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THE STATUS OF THE ATLANTIC SALMON STOCK
ON HARRY'S RIVER/PINCHGUT BROOK, NEWFOUNDLAND, 1995

by

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ABSTRACT

Harrys River is potentially the largest Atlantic salmon producing river in Bay St. George, SFA 13. However, the stock has been declining since the 1970s. A number of fisheries management measures have been put in place to stop the decline, including recreational quotas, complete closure of the commercial fishery in 1992 and in-season review of stock abundance. Thus far these measures do not appear to have resulted in significant improvements to the overall status of the stock on Harrys River. A maximum of 49% of the spawning target was achieved in 1992-1995. However, potential egg depositions increased in 1992-1995 on the Pinchgut Brook tributary system which is the main salmon spawning area of the Harrys River. The recreational fishery on Harrys River is currently controlled by an in-season review and a 350 fish river quota, but other factors such as severe poaching are believed to be contributing to the low spawning escapements.

RÉSUMÉ

Bien que la rivière Harrys soit potentiellement le cours d'eau le plus producteur en saumon atlantique du bassin de la baie St-George (ZPS 13), le stock est à la baisse depuis les années 70. Des mesures de gestion de la pêche ont été mises en oeuvre pour freiner ce déclin, dont des quotas de pêche récréative, la fermeture complète de la pêche commerciale en 1992 et l'examen saisonnier de l'abondance du stock. Ces mesures ne semblent pas jusqu'à maintenant s'être traduites par une amélioration significative de l'état général du stock. Ainsi, 49 % de la fraie cible au maximum a été atteint de 1992 à 1995. Toutefois, la ponte potentielle a augmenté pendant cette période dans le ruisseau Pinchgut, tributaire de la Harrys et principale frayère l'alimentant. Un examen saisonnier de l'abondance et un quota de 350 saumons servent présentement à contrôler la pêche récréative dans la rivière Harrys, mais l'on croit que d'autres facteurs, comme le braconnage répandu, sont responsables des échappées faibles.

INTRODUCTION

Harrys River is one of 8 scheduled Atlantic salmon rivers flowing into Bay St. George, Salmon Fishing Area (SFA) 13 (Fig. 1). Four of these rivers, including Harrys River, are currently managed by an individual river quota.

Angling success on Harrys River peaked during 1953-1960 when the catch-per-unit-effort (CPUE) of small and large salmon ranged from 0.31 to 2.30 (Table 1). In the next 10 years (1961-1970), the mean angling effort on the river increased by 119%, but catches of small and large salmon did not increase to the same degree, and as a result the mean CPUE decreased by 48% (Table 1). Peak catches were recorded on the river in 1964 when 2,673 small (< 63 cm) and 373 large (\geq 63 cm) salmon were taken. This was the highest total catch ever recorded from any river in the Bay St. George area (Mullins et al. 1989) and represented about 30% of the Bay St. George catch in that year compared to 13% in 1995 (Table 2). From 1971-1977, 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 (Table 1; Fig. 2). In 1978-1983, and again in 1984-1989, in an effort to conserve the stock, the season opening dates were delayed in the commercial and recreational fisheries, but this resulted in little improvement in salmon abundance (Claytor and Mullins, 1990). The mean catch in 1978-1983 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 hook and release only of large salmon. In addition, individual river quotas were introduced on several SFA 13 rivers including a quota of 350 fish small salmon on Harrys River in 1987. Low juvenile densities recorded in electrofishing surveys on Harrys River in 1987 and 1988 suggested that upcoming recruitment would be low (Claytor and Mullins, 1989). The recreational fishery on Harrys River was open for the entire season in only two of nine years since 1986 (Table 1).

Fisheries management measures implemented to conserve salmon stocks in Harrys River and others in SFA 13 since 1992 include the following:

1. 1992 - the introduction of a five year commercial salmon moratorium and a recreational quota for SFA 13;
2. 1993 - reduction of the recreational daily bag limit from two to one fish per day;
3. 1994 - reduction of the recreational season bag limit from eight to six (three before 31 July and three after 31 July); daily limit increased from one to two per day; in-season review of stock status.
4. 1995 - recreational season bag limit of six (three before 31 July and three after 31 July); daily limit of two per day; in-season review of stock status.

In 1992, the SFA 13 recreational (zonal) quota of 5,000 small salmon was reached on 2 August and the fishery on Harrys River was closed, except for catch and release angling. In 1993, the quota was not reached but in anticipation that the quota for Harrys River would be reached, the river was closed to retention on 22 August. No zonal quota was in effect in 1994 and the river quota was not reached, but the river was closed on 8 August because of anticipated low returns indicated by low catch rates up to 24 July. The recreational catches of small salmon on Harrys River in 1993-1995 were among the lowest on record, however, the proportion of large salmon angled in 1993-1995 (0.13, 0.17, and 0.15 respectively) was the highest since 1967 (0.26) (Table 1; Fig. 2).

This document presents an updated summary of the results of the counting fence operation carried out on the Pinchgut Brook tributary of Harrys River in 1992-1995. A previous summary of the 1992-1994 results was presented by Mullins and Caines (MS 1995). The potential egg deposition on Pinchgut Brook in 1992-1995 is evaluated based on a spawning target which includes part of Georges Lake in the accessible rearing area for parr produced in Pinchgut Brook. The total returns to Harrys River in 1992-95 were estimated from counts at the Pinchgut Brook counting fence based a spawning survey and a trial mark-recapture experiment conducted on Harrys River in 1995.

There are several factors that need to be considered in the analysis of returns of Atlantic salmon 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 (Table 3). However, the lower reaches of the main stem of Harrys River (~3,944 units; or 64 % of the total) have been classed as largely unproductive in terms of spawning (Clayton and Mullins, 1989; Porter et al., 1974; Downer, 1968). Excluding the lower reaches of the main stem of Harrys River (0-18 km), 84 % of the accessible spawning habitat occurs in the tributaries but only 40 % of the fluvial rearing area. In addition, approximately 56 % of the lacustrine rearing area occurs in Georges Lake which is also on the main stem of the river (Porter et al. 1974). Pinchgut Brook, which is approximately 48 km upstream from the mouth of Harrys River as well as other tributaries, likely produces juvenile salmon which disperse and rear farther downstream in Georges Lake and the main stem, particularly in the summer months. Dispersal of 1 year old parr up to 2400m downstream from the spawning site in summer has been documented by Beall et al. (1994). The potential for dispersal downstream makes it difficult to derive a target spawning requirement for the Pinchgut Brook tributary alone. In the absence of an estimate of salmon returns for the whole river it cannot be assumed that the state of salmon stocks on Pinchgut Brook is indicative of Harrys River as a whole. Estimation of total returns to Harrys River in 1995 based on angling exploitation, was not possible because of the closure of the recreational fishery in mid-July as a result of the in-season review.

METHODS

Estimation of Returns and Spawning Escapements

a) Returns and Spawning Escapements to Pinchgut Brook

Total adult salmon returns to the Pinchgut Brook were determined from a counting fence installed on the tributary in 1992-1995. The spawning escapement was determined by subtracting the retained angling catch above the fence. The counting fence was located at the mouth of the Pinchgut Brook where it empties into Georges Lake, and was operated for the following periods:

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

b) Returns and Spawning Escapements to Harrys River

Two methods were used to estimate total returns and spawning escapements on Harrys River in 1992-1995.

i) Spawning Survey Method

The total spawning escapements to Harrys River in 1992-1995 were estimated based on spawning escapements on Pinchgut Brook which were adjusted by the proportion of spawning that occurred on the Pinchgut Brook system. The estimated spawning escapement on Harrys River was apportioned into small and large spawners based on the proportions of small and large salmon counted at the Pinchgut Brook fence.

