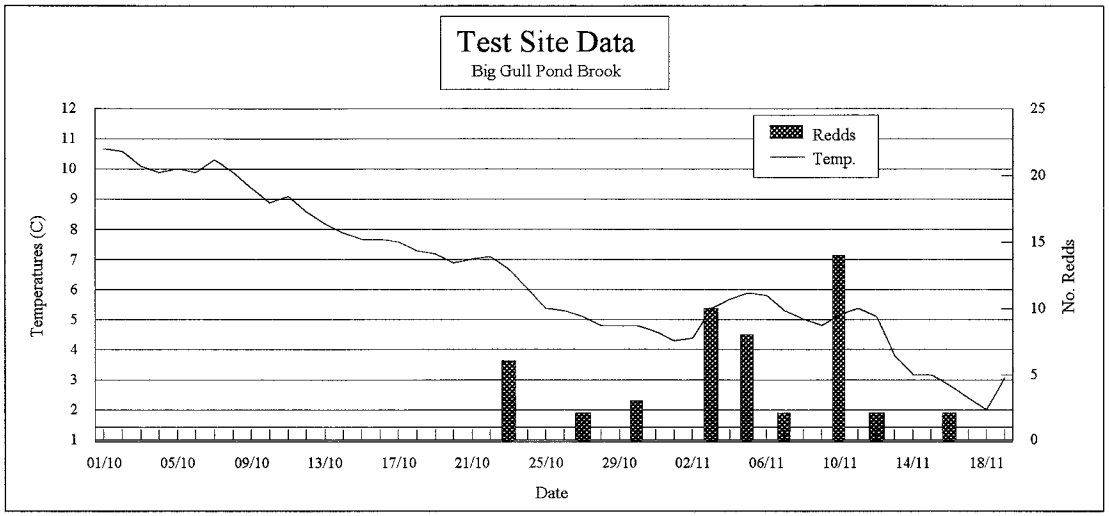


Figure 8. Daily count of Atlantic salmon redds and water temperature at spawning survey test site 1997.

