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**STATUS OF ATLANTIC SALMON IN THE
RESTIGOUCHE RIVER IN 1989**

by

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ABSTRACT

During 1989, about 3,655 1SW and 1,033 MSW salmon were landed by anglers in the Restigouche River (MSW salmon were harvested in Québec tributaries only). Catches of MSW salmon in 1989 were similar to 1988, but catches of 1SW salmon were only about 50% of catches in 1988. Based on angling data, returns of Atlantic salmon to the Restigouche River during 1989 were estimated to be about 7,400 1SW and 11,100 MSW salmon. Total returns of 1SW salmon in 1989 were about 29% less than the previous five year average, while MSW salmon returns in 1989 were the same as the previous five year average. In the Restigouche River most egg deposition comes from MSW salmon (> 95%). Spawning escapement as estimated by the spawner to angled fish ratio, the method traditionally used for the Restigouche River, was 6,569 MSW salmon and 2,559 1SW salmon. These spawners would result in a total egg deposition of 39.2 million eggs (55% of requirements). Estimates of egg deposition in 1989 based on field spawner counts and angling exploitation rates were higher (86 - 119% of requirements). Electrofishing surveys have indicated that densities of juvenile salmon have been consistently above average in recent years, indicating spawning escapements have increased since the introduction of the 1984 management plan.

Assuming average (1985 to 1989) returns of MSW and 1SW salmon in 1990, total returns could be about 11,600 MSW and 9,700 1SW salmon.

Résumé

En 1989, les pêcheurs à la ligne ont capturé environ 3 655 saumons unibermarins et 1 033 redibermarins dans la rivière Restigouche (les redibermarins ont été pêchés uniquement dans les affluents situés au Québec). Ces prises sont comparables à celles de 1988 pour ce qui est des redibermarins, mais inférieures de 50 % aux captures d'unibermarins de cette année-là. En se fondant sur les données de la pêche à la ligne, on chiffrait à 7 400 unibermarins et 11 100 redibermarins les remontées estimées de saumon de l'Atlantique dans la rivière Restigouche en 1989. Les remontées totales des premiers ont été inférieures de 29 % à la moyenne des cinq années antérieures, tandis que les remontées de redibermarins lui étaient comparables. La plupart des oeufs déposés dans la rivière Restigouche proviennent des redibermarins (>95 %). Les échappées de géniteurs, estimées d'après le taux de géniteurs dans les poissons capturés par les pêcheurs à la ligne (méthode traditionnelle d'évaluation pour la rivière Restigouche) étaient de 6 569 redibermarins et 2 559 unibermarins. Si l'on se fonde sur ces chiffres, la ponte serait de 39,2 millions d'oeufs, soit 55 % des besoins. En revanche, les estimations de ponte obtenues d'après le dénombrement des géniteurs sur le terrain et les taux d'exploitation de la pêche à la ligne sont plus élevées (de 86 à 119 % des besoins). Les études réalisées par électro-pêche ont révélé que les densités de saumon juvénile se sont maintenues au-dessus de la moyenne au cours des dernières années, ce qui indique que les échappées de reproducteurs ont augmenté depuis la mise en oeuvre du plan de gestion de 1984.

En tablant sur des remontées d'unibermarins et de redibermarins comparables à la moyenne de 1985 à 1989, celles-ci s'établiraient à 11 600 et 9 700 saumons respectivement en 1990.

INTRODUCTION

During 1989, two user groups exploited Atlantic salmon in the Restigouche River, anglers and native fishermen. Regulations controlling the harvest of salmon in 1989 were similar to regulations in 1988. Anglers in New Brunswick tributaries were obligated to release all MSW salmon (≥ 63 cm) back into the river. Catches of 1SW salmon were restricted by season, possession and daily bag limits of ten, six and two fish respectively. In Quebec tributaries, anglers were allowed to retain both 1SW and MSW salmon but with daily and seasonal bag limits of one and seven fish, respectively. Quebec/New Brunswick boundary waters were regulated by the catch and release policy for MSW salmon as in New Brunswick. Native fishermen at Restigouche, Quebec, were allocated a quota of 6995 kg. Native fishermen at Eel River Bar, New Brunswick, were not regulated by quota. Commercial fisheries in Baie des Chaleurs were closed in both Quebec and New Brunswick in 1989. For both provinces, fishermen were prohibited from landing salmon caught in non-salmon fishing gear (by-catch).

The objective of this report is to provide a preliminary evaluation of the status of Atlantic salmon in the Restigouche for 1989. Angling and native catch and effort data are summarized. Numbers of spawners are estimated from angling data, spawner counts, and juvenile salmon densities. Projections of adult salmon returns in 1990 are also given.

METHODS

1. Angling catch and effort data.

Angling data from Quebec tributaries of the Restigouche River in 1989 were provided by the Ministère du Loisir, de la Chasse et de la Pêche (MLCP); most estimates come directly from angling camp logbooks. Angling data from New Brunswick were provided by DFO fishery officers and by the New Brunswick Department of Natural Resources and Energy (DNRE). DFO fishery officers collect angling data directly from angling camps (daily logbooks) on a monthly basis. In the New Brunswick portion of the Restigouche system, most angling (70% of 1988 catch) occurs at private or government camps who keep individual records of angling catches. Angling catches in crown open water (only 4% of the 1988 catch) are rough estimates based on personal observations and interviews by the Officers. Finally crown reserve data (26% of the 1988 catch) are summarized from data records which are returned by each angling party. At the time of this assessment, only 32% of the potential 1989 crown reserve anglers had reported their catches. Final Crown Reserve estimates were therefore increased accordingly.

For both Quebec and New Brunswick, angling catches were identified as being either 1SW or MSW salmon (≥ 63 cm). Effort was in rod-days, where one rod-day was one fisherman fishing a river for any portion of one day.

2. Native landings.

Landings of Atlantic salmon at Restigouche, Quebec (Fig. 1) are reported on a weekly basis by the Band Office to MLCP. Landings of salmon at Eel River Bar, are reported on a weekly basis, by individual gear types (gill nets vs traps) to DFO fishery officers. Based on personal observations of the Eel River fishery, fishery officers adjusted nominal landings upwards by 15% to account for underreporting. This adjustment has been made since 1987.

3. Within-river mortalities.

Poaching and disease mortality rate was assumed to be 0.14 for 1SW salmon and 0.16 for MSW salmon, as in previous assessments. These mortality rates were estimated from the Upsalquitch River, where mortalities were monitored at a barrier protection pool (Fig. 1), and poaching losses were estimated from spawner counts above the barrier (Randall et al. 1988). Poaching and disease mortality rates were applied to total river returns, before angling exploitation occurred.

During July and August 1989, salmon mortalities in the Main Restigouche River were enumerated and removed on a daily basis by DNRE staff and riparian wardens. Estimates of the total number of mortalities observed are therefore available for the main river.

Mortalities from stress of catch-and-release of MSW salmon in New Brunswick

waters was estimated from observations at five angling camps. Camp managers provided data on the number of MSW salmon caught and released in their stretch of water, and an estimate of the total mortalities their wardens and guides observed that may have resulted from catch and release stress (i.e., no physical indication of furunculosis lesions on the fish). Similar estimates have been made since 1985. Locations of the index angling camps on the Restigouche River are indicated in Figure 1.

4. Spawning escapement in 1989.

Three methods were used to estimate spawning escapement:

Method 1:

Spawning escapement was calculated as angling catch divided by angling exploitation rate, minus angling and broodstock removals. Because of the uncertainty of the exploitation rate on the Restigouche River (see Discussion), three rates were used: 0.2 0.3 and 0.4. Total returns were calculated as the sum of spawning escapement, harvest, and poaching and disease removals.

Method 2:

Escapement in 1989 was estimated as the product of the spawner to angled fish ratio (0.70) and angling catch minus broodstock removal. This ratio was based on 16 years of data (1970-1985) (Randall et al. 1988). Annual egg depositions were back-calculated from small parr (age 1) densities assuming 10% survival (Elson 1957; 1974; Chadwick 1982), and a rearing area of 29,768,000 m². Spawners were calculated by dividing egg deposition by the average number of eggs per MSW salmon (Randall 1984).