The proportion of the spawning that occurred in the Pinchgut Brook system was determined from a spawning survey conducted over 68% of the Harrys River system in 1995. The survey was carried out by five crews of two people each counting redds by walking the river on 13-17 November 1995. Consistency of redd counts among crews was verified before the start of the survey by having each crew survey the same section of the Pinchgut Brook and Big Gull Pond Brook tributaries (Appendix 1). The number of redds counted during the survey was adjusted upwards based on the proportion of the total tributary length that was surveyed.

ii) Mark-Recapture Method

A tagging trap was operated on a trial basis at the mouth of Harrys River on 7-16 July 1995. Small and large salmon were carlin tagged and released. Tagged salmon were subsequently recaptured in the recreational fishery in the Lower section (Fig. 1) of the river and at the counting fence on Pinchgut Brook.

The total returns of small salmon to Harrys River in 1995 (RS) was estimated according to the following formula:

$$RS = \frac{AC / ER}{RS_{prop.}}$$

where:

$$ER = TA/TR$$

and:

AC = retained and released angling catch of small salmon

TA = number of tagged small salmon available to angling

TR = tag returns adjusted for voluntary tag reporting rate (0.6087)

RS_{prop.} = proportion of the small salmon return that was available to angling

The voluntary tag reporting rate of 0.6087 from the Humber River in 1995 (Mullins and Reddin, MS 1996) was used to estimate the total number of tags recaptured by angling.

The proportion of the small salmon returns available to angling was estimated based on the proportion of the total catch taken during this period and the traditional run-timing based on the results of the counting fence operation in 1967 (Downer, 1968). It is assumed that salmon entering the river before the start of tagging were available to angling in the Lower section of Harrys River as no catches were reported from areas further upstream.

Other assumptions associated with the application of this formula are:

1. Tagged salmon have the same mortality as untagged salmon.
2. Random mixing of tagged and untagged fish
3. Tags are not lost during the period of study
4. Tagged and untagged fish are equally vulnerable to angling
5. Not all recaptured tags are recognized and reported

Estimation of Target Spawning Requirements

The target egg deposition requirement for the accessible fluvial (Porter et al., 1974) and lacustrine parr rearing area on Harrys River was based on an optimum egg deposition rates of 240 eggs per fluvial unit (100 sq. m) (Elson, 1975) and 368 eggs per ha of lacustrine area (O'Connell et al., 1991). For the Pinchgut Brook system, the area of Georges Lake and other lakes (> 10 ha) used by juvenile salmon produced by spawners on Pinchgut Brook, was measured directly from a digitized 1:50,000 scale topographic maps (Appendix 2). A portion of the total area of Georges Lake, equivalent to the percentage of the stream lengths flowing into it from the Pinchgut Brook system (45% or 684 ha), was added to the available lacustrine rearing area for Pinchgut Brook salmon.

Estimation of Potential Egg Depositions

Potential egg depositions from spawning escapements of small salmon on Harrys River were estimated based on the sex composition (internal and external), and the mean weight of females determined from sampling conducted in the recreational fishery and at the Pinchgut counting fence in 1992-1995. Because sample sizes of small salmon were low (<30) in 1995 the 1992-1994 mean values of sex composition and weight of females were used to calculate egg depositions in 1995. For large salmon, mean biological characteristic values (86.8% female and 5.06 kg per female) were based on samples collected on other Bay St. George rivers in 1953-1994 (Reddin et al., MS 1996).

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

$$\begin{aligned} \% \text{ Target Achieved} &= \frac{\text{Potential Egg Deposition (small and large)}}{\text{Target Egg Deposition}} \\ &= \frac{(\# \text{ small} * \% \text{ female} * \text{mean wt.} * 1540) + (\# \text{ large} * \% \text{ female} * \text{mean wt.} * 1540)}{(\text{fluvial units} * 240) + (\text{lacustrine area} * 368)} \end{aligned}$$

The estimated mean fecundity of 1540 eggs/kg of body weight is from Anon. (1978).

RESULTS

Recreational Fishery

The recreational fishery on Harrys River was closed to retention on 16 July based on the in-season review which indicated that the target spawning requirements would not be achieved in 1995.

Estimation of Total Returns and Spawning Escapements

a) Returns and Spawning Escapements to Pinchgut Brook

The total count of small salmon at the Pinchgut Brook counting fence in 1995 was 34 % above the count in 1994 and 66 % above the 1992-1994 mean (Table 4). However, the count of large was 40 % less than in 1994 and 13 % below the 1992-1994 mean. The percentage of large salmon was the second lowest since 1992.

b) Returns and Spawning Escapements to Harrys River

i) Spawning Survey Method

Of the total length of streams flowing into the Pinchgut Brook tributary, 97 % was surveyed and of the remaining area, 61 % was surveyed in 1995 (Table 5). The distribution of spawning redds in 1995 was similar to that in 1967 particularly for tributaries flowing into Georges Lake, but the highest percentage of the spawning had shifted from tributaries flowing into the main stem to the Pinchgut Brook system (Table 5). The total redd count on Pinchgut Brook was 293 after adjustment for the percentage of the area surveyed and 421 on the remainder of the system or 714 in total. 41.0 % of all redds counted in 1995 were on Pinchgut Brook system compared to 34.6 % in 1967. Because the three tributaries not surveyed in 1995 (Browmoore Brook, Furries Brook, and Ahwachenjeech Brook) were unproductive in terms of spawning during the 1967 survey (Table 5), it is assumed that these were also unproductive in 1995.

A total of 1,895 small and large were estimated to have spawned in Harrys River in 1995. Based on the proportion of small and large salmon at the counting fence this translates to 1,827 small and 68 large salmon spawners on Harrys River in 1995.

ii) Mark-Recapture Method

A total of 39 small and 5 large salmon were tagged and released at the mouth of Harrys River from 7-17 July 1995 (Table 6). Three tags were returned voluntarily by anglers (whether or not these were from retained or released small salmon could not be determined) fishing in the Lower section of the river after 1-3 days at large. Two small salmon were also recaptured at the Pinchgut fence after 67-69 days at large. Assuming that the voluntary tag reporting rate by anglers on Harrys River in 1995 was the same as that on the Humber River (0.6087) and no adjustment was required to account for tag loss because of the short period of time at large, five ($3/0.6087$) of the tagged small salmon were estimated to have been recaptured (TR) by angling on Harrys River in 1995. The relatively short period of time at large before recapture (1-3 days) suggests that tagged salmon recovered relatively quickly from the tagging experience and were available to angling almost immediately after being tagged. Assuming the effects of tagging were negligible (with the exception of one mortality), 38 tagged small salmon were available (TA) to the recreational fishery in Harrys River. Therefore, the angling exploitation rate (ER) during the period of tagging was 0.1316 ($5/38$).