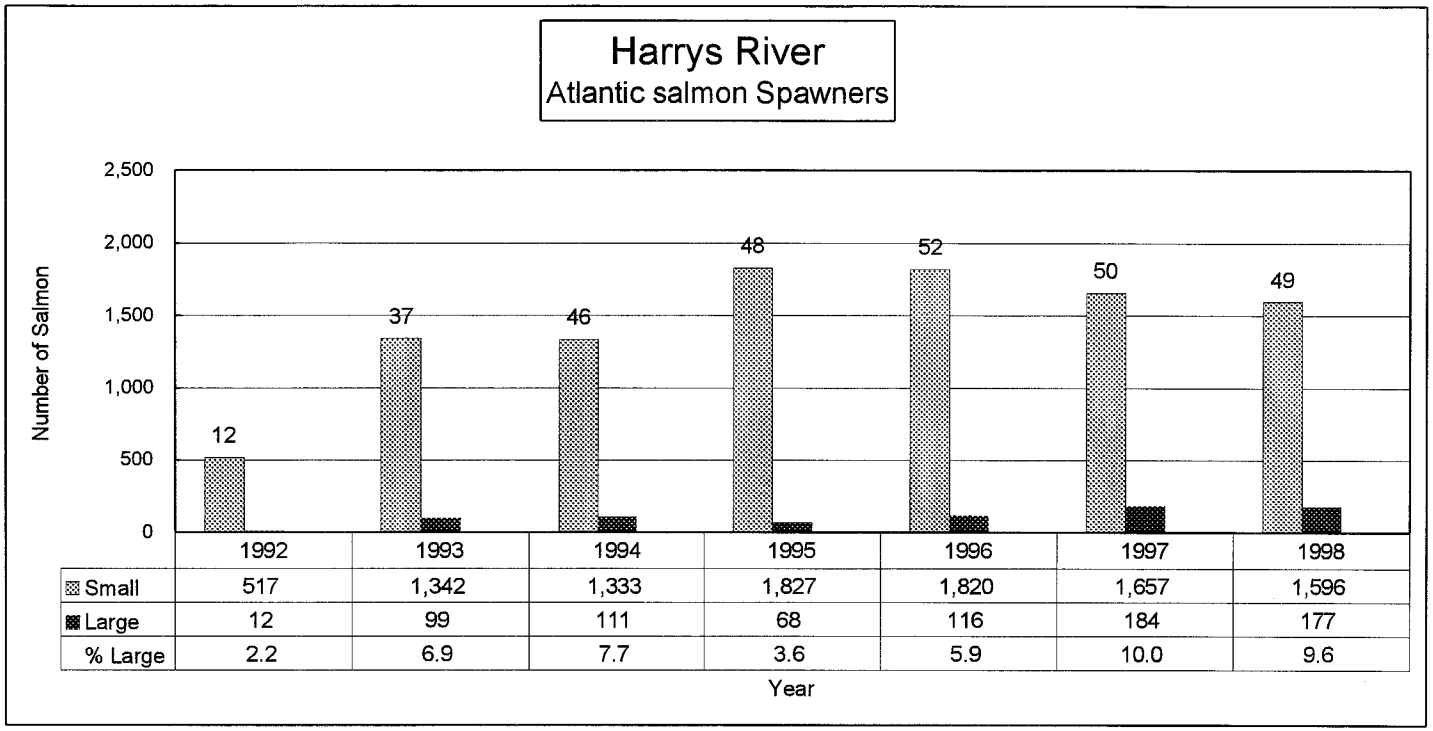


Figure 9. Spawning escapement of small and large salmon on Harrys River, 1992-1998. Numbers above bars represent % of conservation achieved.