Method 3:

Spawning escapement was estimated from visual counts of spawners obtained during canoe surveys in all major tributaries by DNRE and MLCP staff. Spawners were visually counted from canoes; 85% of all habitat was surveyed. Spawner counts provide the only estimate from the Restigouche system independent of angling data. Spawner surveys have been conducted on the Restigouche River since 1982. Preliminary observations were made on variances and potential biases of these field estimates. Numbers of salmon were estimated by visual counts from canoes in enclosures where the numbers of fish present were known (Appendix 1). For this assessment, results of this preliminary observation are reported, but spawner counts are presented without adjustments, for comparative purposes only.

5. Target egg depositions and required spawners.

Egg deposition requirements for the Restigouche River, to provide a deposition rate of 2.4 eggs per square metre, are 71,443,200 eggs (Randall 1984). About 12,200 MSW salmon are required to produce these eggs, and an additional 2,600 1SW salmon are required to ensure a 1:1 sex ratio at spawning.

6. Recruitment.

Densities of juvenile Atlantic salmon in headwater tributaries of the Restigouche River were determined by electrofishing surveys at 15 sites during August 1989. Densities were calculated by the removal method (Zippin 1956); 95% confidence intervals in mean densities among the 15 sites were calculated after individual site counts were transformed (natural logarithms). Densities of salmon fry and parr have been estimated at the same 15 sites each year since 1972.

7. Forecast.

Returns of MSW salmon to the Restigouche River in 1990 were predicted using a significant but weak correlation between 1SW salmon at Kedgwick Lodge (year i) and total MSW returns (year i+1). This regression has been used in previous assessments. Returns of MSW salmon and 1SW salmon were also predicted from previous 5 year averages. Indices of spawning levels (age 1 parr) in years that will contribute to 1SW and MSW salmon returns in 1990 were also considered.

RESULTS

1. Catch and effort.

Commercial fisheries

There was no commercial salmon fishery in 1989. Commercial landings for the years 1951 to 1989 are summarized in Appendix 2.

Angling fisheries

Angling catches for the years 1951 to 1989 in the Restigouche River are summarized in Appendices 3 and 4.

In Quebec tributaries of the Restigouche River (Matapedia, Patapedia and the upper Kedgwick River), angling catches of MSW salmon in 1989 were 1033 fish, which was very similar to the catch in 1988 (1007 fish) (Table 1). Effort (rod-days) and catch-per-unit-effort (CPUE) were similar in the two years (Table 2).

The numbers of MSW salmon estimated to have been caught and released in New Brunswick waters in 1989 were 3641 fish, a 20% decrease from the 1988 catches (Table 1). Effort decreased slightly from 1988 to 1989 from 11076 to 9820 rod-days (decrease of 11%). CPUE for MSW salmon also decreased slightly from 1988 to 1989 (10%). The total catch of MSW salmon in 1989 (Quebec and New Brunswick) was 4674 fish; this was a decrease in total catch of 16% from 1988, but was higher than the long term (1970 to 1988) average by 13% (Table 1).

Landings of 1SW salmon in Quebec tributaries in 1989 decreased slightly from 1988, from 692 fish to 662 fish (decrease of only 4%) (Table 1). As with the MSW salmon in Quebec, CPUE was the same in both years. Total catches of 1SW salmon in Quebec were however about 92% above the long term average. Landings of 1SW salmon in New Brunswick decreased substantially in 1989 from 1988, from 6084 to 2993 fish (decrease of 51%; Table 1). While angling effort was similar, CPUE for 1SW salmon in New Brunswick waters decreased by 45% from 1988 to 1989. The total catch of 1SW salmon in the Restigouche River in 1989 was 3655 fish, which was 46% below the 1988 catches but 37% above the long term average (Table 1).

Native fisheries

Native landings from Baie des Chaleurs and Restigouche River for the years 1975 to 1989 are presented in Appendix 5. Operating dates of these fisheries, 1979 to 1989, are summarized in Appendix 6 (Data sources for Appendices 2-6 are given in Appendix 7).

Native fishermen at Restigouche, Quebec reported catching 1079 MSW salmon and 12 1SW salmon in 1989 (Table 3). In terms of weight, a total of 6894 kg were reported landed, with an average weight per fish of 6.32 kg. The fishing season lasted from late May to 30 June, but most landings (74%) were reported from the period 15 June to 30 June. A quota for the Restigouche native fishery (6995 kg) was not formally negotiated until 15 June in 1989. Native wardens estimated that about 1814 kg were landed prior to 15 June.

Nominal landings by native fishermen at Eel River Bar, New Brunswick, were 568 MSW salmon and 151 1SW salmon (Table 3).

Total nominal landings of Atlantic salmon in the Restigouche River from all fisheries in 1989 are compared to long-term landings in Table 4.

2. Within river mortalities.

During the period 5 July to August 12, 1989 a total of 479 MSW salmon and 28 1SW salmon mortalities were removed from the Main Restigouche River. Some of these fish were tested for furunculosis but the results are not yet available. Based on the physical appearances of the fish (A. Madden, pers. comm.), most fish were believed to have died from this disease. Mortality rate of salmon attributed to furunculosis at the Upsalquitch barrier was estimated to be average for this site. Mortality rates calculated from this barrier pool would not be applicable to the entire river, however, because cold water was being pumped into the pool during the summer. Also, a proportion of the salmon at the barrier fence were inoculated.

Observations of mortalities of MSW salmon from five angling camps are summarized below:

	Catch and release	Mortalities	Proportion
Camp 1	153	6	0.04
2	51	10	0.20
3	96	2	0.02
4	350	30	0.09
5	291	20	0.02
Total	941	68	0.07

A mortality rate of 0.07 is higher than the rate used in the 1988 assessment of 0.04 (Randall et al. 1989a). Many wardens and anglers observed that mortality rates within the river were higher than average in the Restigouche River during 1989. Lower than normal water levels during July and August may have contributed to these mortalities (Fig. 2). With furunculosis being so widely distributed throughout the Restigouche system, it is difficult to differentiate between mortalities resulting from this disease or from the stress of catch and release. It is possible that some fish may die after being hooked and released only because they were initially weakened by disease. A mortality rate of 0.07 was used in this assessment, but it is not possible to attribute this rate solely to the stress of catch-and-release.

A mortality rate of 0.07 would indicate 255 MSW salmon died after being released back into the river by anglers during 1989 (0.07×3641).

3. Spawning escapement.

Upsalquitch protection barrier

Counts of both 1SW and MSW salmon at the Upsalquitch protection barrier in 1989 were less than in 1988, but only slightly ($< 10\%$) (Table 5). Counts of 1SW salmon in 1989 were 11% greater than the long term mean, while counts of MSW salmon were 22% greater than the long term mean.

Spawning escapement, 1989

Spawning escapement was estimated in methods 1 and 2 using angling catches of 4674 MSW salmon and 3655 1SW salmon (Table 1). Total river harvest of MSW salmon was calculated as:

Angling harvest	1033
Broodstock	89
Catch and release mortality	255
Total	1377

Returns and spawning escapement was calculated as:

	Method 1 Exploitation			Method 2 Spawner/ angled	Method 3 Field surveys
	0.2	0.3	0.4		
MSW salmon					
1. Total returns	29469	20195	15558	11106	17193
2. Harvest in estuary	1647	1647	1647	1647	1647
3. Harvest in river	1377	1377	1377	1377	1377
4. PAD	4452	2968	2226	1513	2488
5. Spawners	21993	14203	10308	6569	11681
6. Target spawners	12200	12200	12200	12200	12200
% of target (no.)	180	116	84	54	96
1SW salmon					
1. Total returns	21413	14330	10788	7388	9213
2. Harvest in estuary	163	163	163	163	163
3. Harvest in river	3655	3655	3655	3655	3655
4. PAD	2975	1983	1488	1012	1267
5. Spawners	14620	8528	5483	2559	4128
6. Target spawners	2600	2600	2600	2600	2600
% of target (no.)	562	328	211	98	159
% of target (eggs)	184	119	86	55	98

PAD is poaching and disease, which was assumed to be 0.16 and 0.14 of river returns of MSW and 1SW salmon, respectively.