There was little angling activity after the retention fishery was closed on 16 July but tagged salmon would have been available to catch and release angling for at least three days after the last day of tagging on 17 July. A total of 145 small salmon (AC) were retained and released in the recreational fishery on Harrys River from 10 June to 20 July. Seventy percent of these were angled during the period of tagging. If the angling exploitation rate of 0.1316 is assumed to represent angling exploitation up to 20 July, it is estimated that 1,102 small salmon were available to the recreational fishery.

Harrys River is considered to be a late-run river (Reddin et al., MS 1996) and based on the timing of the returns of small salmon to the counting fence operated on the river in 1967 (Downer, 1968), 50% ($RS_{prop.}$) of the returning salmon enter after mid-July (Fig. 3). Therefore, it is estimated that a total of 2,203 small salmon would have returned to Harrys River in 1995. Based on the ratio of large to small salmon at the Pinchgut fence in 1995 (0.0372), 82 large salmon also entered the river in 1995. This estimate of small salmon returns is within 10% of estimated returns based on the spawning survey and the estimate of large salmon returns is 31% above the estimate based on the spawning survey.

Biological Characteristics

The mean smolt-age of Harrys River small and large salmon in 1995 was three years, similar to previous years (Table 7). The sea-age composition of small salmon was 90% virgin 1SW and 10% consecutive spawning 1SW salmon (Table 8). Large salmon were predominantly virgin or repeat spawning MSWs (Table 8). Mean biological characteristics in 1992-1994 used to estimate egg deposition for small salmon in 1995 are given in Table 9.

Estimation of Target Spawning Requirements

The estimated target egg deposition requirement for Pinchgut Brook is approximately 1.0 million eggs compared to approximately 7.6 million eggs for Harrys River (Table 10).

Estimation of Potential Egg Depositions

Egg depositions from small and large salmon spawners on Pinchgut Brook after angling removals in 1995, was the highest in the four years of the counting fence operation (Table 11; Fig. 4). This increased spawning escapement in 1995 can be attributed, at least in part, to the low angling removals of small salmon on Harrys River as a result of the early closure of the retention fishery.

On the basis that 41% of the spawning in Harrys River occurs in the Pinchgut Brook tributary system, estimated egg depositions on Harrys River in 1995 were the highest since 1992 but only 49% of the target spawning requirement was achieved which is similar to the 1994 value but 30% above 1993 for (Table 12; Fig. 4).

DISCUSSION

The Pinchgut Brook tributary system is the uppermost headwater of Harrys River and based on the 1995 spawning survey, is the primary spawning area for the 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 in comparison to Harrys River as a whole, particularly on the main stem which appears to be less preferred for spawning. Angling catches on the Pinchgut Brook system and other tributaries flowing into Georges Lake represented only 7.2% of the Harrys River catch in 1984-1989. Considering that the stock is still at an extremely low level, it would be to the long term benefit of the salmon stock and to the fishery if this area were closed completely in 1996 to angling in order to preserve it as a spawning area.

Spawning escapements and egg deposition appear to have increased on both Harrys River and Pinchgut Brook in the last four years. However, spawning on Harrys River as a whole has been at most 49% of the target requirement based on this assessment. This is consistent with estimates of the stock status based on angling exploitation rates derived during the in-season review in 1994 and 1995. It is also consistent with the view of anglers expressed during 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 has also been identified as a long standing problem on Harrys River by both anglers and DFO guardians. It was suggested that mortalities within the river could be as high as 50% of the run. If this is true, the target spawning requirements could be achieved by addressing this problem alone.

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Table 1. Recreational catch of small and large Atlantic salmon on Harry's River, 1953-1995. Means are for years with similar management plans.

Year(Rod days)	Effort	Small salmon			Large salmon			Total Catch			CPUE	Prop. Large
		Retained	Release	Total	Retained	Release	Total	Retained	Release	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	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
Mean(92-94)	1827	273	36	308	0	43	43	273	78	351	0.19	0.13
Mean(84-89)	2090	402	0	402	0	7	7	402	7	409	0.19	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 1995 from:												
Mean(92-94)	-31.5	-45.4	68.2	-32.2	.	3.1	3.1	-29.2	32.8	-15.4	23.3	18.0
Mean(84-89)	-40.1	-62.9	.	-48.0	.	543.9	543.9	-52.0	1422.0	-27.3	23.3	885.7

Numbers in parentheses refer to:

1. River quota reached.
2. Zone quota reached.
3. No closures

4. Closed due to low water.

5. Closed after in-season review.

Table 2. Recreational catch and effort of Atlantic salmon in Bay St. George (Statistical Area K), and percentage from Harry's River, 1953-1995. Means are for years with similar management plans.

Year	Effort (rod days)		Small salmon		Large salmon	
	BSG	% Harry's	BSG	% Harry's	BSG	% Harry's
1953	8040	43.0	3118	30.0	1066	13.7
1954	3994	20.0	1578	15.5	670	2.7
1955	5696	25.7	2126	23.5	617	9.9
1956	8213	26.9	3187	21.0	1166	17.7
1957	8720	19.4	4580	31.0	1621	30.4
1958	7699	7.0	3172	31.0	1551	14.1
1959	8824	16.6	2664	22.7	928	10.2
1960	8054	3.7	3935	15.3	603	15.1
1961	10244	16.4	3930	18.7	967	12.3
1962	12834	25.8	6485	22.9	1133	19.9
1963	15743	27.7	8420	29.3	2240	20.4
1964	16849	23.3	8956	29.8	1878	19.9
1965	14721	22.7	6127	19.2	1544	17.0
1966	11977	17.6	3648	17.0	1450	21.8
1967	15534	16.9	5608	12.6	1577	15.7
1968	15114	17.5	5615	15.4	987	8.6
1969	16025	21.0	6987	21.3	1082	16.7
1970	19612	27.0	6153	27.0	1049	19.7
1971	18103	28.4	5339	26.9	660	7.1
1972	15803	23.0	4218	18.5	871	3.7
1973	19017	25.0	6430	24.6	1020	19.2
1974	18946	22.3	4322	21.8	744	4.6
1975	21678	10.1	5771	12.2	756	2.1
1976	20964	13.8	5121	17.6	554	7.2
1977	17209	22.4	4355	23.1	994	6.8
1978	11084	28.3	2327	30.6	597	10.9
1979	7751	9.7	2572	5.8	84	1.2
1980	12316	13.0	4213	12.3	673	9.7
1981	14311	14.5	4911	13.4	500	3.6
1982	15417	13.9	5045	11.3	469	6.6
1983	16480	14.8	3075	17.3	554	5.4
1984	14783	17.2	4847	14.9	262	4.2
1985	12779	13.2	2871	6.0	246	0.0
1986	16588	15.8	3819	10.0	430	1.9
1987	12346	13.3	2807	13.5	216	3.7
1988	14393	14.4	3834	11.3	230	4.8
1989	10366	18.9	1717	18.9	103	2.9
1990	13062	16.7	3357	21.0	248	8.9
1991	12985	11.2	3465	10.7	147	2.7
1992	13149	15.9	3159	11.0	672	4.2
1993	13169	14.2	2471	13.8	524	9.5
1994	11800	12.9	1848	12.8	647	7.7
1995	8973	14.0	1599	13.1	516	8.5
Mean(92-94)	12706	14.3	2493	12.5	614	7.1
Mean(84-89)	13543	15.5	3316	12.4	248	2.9
Mean(78-83)	12893	15.7	3691	15.1	480	6.2
Mean(71-77)	18817	20.7	5079	20.7	800	7.3
Mean(61-70)	14865	21.6	6193	21.3	1391	17.2
Mean(53-60)	7405	20.3	3045	23.7	1028	14.2
% Change in 1995 from:						
Mean(92-94)	-29.4	-2.6	-35.9	4.2	-16.0	19.3
Mean(84-89)	-33.7	-9.9	-51.8	5.2	108.2	193.1

Table 3. Fluvial rearing and spawning area available to Atlantic salmon on Harry's River.
From Porter et al, (1974).