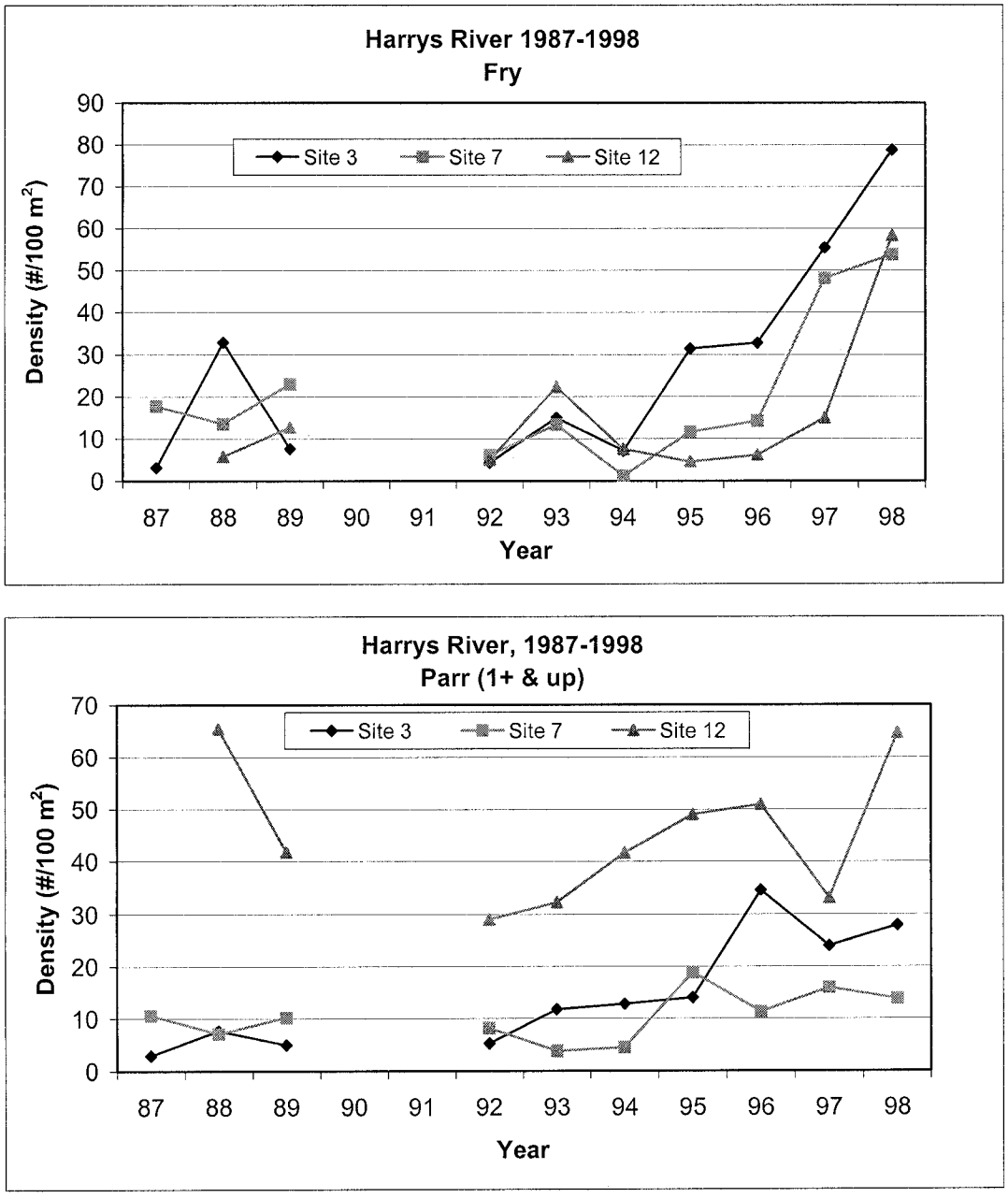


Figure 10. Density of juvenile salmon at sites 3, 7 and 12 on Harrys River, 1987-1998.