All methods indicated that numbers of 1SW salmon at spawning approximated or exceeded the spawning requirements. Estimates of the numbers of MSW salmon spawners varied substantially depending on the method used. Reasonable lower and upper limits of spawning escapement are probably provided by the angling exploitation rate of 0.3 (Method 1) and the spawner to angled fish ratio (Method 2) (see Discussion). These methods indicated spawning escapements of between 6569 MSW salmon (54% of requirements) and 14203 salmon (116% of requirements). In terms of egg depositions, Methods 1 (0.3) and 2 indicate between 55% and 119% of target egg depositions were achieved.

In the 1988 assessment of Atlantic salmon in the Restigouche River, returns of MSW and 1SW salmon forecasted to return in 1989 were:

Method	Forecast MSW salmon	1SW salmon
Regression	14611 (7659-27867)	-
Three year mean	12272	11397

Both forecasts were based on total returns as estimated by Method 2 (Randall et al. 1989a). Actual returns in 1989 based on Method 2 were 11106 fish; which were 76% of the regression forecast and 90% of the previous three year average. Actual returns of 1SW salmon were 7388 fish, which was 65% of the previous three year average.

4. Spawning escapement and egg depositions, 1970 to 1989.

Spawning escapements, as estimated using Method 2, are summarized for the period 1970 to 1989 in Tables 6 and 7 (updated from Randall et al. 1989a). Angling data indicated that total returns and spawning escapement of both MSW and 1SW salmon were less in 1989 than in 1988, particularly the numbers of 1SW salmon (Table 7). In contrast, numbers of spawners as estimated from canoe surveys showed an increase from 1988 to 1989. Canoe surveys have been made in the Restigouche River since 1982; for the period 1982 to 1989, spawners as estimated from angling data (Method 2) and canoe surveys were significantly correlated for both MSW salmon ($R^2=0.82$; $P<0.01$) and 1SW salmon ($R^2=0.70$; $P=0.01$). In most years, numbers of spawners as estimated by canoe surveys were greater than numbers of spawners as estimated from angling data (Tables 6 and 7).

Estimated total egg depositions in the Restigouche River from 1971 to 1989 are given in Table 8. Egg depositions were calculated as the product between the estimated numbers of spawners (Method 2) and the average numbers of eggs per spawner (Randall 1984). Egg depositions were significantly correlated with resulting age 0 and age 1 parr densities (Table 8 and Fig. 3).

5. Recruitment.

Average densities of both age 0 and age 1 salmon parr at the 15 electrofishing sites in 1989 exceeded densities from previous years (Table 8; Fig. 4), suggesting that spawning levels and/or freshwater survival rates were greater than average in 1988 and 1989. Variation in densities among individual sites was considerable, however, as indicated by the wide confidence intervals (Fig. 4). Electrofishing data are presently being examined in more detail to determine their usefulness as an index of recruitment strength in the Restigouche River.

6. Forecast for 1990.

The regression between catches of 1SW salmon at Kedgwick Lodge (year i) and total MSW salmon returns to the Restigouche River (year $i+1$) was significant but weak (Table 9; Fig. 5). Returns of MSW salmon in 1990 were predicted to be 11626 (6413-21074).

Assuming average returns of MSW and 1SW salmon in 1990, returns would be 11592 MSW salmon and 9713 1SW salmon (calculated from the previous five year means in Table 6 and 7). Over the long term (1970 to 1989), returns of MSW salmon to the Restigouche River have not varied substantially ($CV=31\%$). Returns

of 1SW salmon were relatively more variable (CV=54%).

Indices of spawning escapement and adult survival in years that will produce 1SW and MSW salmon returns in 1990 were also considered. For MSW salmon, average returns of 1SW salmon in 1988 and 1989 (i.e., same smolt years that will produce 2SW and 3SW salmon in 1990) were compared to the previous five year averages, as a possible index of sea survival. Also, average age 1 parr densities for the period 1985 to 1987 were compared to the previous five year average, as a possible index of recruitment strength. Similarly, for potential returns of 1SW salmon in 1990, age 1 parr densities for 1987 and 1988 were considered:

Spawning or survival index		
	1SW returns	Age 1 parr
MSW salmon (1990)	+24%	+85%
(index years)	(1988,1989)	(1985,1987)
1SW salmon (1990)	-	+ 7%
(index years)		(1987,1988)

The spawning/survival indices suggest MSW salmon returns could be at least average, and 1SW salmon returns could be average in 1990.

DISCUSSION

Judging from angling data, returns of MSW salmon to the Restigouche River were slightly less in 1989 compared to 1988. Total returns were estimated to be about 11,100 MSW salmon, which was the same as the previous five year average of returns to the Restigouche. As in the previous five years, the management plan in effect resulted in a high proportion of total returns potentially surviving to spawn. About 59% of MSW salmon that returned to river were estimated to have spawned. Total harvest of MSW salmon in the river by anglers (Quebec) and native fishermen in 1989 was 2680 fish, which was a slight increase (10%) from the harvest in 1988 (2437).

In contrast to MSW salmon, total returns of 1SW salmon decreased substantially from 1988 to 1989. Landings of 1SW salmon in 1989 were 44% below the landings in 1988. Angling catches of 1SW salmon in 1988 however, were the highest on record. Angling catches in 1989 were closer to average catches for the previous five years; catches in 1989 were 3655 fish, compared to a five year average of 4507. Total returns in 1989 were estimated to be 7388 fish, which was about 29% less than the previous five year average.

Most egg deposition in the Restigouche River comes from MSW salmon. Judging from angling catches of MSW salmon, total egg deposition in 1989 probably ranged between 55% and 119% of the target egg deposition (71.4 million eggs). In past assessments, Method 2 (ratio of spawner to angled fish) has been used to estimate

the long term trends in egg deposition rates. Based on this method, egg deposition rates in 1989 were below target levels, but they were above the average deposition rates in years before the 1984 management plan was introduced (Fig. 6). Juvenile salmon densities at the 15 electrofishing sites seem to confirm that egg depositions have been increasing in recent years (Fig. 4).

Spawning escapement and egg deposition rates as estimated from Method 2 are probably underestimates. The ratio of spawners to angled fish of 0.7 implies an angling exploitation rate of 0.49 which is extremely high. Spawning escapement as estimated from canoe surveys in the Restigouche River also suggest that angling exploitation rates are high (sometimes > 0.5; Table 10). However, canoe surveys may provide estimates of spawners that are negatively biased (Appendix 1; Shardlow et al. 1987), and this would result in estimates of angling exploitation which are too high. In the Miramichi River, exploitation rate by anglers on early run salmon, as estimated from mark-recapture data, averaged 0.34 (Randall et al. 1989b). Exploitation rate by anglers on adult salmon in the Restigouche River is probably at least this high; all Restigouche salmon enter the river early (Peppar 1983) and are thus available to anglers for the entire angling season. Also clear water makes the salmon very visible in the Restigouche and anglers only fish where they can see salmon. Therefore an exploitation rate of 0.3 is probably a reasonable lower limit that can be applied to angling catches in the Restigouche which would give a maximum estimate of returns and spawning escapement (Fig. 6). On the other hand, an exploitation rate of 0.49 is probably an upper limit, which would provide a minimum estimate of spawning escapement. Actual exploitation rate in the Restigouche is probably somewhere between 0.3 and 0.5; obviously exploitation rate needs to be determined accurately if angling catches are going to be continued to be used to estimate salmon abundance in this river. An attempt was made to estimate exploitation rate in 1989 by tagging 1SW salmon at Dalhousie, but the trapping operation was unsuccessful (Appendix 8). Method 2 is used in this assessment to estimate spawning escapement, but this method probably results in underestimates of total egg depositions.

Returns of MSW salmon to the Restigouche River have remained relatively constant over the past several years. Both the regression model and the previous five year averages suggest that total returns in 1990 could be about 11,600 MSW salmon. Assuming average returns of 1SW salmon in 1990, total returns could be about 9,700 fish.