	Fluvial Rearing Area (100 sq. m)		Total Spawning Area (100 sq. m)*		Spawning Area (100 sq. m) (excluding lower reaches)	
	Units	%	Units	%	Units	%
Main Stem	15,822	59.9	4,296	70.1	352	16.1
Other 13 Trib's	8,920	33.8	1,548	25.2	1,548	70.8
Pinchgut Brook	1,655	6.3	287	4.7	287	13.1
Total	26,397	100.0	6,131	100.0	2,187	100.0

* spawning area in lower reaches (~64% of total; 3944 units) largely unproductive.

Table 4. Counts of small and large salmon at Pinchgut counting fence in 1992-1995.

	Total Returns			Percentage	
	Small	Large	Total	Small	Large
1992	222	5	227	97.8	2.2
1993	576	43	619	93.1	6.9
1994	563	47	610	92.3	7.7
1995	752	28	780	96.4	3.6
Mean (92-94)	454	32	485	94.4	5.6

Table 5. Comparison of redd counts on Harry's River in 1967 and 1995.

Location	Total Tributary Length (km)	1967			1995			Adjusted Redd Count
		Length Surveyed (km)	%	Redd Count	Length Surveyed (km)	%	Redd Count	
I. Pinchgut Brook System:								
Big Gull Pond BK T14-1	5.0	0.0			5.0	100	70	70
Pinchgut BK T14-2	7.5	7.5	100	164	7.5	100	58	58
Stag Hill BK N. T15-2A	9.0	9.0	100 ₁	0	9.0	100	36	36
Stag Hill BK S. T15-2B	7.0	7.0	100 ₁	0	7.0	100	1	1
Meadows BK T15-1	6.5	0.0			5.9	90	46	51
Camp Eleven BK T15-3	3.5	0.0			3.2	90	69	77
Sub-Total	38.5	23.5	61.0	164	37.5	97.4	280	293
Percent of Total				34.6%				41.0%
II. George's Lake System:								
Stag LK BK/L Grg's BK T13-1	3.0	1.1	36	0	3.0	100	123	123
Stag LK Trib. N. T13-2-1	4.5	0.0				100	0	0
Stag LK Trib. S. T13-2-2	7.0	0.0				100	15	15
Beaver Brook T12	5.0	5.0	100 ₁	0	3.0	59 ₃	38	64
Spruce Brook T11	25.0	25.0	100 ₄	0	25.0	100	1	1
Muskrat Brook T10	3.0	0.0				100	2	2
Sub-Total	47.5	31.1	65.4	0	31.0	65.2	179	205
Percent of Total				0.0%				28.8%
III. Main River System:								
North BK T9/ T9-1	19.3	19.3	100 ₁	0	19.3	100 ₅	0	0
Jack Burke's BK T9A	1.4	1.4	100	0	1.4	100	6	6
Robert's (Crooced) BK T5	19.8	8.9	45	0	11.9	60	0	0
Black Duck BKs T3	4.5	4.5	100	153	4.5	100	19	19
Long Gull pond BK T2	4.7	4.7	100	152	4.7	100	61	61
Browmoore BK T1	9.7	9.7	100 ₁	0	0.0			
Trout Brook T4	23.2	23.2	100 ₃	5	2.3	10 ₆	13	130
Furries Brook T6	10.5	10.5	100	0	0.0			
Ahwachenjeech BK T8	7.4	7.4	100 ₂	0	0.0			
Sub-Total	100.5	89.6	89.2	310	44.1	43.9	99	216
Percent of Total				65.4%				30.2%
Total	186.5	144.2		474	112.6		558	714

Footnotes:

1. examined only from the air
2. 45 % of total length examined by helicopter
3. 50 % of total length examined by helicopter

4. 60 % of total length examined by helicopter
5. 70 % of total length examined by helicopter
6. very high water; bottom difficult to see

Table 6. Tagged Atlantic salmon released and recaptured on Harrys River, 1995.

Tag No.	Date Tagged		Fork Length (cm)	Age					Recapture			No. Days at Large
	Day	Month		FA	SA	+	SM	+	Date		Location	
									Day	Month		
Small Salmon												
1	7	7	45.7	3	1	1						
2	8	7	51.6	3	1	1						
3	8	7	58.7	3	1		7	1				
4	9	7	50.2	3	1	1			16	9	Pinchgut Fence	69
5	10	7	52.7	3	1	1						
6	10	7	51.2	3	1	1						
7	10	7	52.6	3	1	1						
8	11	7	55.1	4	1	1			12	7	Tagging Trap	1
9	11	7	48.8	4	1	1						
10	11	7	49.6	3	1	1			13	7	Tagging Trap*	2
11	11	7	50.4	3	1	1						
12	11	7	48.2	4	1	1						
13	12	7	52.8	2	1	1						
14	12	7	49.5	4	1	1						
15	13	7	51.7	4	1	1						
16	13	7	46.9	4	1	1			16	7	Angled	3
17	14	7	53.0	3	1	1						
18	14	7	50.3	3	1	1						
19	14	7	52.7	2	1	1			16	7	Angled	2
20	14	7	50.0	3	1	1						
21	14	7	52.8	3	1	1						
22	14	7	54.4	3	1	1						
23	14	7	49.5	3	1	1			19	9	Pinchgut Fence	67
24	14	7	53.4	4	1	1						
25	14	7	53.4	3	1	1						
26	14	7	48.1	3	1	1						
27	14	7	54.2	3	1	1						
28	14	7	53.4	3	1	1						
29	15	7	53.0	3	1	1						
30	15	7	50.8	4	1	1						
31	15	7	57.0	4	1	1			16	7	Angled	1
32	15	7	51.0	4	1	1						
33	16	7	57.0	3	1	1						
34	16	7	46.5	3	1	1						
35	17	7	51.3	3	1	1						
36	17	7	54.8	3	1		7	1				
37	17	7	54.3	3	1	1						
38	17	7	52.5	3	1	1						
39	17	7	53.0	3	1	1						
Large Salmon												
1	10	7	81.5	3	2		7	1				
2	12	7	74.3	3	2	1						
3	14	7	75.1	4	2	1						
4	14	7	78.5	3	2		7	1				
5	15	7	76.0	3	2	1						

* mortality

Table 7. Smolt-age distribution of small and large Atlantic salmon on Harry's River, 1975-1995. Smolt ages were determined from scale samples collected from fish landed in the recreational fishery and at the Pinchgut Brook counting fence.