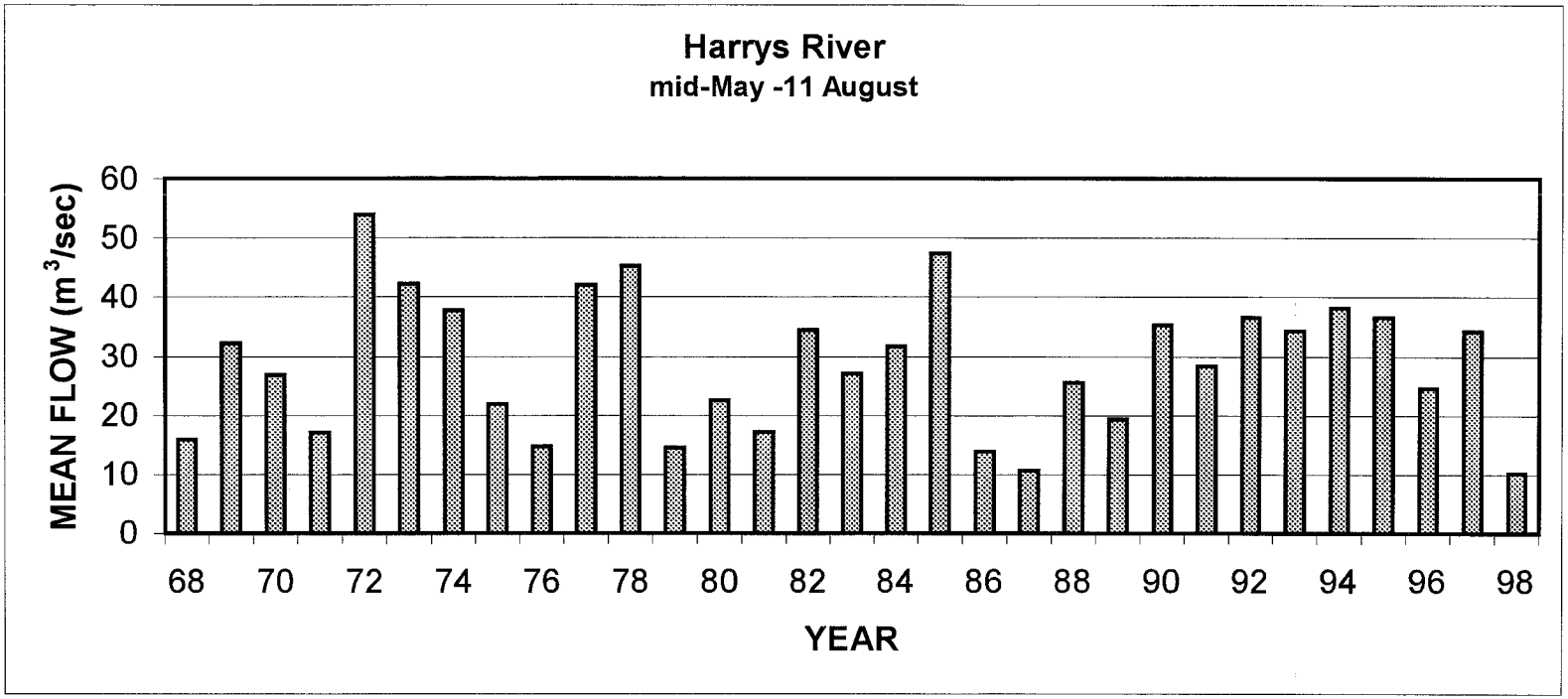


Figure 11. Mean water flow (m^3/sec) on Harrys River from mid-May to 11 August, 1968-98. Data supplied by Environment Canada.