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Table 1. Estimated angling catches of salmon in the Restigouche River, 1970 to 1989.

Year	MSW			1SW			Proportion MSW		
	PQ	NB	Total	PQ	NB	Total	PQ	NB	Total
1970	326	1,716	2,042	166	1,340	1,506	0.66	0.56	0.58
1971	259	757	1,016	173	999	1,172	0.60	0.43	0.46
1972	1,171	3,870	5,041	111	978	1,089	0.91	0.80	0.82
1973	1,146	3,746	4,892	147	1,423	1,570	0.89	0.72	0.76
1974	1,163	4,785	5,948	129	1,038	1,167	0.90	0.82	0.84
1975	741	2,160	2,901	149	1,130	1,279	0.83	0.66	0.69
1976	1,029	4,481	5,510	377	2,345	2,722	0.73	0.66	0.67
1977	1,579	5,128	6,707	459	2,333	2,792	0.77	0.69	0.71
1978	1,652	3,373	5,025	282	1,322	1,604	0.85	0.72	0.76
1979	826	997	1,823	556	1,990	2,546	0.60	0.33	0.42
1980	2,059	4,098	6,157	409	2,833	3,242	0.83	0.59	0.66
1981	1,408	2,832	4,240	635	3,010	3,645	0.69	0.48	0.54
1982	962	1,620	2,582	402	2,449	2,851	0.71	0.40	0.48
1983	587	1,481	2,068	181	715	896	0.76	0.67	0.70
1984	570	[1,672] ¹	[2,242]	348	1,474	1,822	0.62	0.53	0.55
1985	752	[3,563]	[4,315]	259	3,258	3,517	0.74	0.52	0.55
1986	1,418	[4,763]	[6,181]	498	4,915	5,413	0.74	0.49	0.53
1987	873	[3,203]	[4,076]	591	4,414	5,005	0.60	0.42	0.45
1988	1,007	[4,546]	[5,509]	692	6,084	6,776	0.59	0.43	0.45
1989	1,033	[3,641]	[4,674]	662	2,993	3,655	0.61	0.55	0.56
Mean (70-88)	1,028	[3,094]	[4,120]	345	2,318	2,664	0.74	0.57	0.61

¹ Estimates in parenthesis [] include MSW salmon released in New Brunswick. New Brunswick catch-and-release data (1984 to 1989) were estimated from DFO fishery officers.

Table 2. Preliminary estimates of angling catch, effort and CPUE in New Brunswick and Quebec portions of the Restigouche River.

		1989			1988		
		Catch	Effort	CPUE	Catch	Effort	CPUE
N.B.	1SW	2993	9820	0.30	6084	11076	0.55
	MSW	[3641]	9820	0.37	[4546]	11076	0.41
P.Q.	1SW	662	8805	0.08	692	9165	0.08
	MSW	1033	8805	0.12	1007	9165	0.11

Table 3. Preliminary estimates of harvest (numbers) of 1SW and MSW salmon in Restigouche River, 1989. Harvests of salmon in 1988 are given for comparison.

		1989		1988	
Fishery		1SW	MSW	1SW	MSW
Native					
	N.B.	151	568	70	509
	P.Q.	12	1079	3	921
Angling					
	N.B.	2993		6084	
	P.Q.	662	1033	692	1007
Total		3818	2680	6849	2437

Table 4. Commercial, angling and Native salmon landings from Baie des Chaleurs and Restigouche River, 1951 to 1989. Data sources given in Appendix 7.

Year	Commercial		Angling		Native		Total
	1SW	MSW	1SW	MSW	1SW	MSW	
1951		42,453					(46,149) ¹
1952		39,619					(45,758)
1953		31,893					(35,042)
1954		31,327					(34,683)
1955		18,356					(20,705)
1956		15,167					(17,829)
1957		19,916					(23,686)
1958		26,791					(36,496)
1959		32,035					(35,513)
1960		30,618	627	2,427			33,672
1961		21,970	125	3,135			25,230
1962		27,428	203	3,236			30,867
1963		24,097	1,621	5,793			31,511
1964		28,775	136	6,788			35,699
1965		39,547	4,071	3,526			47,144
1966		33,310	1,909	2,138			37,357
1967		34,728	1,341	3,020			39,089
1968		26,719	465	745			27,929
1969		18,356	1,489	1,512			21,357
1970		18,180	1,506	2,042			21,728
1971		8,967	1,172	1,016			11,155
1972	36	23	1,089	5,041			6,189
1973	1,272	295	1,570	4,892			8,029
1974	132	68	1,167	5,948			7,315
1975	163	1,026	1,279	2,901	3	132	5,504
1976	5,107	225	2,722	5,510	13	1,641	15,218
1977	1,134	168	2,792	6,707	19	2,950	13,770
1978	1,522	156	1,604	5,025	23	129	8,459
1979	83	671	2,546	1,823	169	896	6,188
1980	1,986	9	3,242	6,157	58	1,827	13,279
1981	3,045	3,534	3,645	4,240			14,464
1982	2,202	4,437	2,851	2,582	148	1,521	13,741
1983	1,552	4,569	896	2,068	32	1,476	10,593
1984	7,161	2,026	1,822	570	178	1,283	13,040
1985	0	0	3,517	752	35	1,217	5,521
1986	0	0	5,413	1,418	30	1,576	8,437
1987	0	0	5,005	873	100	1,902	7,880
1988	0	0	6,776	1,007	73	1,430	9,286
1989	0	0	3,655	1,033	163	1,647	6,498

¹ Totals from 1951 to 1959 include angling landings for which the 1SW to MSW ratio was unknown.

Table 5. Counts of salmon at a fish barrier on NW Upsalquitch River, 1980 to 1989.

Year	1SW	MSW	Total
<u>Upsalquitch barrier</u>			
1980	843	887	1,730
1981	789	481	1,270
1982	819	622	1,441
1983	430	301	731
1984	518	642	1,160
1985	748	517	1,265
1986	1,738	1,166	2,904
1987	1,557	1,000	2,557
1988	1,121	993	2,114
1989	1,051	894	1,945
Mean (80-88)	951	734	1,686

Table 6. Estimated spawners and total returns of MSW salmon in Restigouche River, 1970 - 1989. Spawners were estimated using a spawner/angled fish ratio of 0.7.

Year	Harvest		MSW Released plus P.Q.	PAD	Spawners (S)	Returns (R)	S/R
	Estuary	River					
1970	18,180	2,042	-----	661	1,429	22,313	0.06
1971	8,967	1,016	-----	329	711	11,023	0.06
1972	23	5,041	-----	1,633	3,529	10,225	0.35
1973	295	4,892	-----	1,584	3,424	10,196	0.34
1974	68	5,948	-----	1,926	4,164	12,106	0.34
1975	1,158	2,901	-----	999	2,031	7,029	0.29
1976	1,866	5,510	-----	1,784	3,857	13,017	0.30
1977	3,118	6,707	-----	2,172	4,695	16,692	0.28
1978	285	5,025	-----	1,627	3,517	10,455	0.34
1979	1,567	1,823	-----	590	1,276	5,256	0.24
1980	1,836	6,157	-----	1,994	4,310	14,297	0.30
1981	3,534	4,240	-----	1,373	2,968	12,115	0.24
1982	5,958	2,582	-----	836	1,807 (3,563) ¹	11,184	0.16
1983	6,045	2,068	-----	670	1,448 (2,397)	10,230	0.14
1984	3,309	688 ²	2,242	726	3,123 (5,233)	7,846	0.40
1985	1,217	1,074	4,315	1,397	6,262 (7,898)	9,950	0.63
1986	1,576	1,693	6,181	2,002	8,815 (9,542)	14,085	0.63
1987	1,902	1,073	4,076	1,320	5,856 (8,535)	10,151	0.58
1988	1,430	1,207	5,553	1,798	8,233 (9,520)	12,668	0.65
1989	1,647	1,377	4,674	1,513	6,569 (11,681)	11,106	0.59

¹ (Spawner counts from field surveys.)