Year	N	Smolt Age %			Mean
		2	3	4	Smolt age
Large salmon (>= 63cm)					
1977	1			100	4.0
1993	55	5	20	80	2.8
1995	8		88	13	3.1
Small salmon (< 63cm)					
1975	27		81	19	3.2
1977	18		61	39	3.4
1979	16	6	63	31	3.2
1989	3		100		3.0
1990	11		91	9	3.1
1991	2		100		3.0
1992	62	3	94	3	3.0
1993	50		82	16	3.2
1994	43		70	30	3.3
1995	129	2	91	36	3.3
Mean(75-91)		6.0	82.7	24.5	3.2
Mean(92-94)		3.0	82.0	16.3	3.2

Table 8. Sea-age composition of small and large Atlantic salmon on Harry's River , 1975-1995.
 CS" refers to consecutive spawners and "AS" refers to alternate spawners.

Year	N	% 1SW	% CS 1SW	% AS 1SW	% V. MSW	% CS MSW	% AS MSW
Large Salmon (≥ 63 cm)							
1977	1				100		
1993	5			80		20	
1995	8		13		62	25	
Small salmon (< 63 cm)							
1975	27	100					
1977	18	94	6				
1979	16	100					
1989	3	67		33			
1990	11	100					
1991	2	50	50				
1992	63	71	29				
1993	52	83	17				
1994	45	91	9				
1995	129	90	10				
Mean(75-91)		85.2	28.0	33.0			
Mean(92-94)		81.7	18.3				

Table 9. Biological characteristics of small and large virgin and repeat spawners Atlantic salmon of Harrys River, 1975-1995. Samples collected from the recreational fishery and Pinchgut Brook counting fence. Sex is internal & external.

Year	Fork Length Females (cm)					Whole Weight Females (kg)					No. FEMALE	
	N	MEAN	MIN	MAX	STD	N	MEAN	MIN	MAX	STD	Sexed N	%
Large salmon												
(>=63cm)												
1977	0											
1993	5	70.7	67.5	73.0	2.10	2	3.70	3.40	4.00	0.42	5	5 100.0
1994												
1995	1	72.1	72.1	72.1		1	4.30	4.30	4.30		1	1 100.0
Small salmon												
(<63cm)												
1975	0					18	1.32	0.91	1.82	0.23	26	18 69.2
1977	0					7	1.30	1.10	2.10	0.35	18	7 38.9
1979	8	48.6	45.7	50.8	2.00	2	1.36	1.36	1.36	0.00	16	8 50.0
1989	0					0					0	0
1990	0					0					0	0
1991	0					0					0	0
1992	39	50.7	42.5	57.2	3.50	0					61	39 63.9
1993	38	50.4	43.2	60.5	3.50	35	1.43	0.80	2.20	0.33	50	38 76.0
1994	38	51.4	46.5	58.5	2.70	37	1.81	1.00	2.50	0.35	49	38 77.6
1995	9	50.9	47.6	56.1	2.70	9	1.50	1.00	2.20	0.40	15	9 60.0
Mean(75-91)	8	48.6	45.7	50.8	2.00	27	1.32	0.99	1.86	0.24	60	33 55.0
Mean(92-94)	115	50.8	44.1	58.7	3.24	72	1.63	0.90	2.35	0.34	160	115 71.9

Table 10. Estimation of Atlantic salmon target egg deposition and spawner requirements for Harry's River and Pinchgut Brook.

TARGET EGG DEPOSITION REQUIREMENTS:**Harrys River:**

Fluvial Rearing Units (100 sq. m) 26,394 (Porter and Chadwick, 1983)

Lacustrine Area (ha) 3,546 (this document)

Minimum Egg Deposition for Conservation: 240 eggs per Rearing Unit
368 eggs per ha of Lacustrine Area

$$= (26,394 * 240) + (3,546 * 368)$$

$$= 7,639,635 \text{ eggs}$$

Pinchgut Brook:

Fluvial Rearing Units (100 sq. m) * 1,655 (Porter et al., 1974)

Lacustrine Area (ha) 1,036 (Pinchgut tributary - this document)

684 (45% of Georges Lake (1520 ha))

Minimum Egg Deposition for Conservation: 240 eggs per Rearing Unit
368 eggs per ha of Lacustrine Area

$$= (1655 * 240) + ((1036+684) * 368)$$

$$= 1,030,160 \text{ eggs}$$

Table 11. Total returns, spawning escapement, and potential egg deposition of Atlantic salmon on Pinchgut Brook, 1992-1995.

Pinchgut Brook, 1992-1995.

Year	Total Returns to Pinchgut Fence			Retained Above Fence		Spawning Escapement			Potential Egg Deposition ($\times 10^6$)			Percent Target Achieved
	Small	Large	Prop. Small	Small	Large	Small	Large	Total	Small	Large	Total	
1992	222	5	0.978	10	0	212	5	217	0.34	0.03	0.37	36
1993	576	43	0.931	28	0	548	43	591	0.92	0.29	1.21	117
1994	563	47	0.923	18	0	545	47	592	1.18	0.32	1.50	145
1995	752	28	0.964	3	0	749	28	777	1.35	0.19	1.54	150
Mean (92-94)	454	32	0.944	19	0	435	32	467	0.81	0.21	1.03	100

Table 12. Estimated spawning escapement, and percent of egg target achieved on Harrys River, 1992-1995.

Harrys River, 1992-1995								
Year	Spawning Escapement				Potential Egg Deposition (x 10^6)			Percent Target Achieved
	Pinchgut	Harrys		Total	Small	Large	Total	
	Total	Small	Large					
1992	217	518	12	529	0.83	0.08	0.91	12
1993	591	1342	99	1441	2.25	0.67	2.92	38
1994	592	1333	111	1444	2.88	0.75	3.64	48
1995	777	1827	68	1895	3.30	0.46	3.76	49
Mean (92-94)	467	1064	74	1138	1.99	0.50	2.49	33