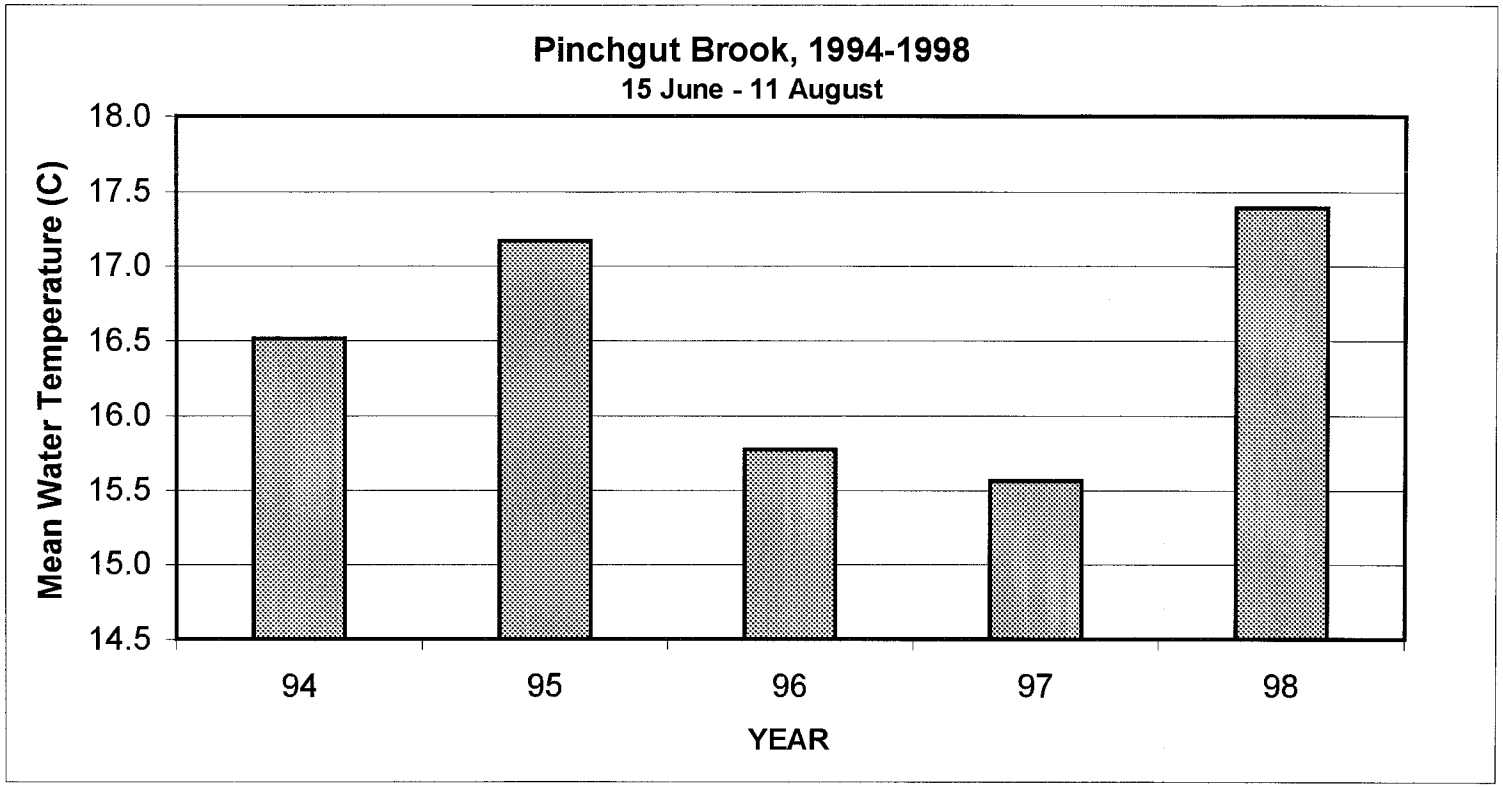


Figure 12. Mean water temperature for 15 June - 11 August recorded at the Pincgut Brook counting fence, 1994-98.

Appendix 1. Recreational catches of retained and released Atlantic salmon on Harry's River, 1953-98. Means are for years with similar management plans.

Year	Effort (Rod days)	Small salmon			Large salmon			Total Catch			CPUE	Prop. Large
		Ret.	Rel.	Total	Ret.	Rel.	Total	Ret.	Rel.	Total		
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	311 (2)	35	346	.	28	28	311	63	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	149	104	253	0.20	0.17
1996*	.	34	1196	.	.	206	.	34	1402	1436	.	0.14
1997*	.	2	591	.	.	139	.	2	730	732	.	0.19
1998*	.	.	139	.	.	67	.	.	206	206	.	0.33
Mean(92-96)	1347	193	280	227	0	76	34	193	355	548	0.16	0.14
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 1992-96 from:												
Mean(84-91)	-33	-56	.	-48	.	803	311	-56	4141	23	-29	747

* Data based on license stub return system.

Numbers in parentheses:

1. River quota reached.
2. Zone quota reached.
3. No closures
4. Closed due to low water.
5. Closed after in-season review.

Appendix 2. Mean fork length, weight and sex composition of small and large female Atlantic salmon.
Note: Sex is determined internally and externally for small and large salmon.
Note: Samples are from recreational fishery and counting fence.
Note: The whole weight given for Harrys 1996 is for males and females combined.