² River harvests, 1984 to 1989, include catch and release mortalities and broodstock removals.

Table 7. Estimated spawners and total returns of 1SM salmon in Restigouche River, 1970 - 1989. Spawners were estimated using a spawner/angled fish ratio of 0.7.

Year	Harvest		PAD	Spawners (S)		Returns (R)	S/R
	Estuary	River					
1970	0	1,506	417	1,054		2,977	0.35
1971	0	1,172	324	820		2,317	0.35
1972	36	1,089	301	762		2,189	0.35
1973	1,272	1,570	435	1,099		4,376	0.25
1974	132	1,167	323	817		2,439	0.33
1975	166	1,279	354	895		2,694	0.33
1976	5,120	2,722	753	1,905		10,501	0.18
1977	1,153	2,792	773	1,954		6,672	0.29
1978	1,545	1,604	444	1,123		4,716	0.24
1979	252	2,546	705	1,782		5,285	0.34
1980	2,044	3,242	897	2,269		8,453	0.27
1981	3,045	3,645	1,009	2,551		10,250	0.25
1982	2,350	2,851	789	1,996	(1,577) ¹	7,986	0.25
1983	1,584	896	248	627	(986)	3,355	0.19
1984	7,339	1,822	504	1,275	(1,374)	10,941	0.12
1985	35	3,517	973	2,462	(2,111)	6,987	0.35
1986	30	5,413	1,498	3,789	(5,190)	10,730	0.35
1987	100	5,005	1,385	3,504	(3,930)	9,994	0.35
1988	73	6,776	1,875	4,743	(3,861)	13,468	0.35
1989	163	3,655	1,012	2,559	(4,128)	7,388	0.35

¹ (Spawner counts from field surveys.)

Table 8. Estimates of total egg deposition and resulting juvenile densities of Atlantic salmon in the Restigouche River, 1971 to 1989.

Year	Egg deposition (millions)	Juvenile salmon densities		
		0+	1+	2+
1	1.	2.	3.	4.
1971	4.3	5.2	2.8	0.6
1972	20.1	22.0	6.1	1.5
1973	21.7	13.1	4.8	1.0
1974	25.3	28.6	6.9	1.4
1975	13.4	13.3	3.9	1.0
1976	24.9	14.7	6.3	1.4
1977	25.6	19.5	5.9	2.1
1978	21.4	6.1	3.8	0.4
1979	8.1	9.3	2.4	0.4
1980	20.5	18.9	3.3	3.1
1981	17.8	11.2	7.8	2.5
1982	10.9	25.4	7.3	1.6
1983	8.7	25.1	10.4	2.8
1984	18.6	25.2	7.5	4.7
1985	37.4	23.9	9.4	2.1
1986	52.6	42.0	6.1	1.9
1987	35.0	53.2	12.1	---
1988	49.3	72.1	----	---
1989	39.2	----	----	---

Correlations:

	n	r	P
ln 1. with ln 2.	17	0.74	< 0.01
ln 1. with ln 3.	16	0.65	< 0.01
2. with 3.	16	0.74	< 0.01
2. with 4.	15	0.45	0.09
3. with 4.	15	0.51	0.05

Table 9. Total returns of MSW salmon to Restigouche River and catch of 1SW salmon at Kedgwick Lodge in the previous year (1969-89). Total returns are calculated in Table 6. Returns of MSW salmon predicted for 1990 are given in parenthesis.

Year (i)	Kedgwick Lodge 1SW salmon catch (year i)	Total returns of MSW salmon to Restigouche (year i+1)
1969	174	22,313
1970	124	11,023
1971	72	10,225
1972	36	10,196
1973	30	12,106
1974	27	7,029
1975	33	13,017
1976	71	16,692
1977	37	10,455
1978	25	5,256
1979	128	14,297
1980	26	12,115
1981	45	11,184
1982	69	10,230
1983	44	7,846
1984	83	9,950
1985	98	14,085
1986	199	10,151
1987	238	12,668
1988	223	11,106
1989	86	11,626

MSW returns in 1990 (parenthesis) were estimated from the regression: $\ln \text{MSW (yr } i+1) = 8.52 + 0.19 \ln (1\text{SW, yr } i)$.
($R = 0.47$, $df = 19$, $F = 5.24$, $P < 0.034$).

Table 10. Estimated angling exploitation rates (U) in Restigouche River, 1982 to 1989. Number of spawners were estimated from field spawning surveys and returns were estimated assuming a poaching and disease rate of 0.14 for 1SW salmon.

1SW				
Yr	Angling	Spawners	Returns	u
1982	2,851	1,577	5,149	0.55
1983	896	986	2,188	0.41
1984	1,822	1,374	3,716	0.49
1985	3,517	2,111	6,544	0.54
1986	5,413	5,190	12,329	0.44
1987	5,005	3,930	10,390	0.48
1988	6,776	3,861	12,369	0.55
1989	3,655	4,128	9,050	0.40

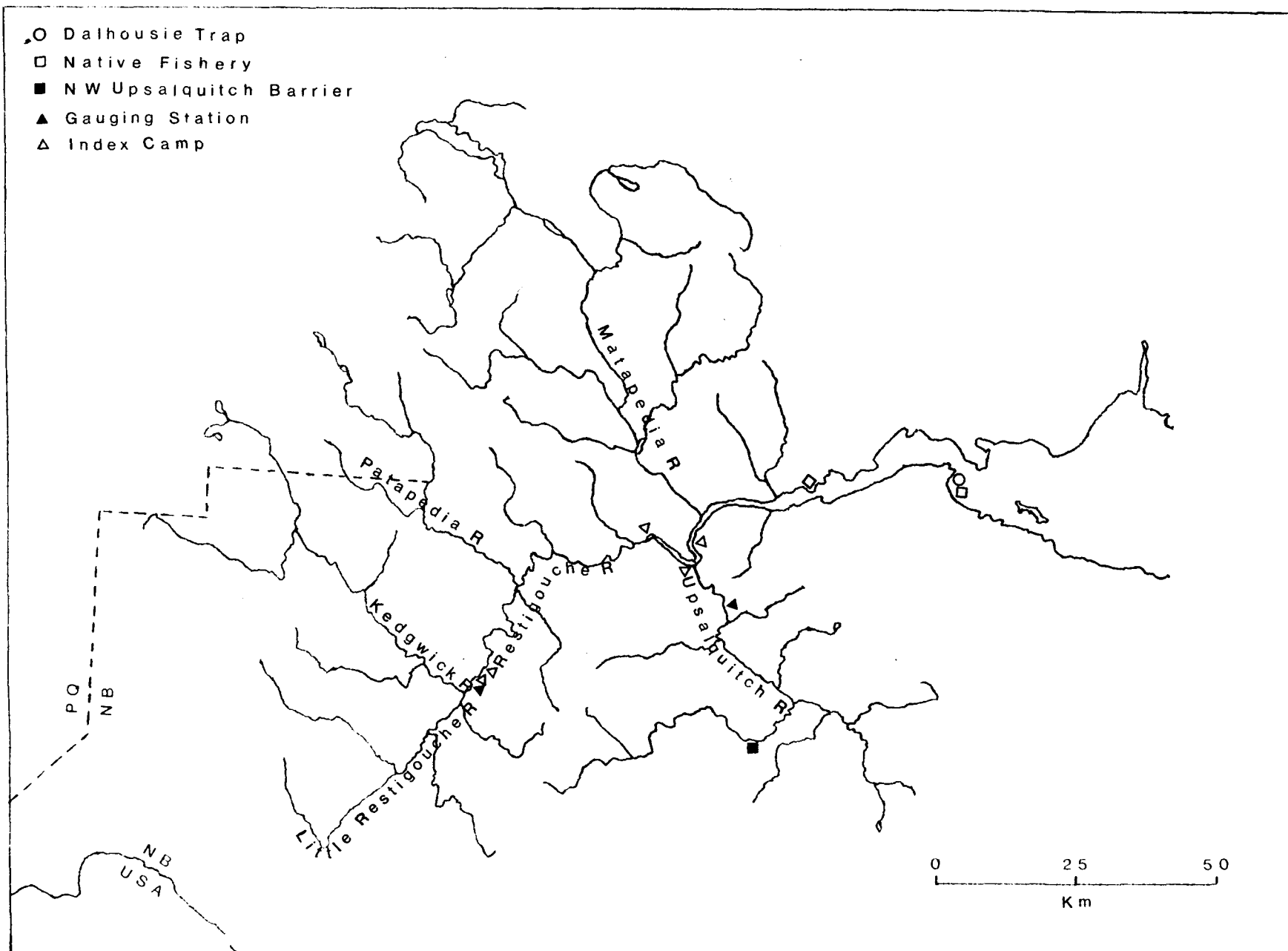
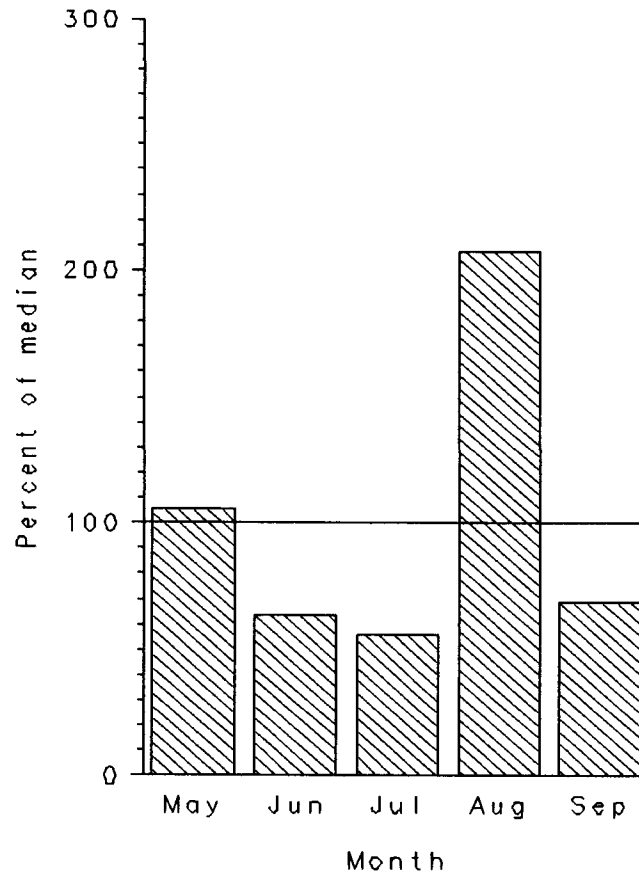