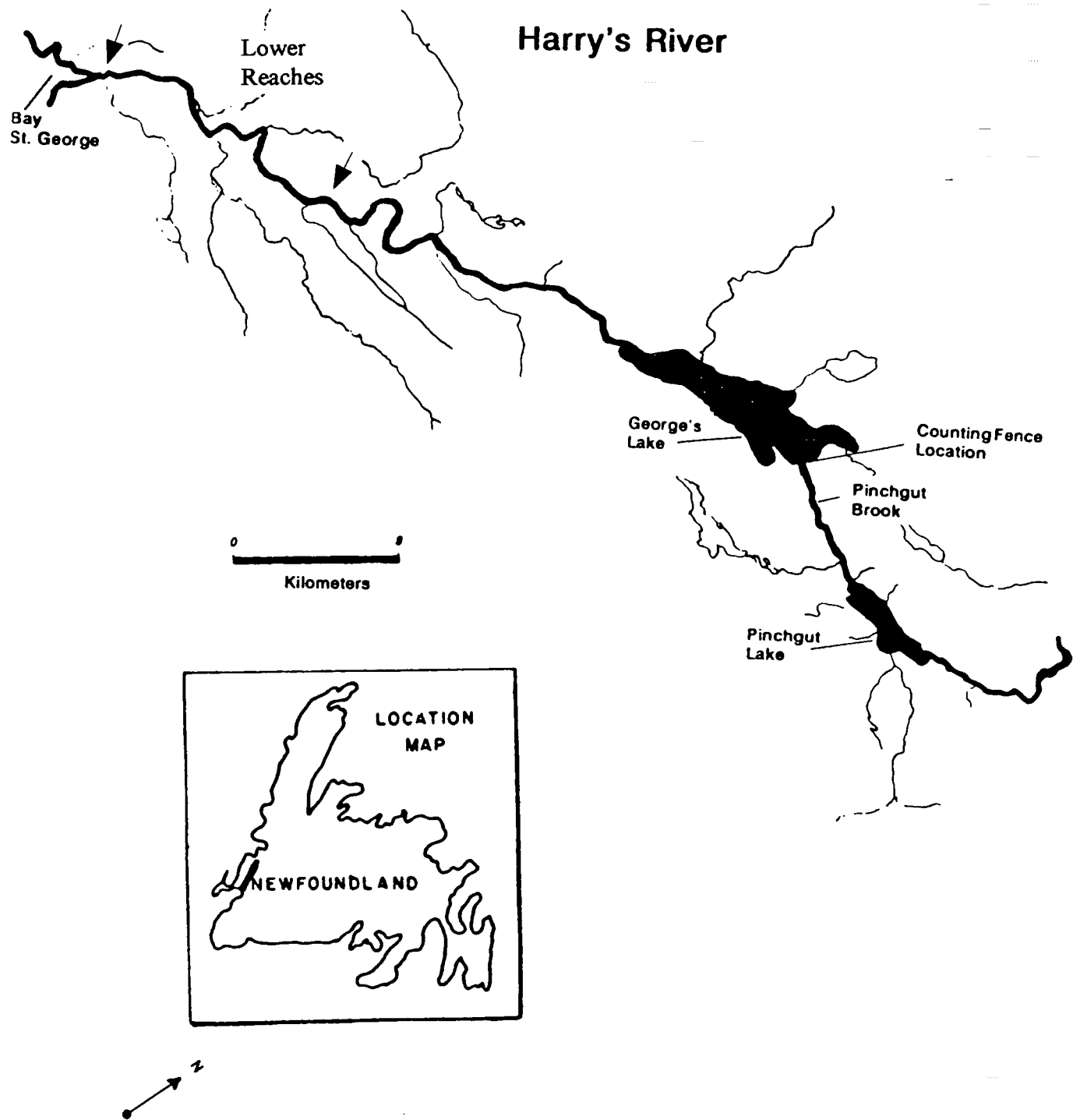


Figure 1. Location map of the Harrys River system.

Recreational Catch - Harrys River, 1953-1995

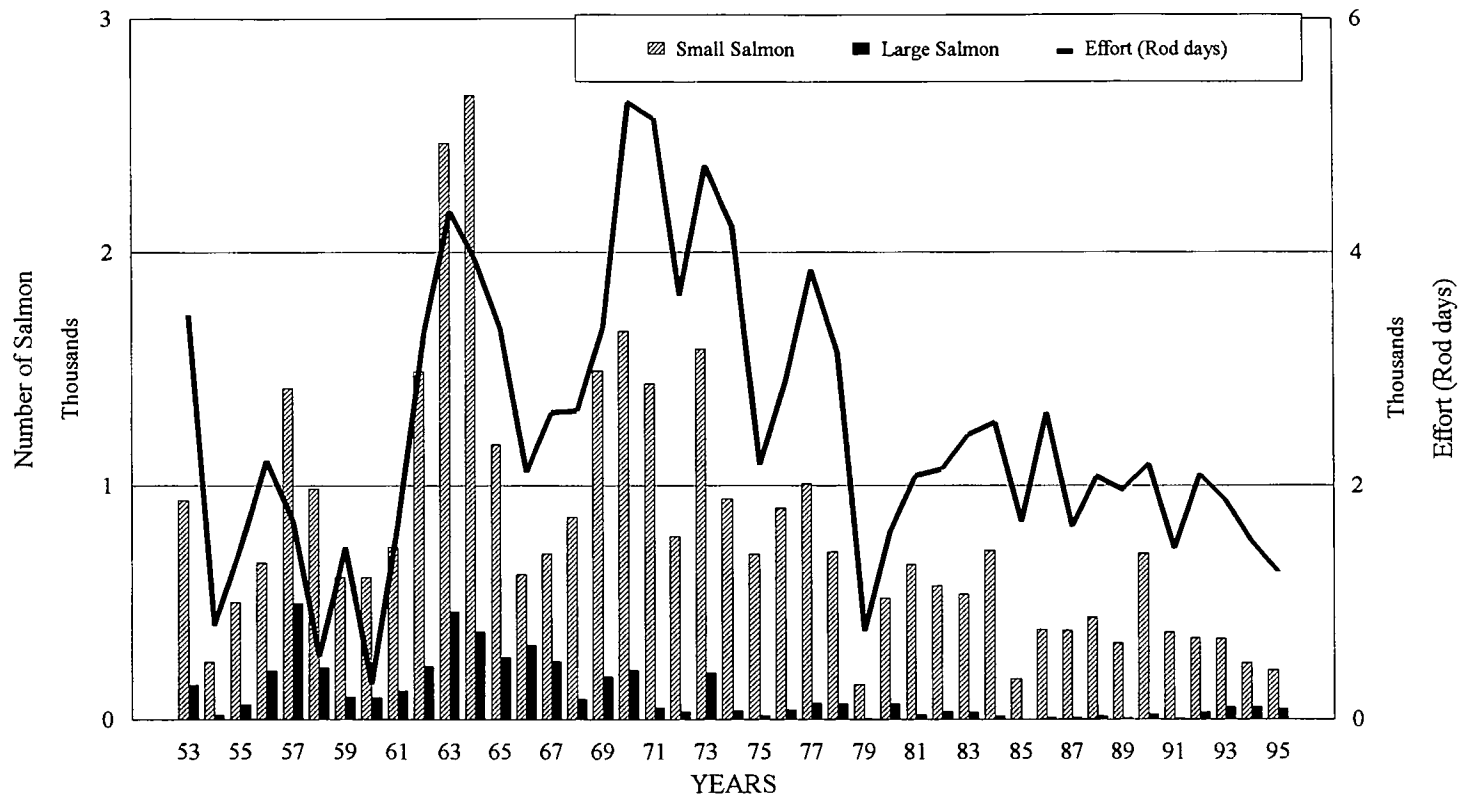


Figure 2. Recreational catch and effort of small and large salmon on Harrys River, 1953-1995. Catches include retained and released fish. The fishery has been managed by a river quota of 350 small salmon since 1987 and an in-season review of abundance in 1994-1995.