HARRYS

		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	YY																		
	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	.
	97	4	77.30	71.4	82.3	5.21	3	4.20	3.1	5.5	1.21	0	.	.	.	.	3	0	.
	98	8	72.48	65.0	80.3	5.57	8	3.19	2.1	4.7	0.88	5	3.04	2.1	4.7	1.09	8	5	62.5
	1992-98	29	72.66	63.0	82.3	5.41	19	3.54	2.1	5.5	0.87	12	3.35	2.1	4.7	0.86	17	11	64.7
	Total	29	72.66	63.0	82.3	5.41	19	3.54	2.1	5.5	0.87	12	3.35	2.1	4.7	0.86	17	11	64.7
SMALL	YY																		
	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	.	.	.	.	19	1.52	0.9	4.8	0.84	8	1.76	1.1	4.8	1.27	19	8	42.1
	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	53	51.11	43.0	62.0	4.04	44	1.45	0.8	2.2	0.33	36	1.42	0.8	2.2	0.33	53	41	77.4
	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	.
	97	53	53.04	46.5	61.0	3.23	53	1.68	1.0	3.0	0.40	34	1.62	1.0	3.0	0.42	53	34	64.2
	98	69	50.12	40.8	59.8	4.16	66	1.19	0.5	1.9	0.33	44	1.16	0.5	1.9	0.34	68	45	66.2
		17	50.12	45.7	55.9	2.69	48	1.41	0.9	4.8	0.55	28	1.45	0.9	4.8	0.70	61	34	55.7
	1984-91	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
	1992-98	485	51.54	40.8	62.2	3.62	371	1.52	0.5	3.0	0.41	251	1.52	0.5	3.0	0.43	332	232	69.9
	Total	517	51.60	40.8	62.2	3.64	421	1.51	0.5	4.8	0.43	280	1.51	0.5	4.8	0.46	406	273	67.2

Appendix 3. Sea-age distribution of small and large Atlantic salmon.

HARRYS

		SEA-AGE										Total	
		1SW		CS 1SW		AS 1SW		CS 2SW		2SW			
		N	%	N	%	N	%	N	%	N	%	N	%
LARGE	YY												
	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
	97	.	.	1	33.3	2	66.7	.	.	.	.	3	100.0
	98	.	.	1	12.5	5	62.5	2	25.0	.	.	8	100.0
	1992-98	.	.	3	10.7	11	39.3	7	25.0	7	25.0	28	100.0
	Total	.	.	3	10.7	11	39.3	7	25.0	7	25.0	28	100.0
SMALL	YY												
	75	27	100.0	.	.	.	.	.	.	.	.	27	100.0
	77	17	89.5	1	5.3	.	.	.	.	1	5.3	19	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
	97	40	78.4	10	19.6	1	2.0	.	.	.	.	51	100.0
	98	59	85.5	9	13.0	1	1.4	.	.	.	.	69	100.0
		60	96.8	1	1.6	.	.	.	.	1	1.6	62	100.0
	1984-91	14	87.5	2	12.5	.	.	.	.	.	.	16	100.0
	1992-98	398	83.4	77	16.1	2	0.4	.	.	.	.	477	100.0
	Total	472	85.0	80	14.4	2	0.4	.	.	1	0.2	555	100.0

Appendix 4. Smolt-age distribution of small and large Atlantic salmon.
Virgin spawners only.

HARRYS

		SMOLT-AGE												Total		
		2			3			4			5					
		N	%	MEAN	N	%	MEAN	N	%	MEAN	N	%	MEAN	N	%	MEAN
LARGE	YY															
	95	.	.	.	4	80.0	3.0	1	20.0	4.0	.	.	.	5	100.0	3.2
	96	.	.	.	.	.	.	2	100.0	4.0	.	.	.	2	100.0	4.0
	1992-98	.	.	.	4	57.1	3.0	3	42.9	4.0	.	.	.	7	100.0	3.4
SMALL	YY															
	75	.	.	.	22	81.5	3.0	5	18.5	4.0	.	.	.	27	100.0	3.2
	77	.	.	.	11	61.1	3.0	7	38.9	4.0	.	.	.	18	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
	97	.	.	.	35	87.5	3.0	5	12.5	4.0	.	.	.	40	100.0	3.1
	98	1	1.7	2.0	37	63.8	3.0	19	32.8	4.0	1	1.7	5.0	58	100.0	3.3
		1	1.6	2.0	43	70.5	3.0	17	27.9	4.0	.	.	.	61	100.0	3.3
	1984-91	.	.	.	13	92.9	3.0	1	7.1	4.0	.	.	.	14	100.0	3.1
	1992-98	5	1.3	2.0	291	74.0	3.0	94	23.9	4.0	3	0.8	5.0	393	100.0	3.2