Figure 1. Map of the Restigouche River showing the location of salmon counting facilities, index angling camps and discharge gauging stations.

Upsalquitch



Main Restigouche

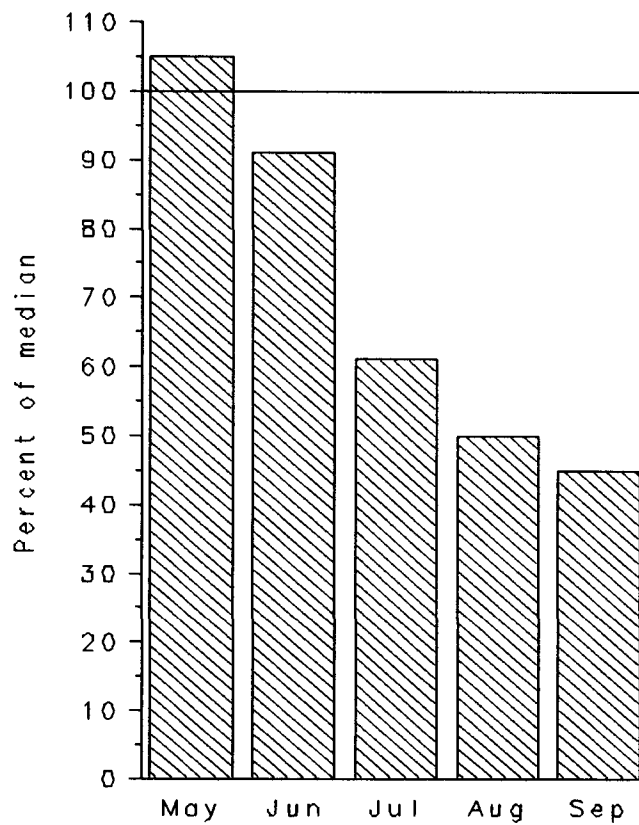
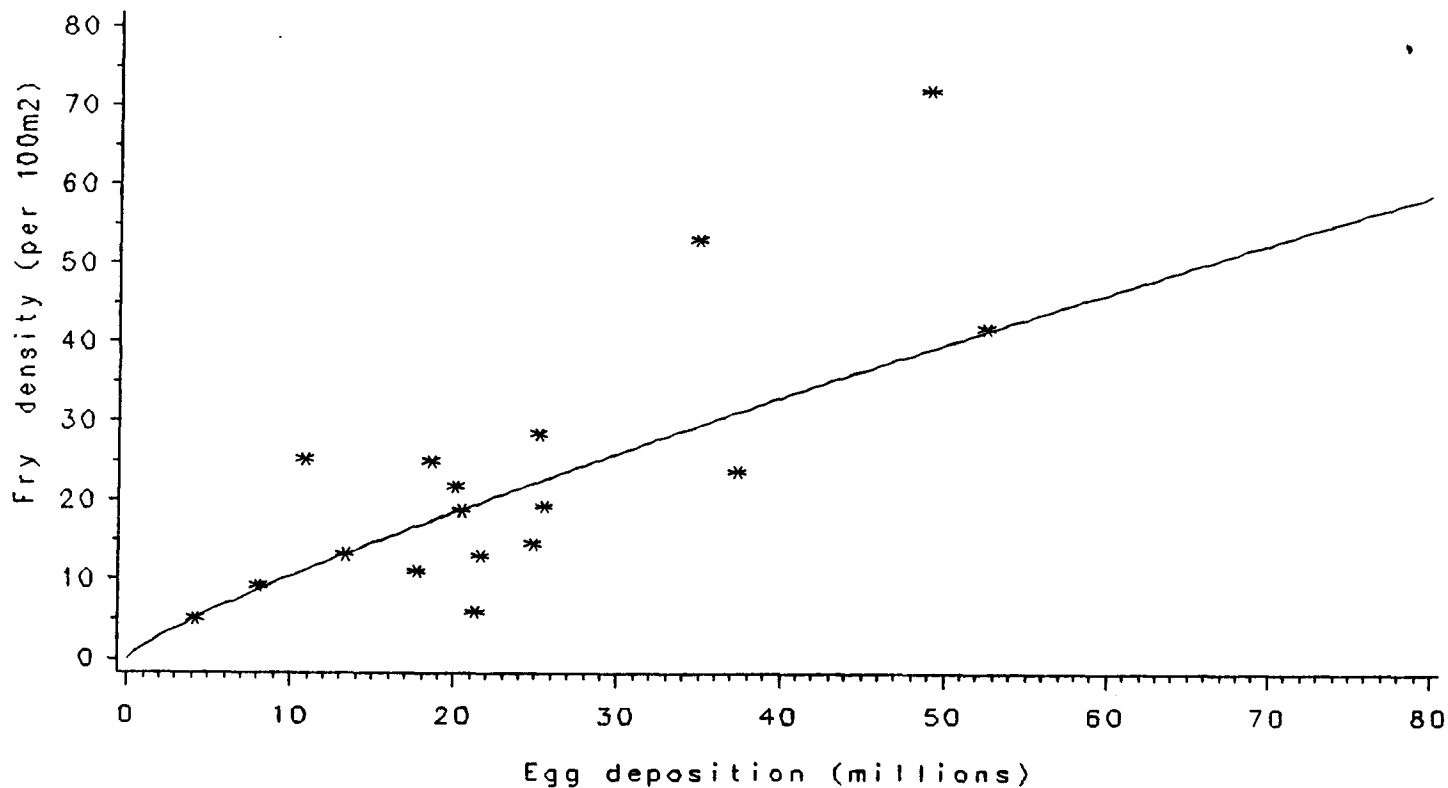


Fig. 2. Mean monthly discharge (% of long term mean) in Upsalquitch and Main Restigouche Rivers during 1989.