Harry's River, 1967

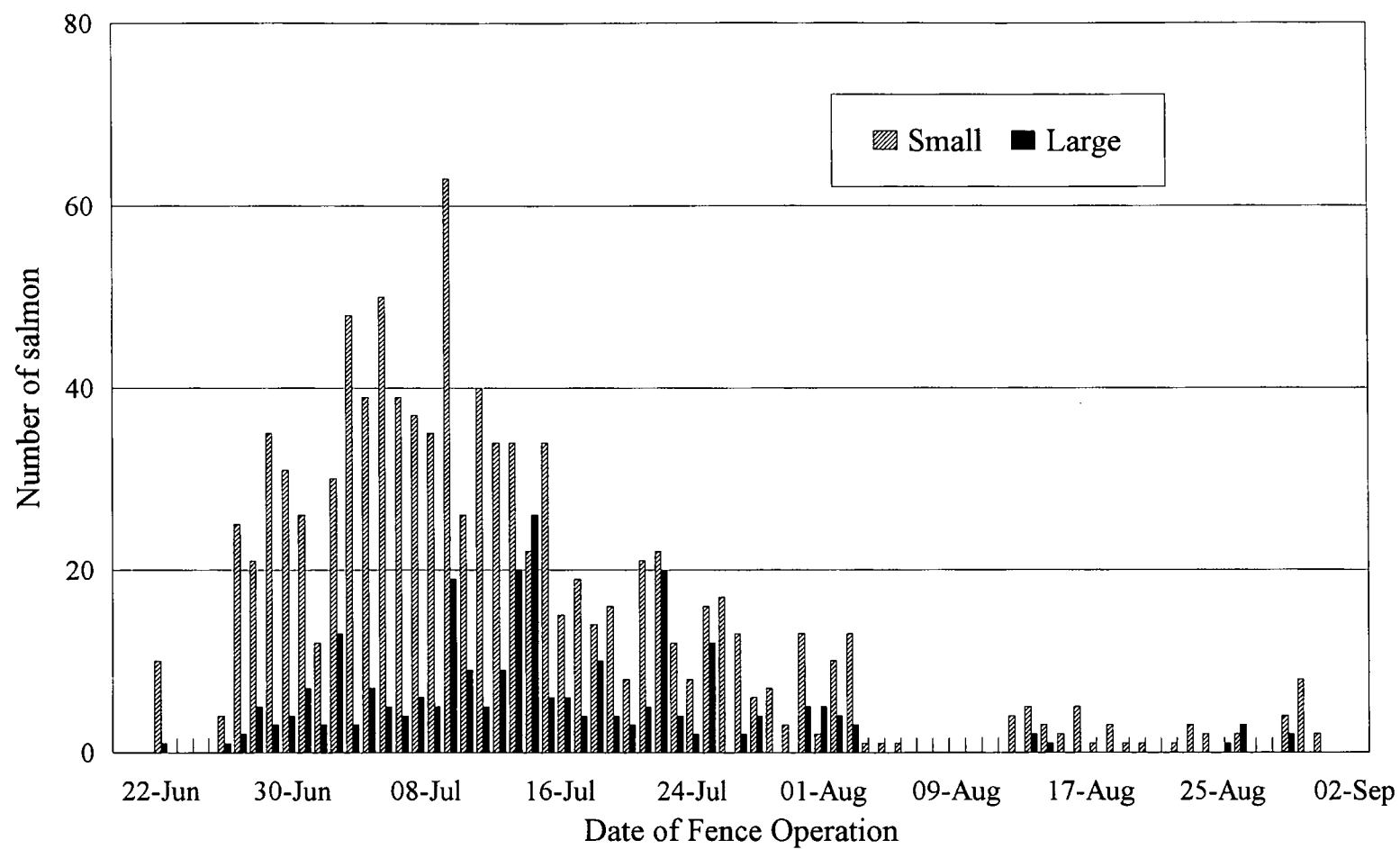


Figure 3. Counts of small and large salmon observed at the counting fence operated on Harry's River in 1967.

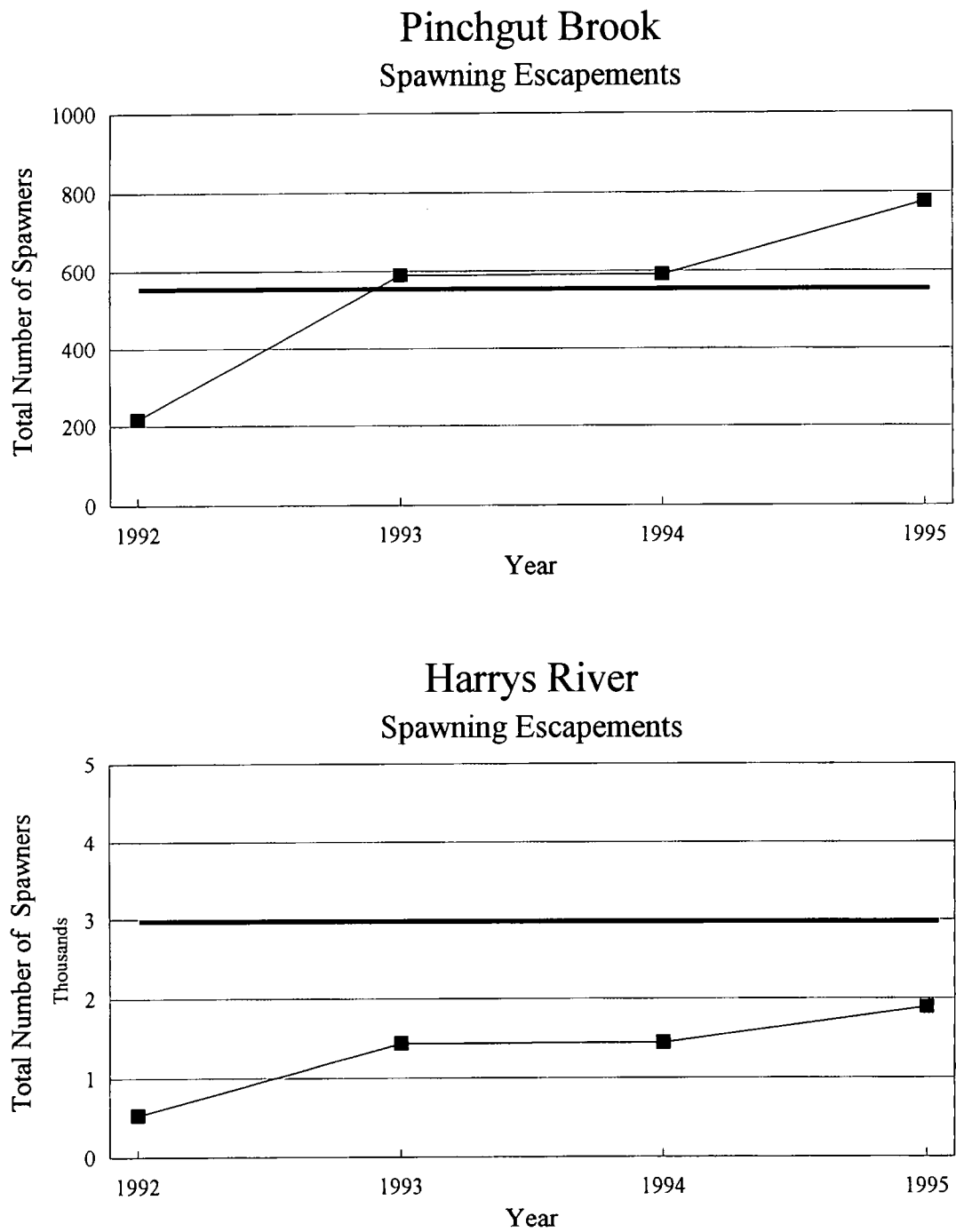


Figure 4. Spawning escapements of Atlantic salmon on Pinchgut Brook and Harrys, 1992-1995
The horizontal line refers to the target spawners requirements.

Appendix 1. Comparison of counts of salmon redds on BigGull Pond and Pinchgut Brook, (Harrys River) by survey crews, 13 November 1995.