Age 0 parr; $R^2 = 0.55$



Age 1 parr; $R^2 = 0.42$

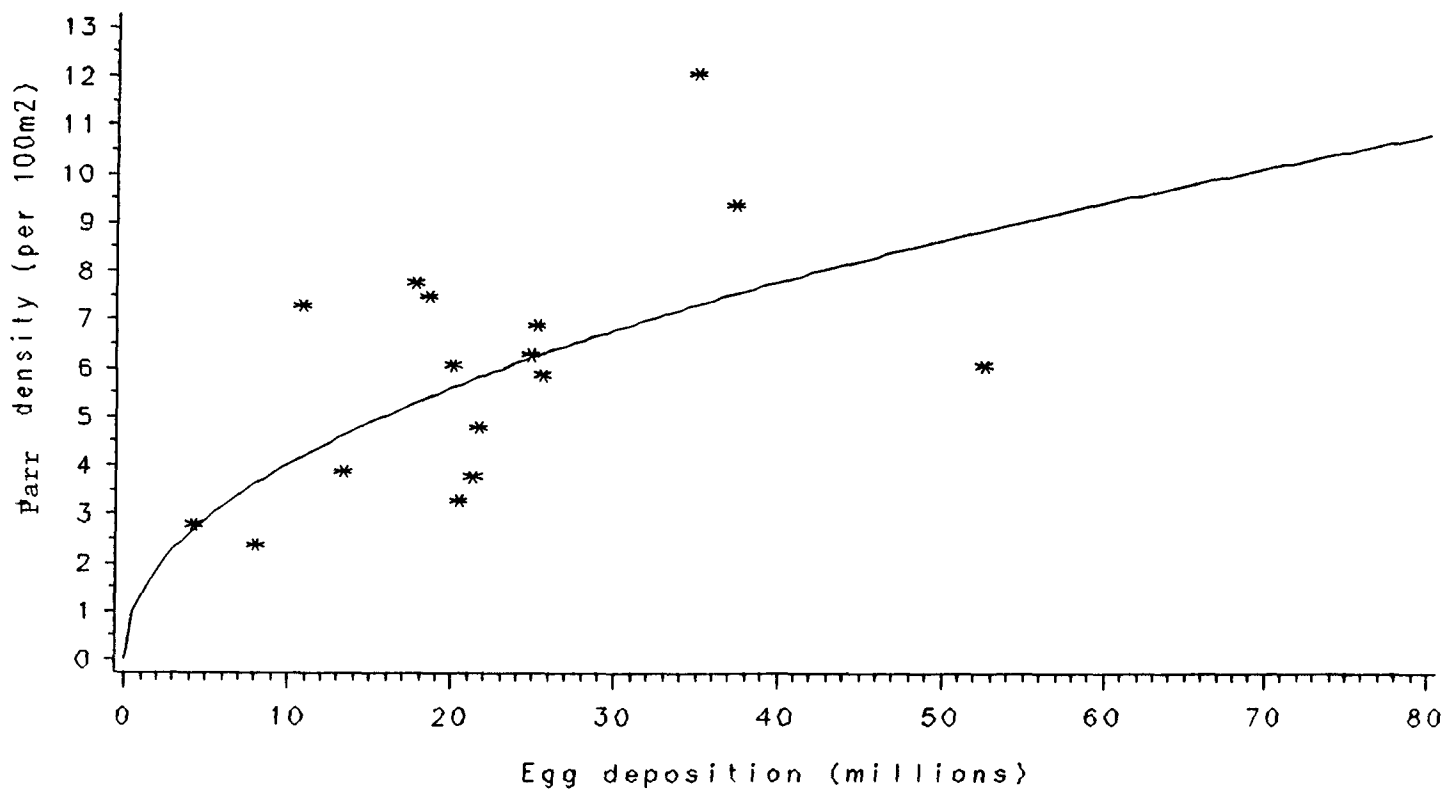
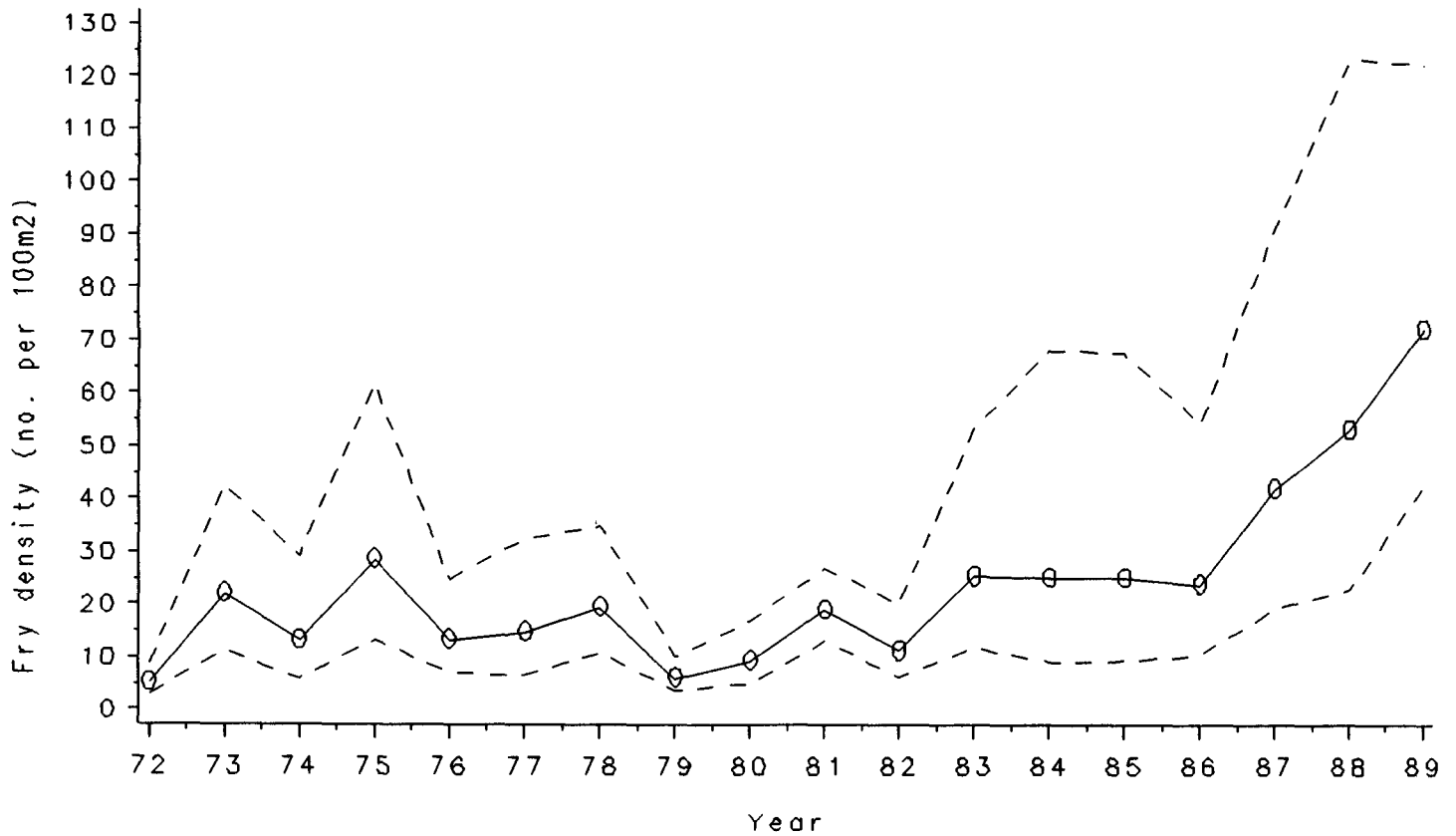


Fig. 3. Relationships between estimated egg deposition levels and resulting mean densities of age 0 and age 1 parr in the Restigouche River, 1972-1989.