13 November 1995.

Team	Date	Sect. #	Salmon	Mean	Substrate Type (%)									Vegetation Type (%)				
			Redds	Width (m)	bdr	smbld	lrld	cobb	rub	grav	sand	pebb	mud	ovhng	instrea	aqveg	can	
Big Gull Pond Brook																		
DC/AS	13-Nov	1	0	15.0	15	50	25		10						50	5	5	40
		2	19	15.0		10		30	40	20				10		10	80	
		3	17	15.0	10	40	30	10	10					50			50	
		4	26	27.0	10	20	30	10	20	10				10	5	5	80	
Total				62														
DI/SL	13-Nov	1		7.7		20		60	15	5				10			5	30
		2		7.7	3	40	2	45	10					15	5	5	30	
		3		10.7		40	30	20	10					15	10	10	30	
		4	28	10.3	10	20		32	30	8				75	5	1	50	
		5		8.0		70	15	15						3	2		30	
		6	22	8.0		15	5	40	20	15		5		2	3		20	
Total				50														
HJ/KP	13-Nov	1	20	21.7		15		75		20				15	10	10	75	
		1	20	10.3		5		25	30			40		10			4	
		2	10			10		35	10			45			20		20	
		3	27															
Total				77														
Pinchgut Brook																		
DD/GL	13-Nov	1	4	33.3		35		30		20	15			20	20		10	
		2	0	30.0			50	25	25					37	15		15	
		3	2	32.0										30	50		10	
		4	0	23.0										40	50		20	
		5	0	23.0			50			20	30			20	30		10	
		6	8	30.0			40	10		50								
		7	0	20.0			45	15	20	20				30	60		10	
		8	0	21.0			70		25	5								
		9	4	29.0										40	60		15	
		10	1	30.0		30	40			30				30	50		20	
		11	1	35.0		10		10	10	70				30	10		15	
		12	0	33.0		20	20			50	10			20	15		10	
Total				20														
CM/JF		1	12	33.3		60	5	15	15	5				10	10		10	
		2	4	26.6		60	5	15	15	5				15	15		5	
		3	0			75	10	5	10					60	50		5	
		4	8	15.7		60	10	5	20	5				5		60	5	
		5	10	13.0		40	5	15	25	15				60	5		20	
		6	1	12.0		60	20	5	10	5				40	20		10	
		7	0	11.0				20	60	20				50	5		50	
		8	1	10.7		40	5	10	40	5				40	5		5	
		9	0			10		15	50	15		10		70	5		30	
		10	0	12.0		25		25	25	25				65			10	
Total				36														

Substrate Type Codes:

bdr = bedrock
smbld = small boulders
lrld = large boulders
cobb = cobble
rub = rubble
grav = gravel
sand = sand
pebb = pebble
mud = mud

Vegetation Type Codes:

ovhng = overhanging
instrea = in-stream
aqveg = aquatic vegetation
can = canopy

Appendix 2. Area of lakes and ponds on Pinchgut Brook and other lakes on Harry's River with a surface area greater than 10 ha.

Lake Number Lake Name	Area (ha)	Lake Number Lake Name	Area (ha)	Lake Number Lake Name	Area (ha)
1 Small Pond off Trib.	1.6	40 Small Pond	1.6	78 George's Lake	1520.0
2 Fox Pond	53.6	41 Norman's Pond	3.2	79 Beaver Pond	19.2
3 Small Pond	1.6	42 Whale Back Pond	6.4	80 Old Mans Pond	26.4
4 Small Ponds on Trib.	2.4	43 Small Pond	1.6	81 Little Georges Lake	33.6
5 Small Ponds on Trib.	2.4	44 Cain Pond	5.6	82 Stag Lake	68.8
6 Small Ponds on Trib.	1.6	45 Abil Pond	2.4	83 Blue Pond	17.6
7 Small Ponds on Trib.	0.8	46 Muskrat Pond	5.6	84 Rocky Pond	18.4
8 Gull Pond Steady	28.0	47 Ladies Slipper Bk. Ponds	1.6	85 Noname (near Rocky P.)	12.0
9 Small Pond nearby	1.6	48 Ladies Slipper Bk. Ponds	0.8	86 Noname (near Rocky P.)	6.8
10 Third Pond (Camp Eleven Bk.)	8.0	49 Stag Hill Bk. Ponds	2.4	87 Spruce Brook	8.0
11 nearby ponds:	0.8	50 Stag Hill Bk. Ponds	1.6	88 Spruce Brook	8.0
12 nearby ponds:	0.8	51 Stag Hill Bk. Ponds	4.0	89 Spruce Brook	22.0
13 nearby ponds:	0.8	52 Stag Hill Bk. Ponds	1.6	90 Lond Gull Pond	256.8
14 Gullet Pond	1.6	53 Stag Hill Bk. Ponds	1.6	91 Lond Gull Pond	8.8
15 Pinchgut Lake	70.4	54 Stag Hill Bk. Ponds	4.0	92 Lond Gull Pond	11.2
16 Pinchgut Lake	280.0	55 Stag Hill Bk. Ponds	2.4	93 Rushy Brook	15.2
17 Cove Pond	9.6	56 Stag Hill Bk. Ponds	1.6	94 Black Duck Pond	40.8
18 nearby ponds:	1.6	57 Stag Hill Bk. Ponds	1.6	95 Mistaken Pond	18.4
19 nearby ponds:	0.8	58 Stag Hill Bk. Ponds	1.6	96 Roberts Brook	19.6
20 Rocky Pond	3.2	59 Camp Eleven Bk. Ponds:		97 Landouwns Pond	78.4
21 nearby ponds:	0.8	60 Angle Pond	12.8	98 Crooked Lake	24.0
22 nearby ponds:	1.6	61 First Pond	3.2	99 Bras Mort Brook	52.0
23 nearby ponds:	1.6	62 Annette Pond	2.4	100 Trout Brook	24.0
24 nearby ponds:	1.6	63 Yvonne Pond	4.0	101 Trout Brook	10.8
25 nearby ponds:	1.6	64 Cecile Pond	0.8	102 Trout Brook	13.6
26 nearby ponds:	2.4	65 Millie Pond	0.8	103 Trout Brook	23.2
27 nearby ponds:	3.2	66 Big Gull Pond	135.2	104 Jacke's Burke Pond	16.0
28 Middle Pond	16.8	67 Big Gull Pond	142.4	105 Middle Pond	36.0
29 Oxbow Pond	4.0	68 Big Gull Pond	6.4	106 Eastern Pond	8.8
30 Muddy Pond	4.0	69 Big Gull Pond	4.8	107 Eastern Pond	8.0
31 Eel Pond	3.2	70 Big Gull Pond	4.8	108 Ahwachenjeech Brook	8.0
32 Diamond Pond	9.6	71 Big Gull Pond	1.6	109 Ahwachenjeech Brook	13.2
33 Round Pond	4.0	72 Big Gull Pond	3.0	110 Ahwachenjeech Brook	7.2
34 Island Pond	56.8	73 Big Gull Pond	2.8	111 Muskrat Pond	12.8
35 Howe Pond	26.4	74 Big Gull Pond	0.8	112 Gull Pond	9.8
36 Ladies Slipper Pond	4.0	75 Big Gull Pond	8.0	113 Lond Pond	16.4
37 Small Pond	4.8	76 Big Gull Pond	2.4	114 Bond Pond	8.4
38 Meadows Pond	22.4	77 Big Gull Pond	2.4	115 East North Brook	8.0
39 Small Pond	6.4				
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				TOTAL LAKE AREA	3546.4
				Pinchgut Total:	1036.2
				Big Gull Pond Bk. Total:	314.6
				Other Lakes	371.2