Age 0 parr



Age 1 parr

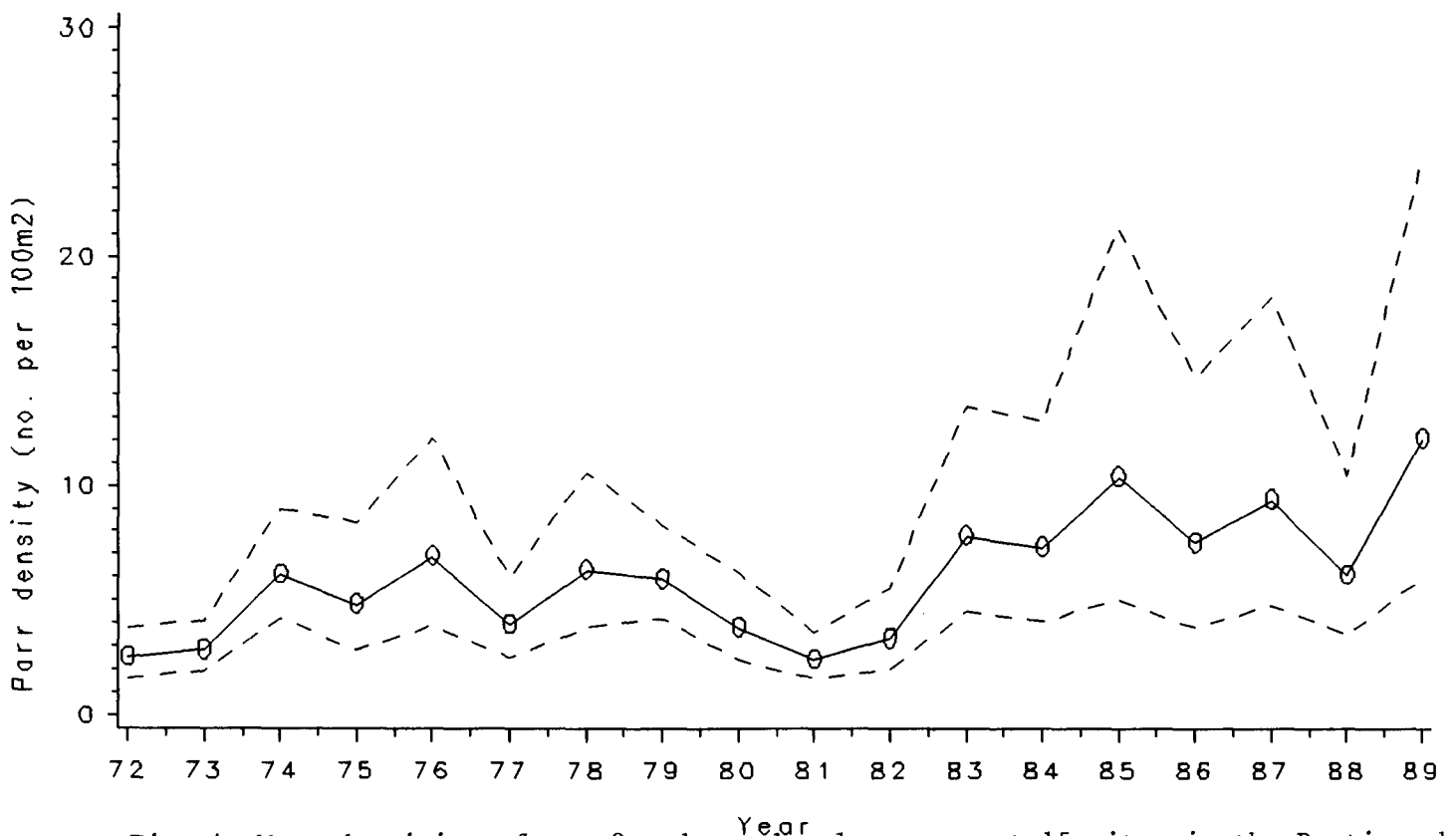


Fig. 4. Mean densities of age 0 and age 1 salmon parr at 15 sites in the Restigouche River, 1972 to 1989. Dashed lines indicate 95% confidence intervals.

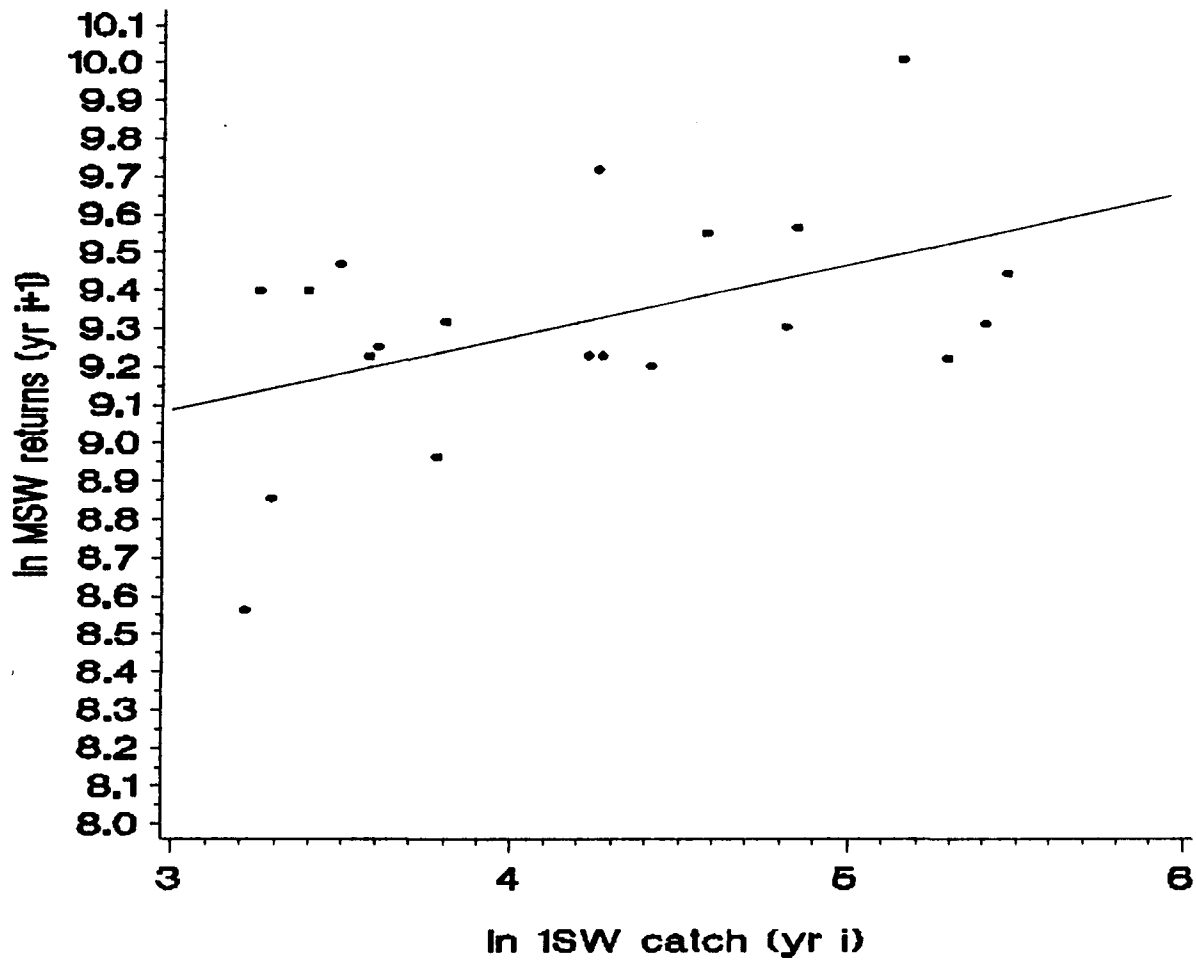


Fig. 5. Correlation between catches of 1SW salmon at Kedgwick Lodge (year i) and total returns of MSW salmon to the Restigouche River (year i+1).

Restigouche

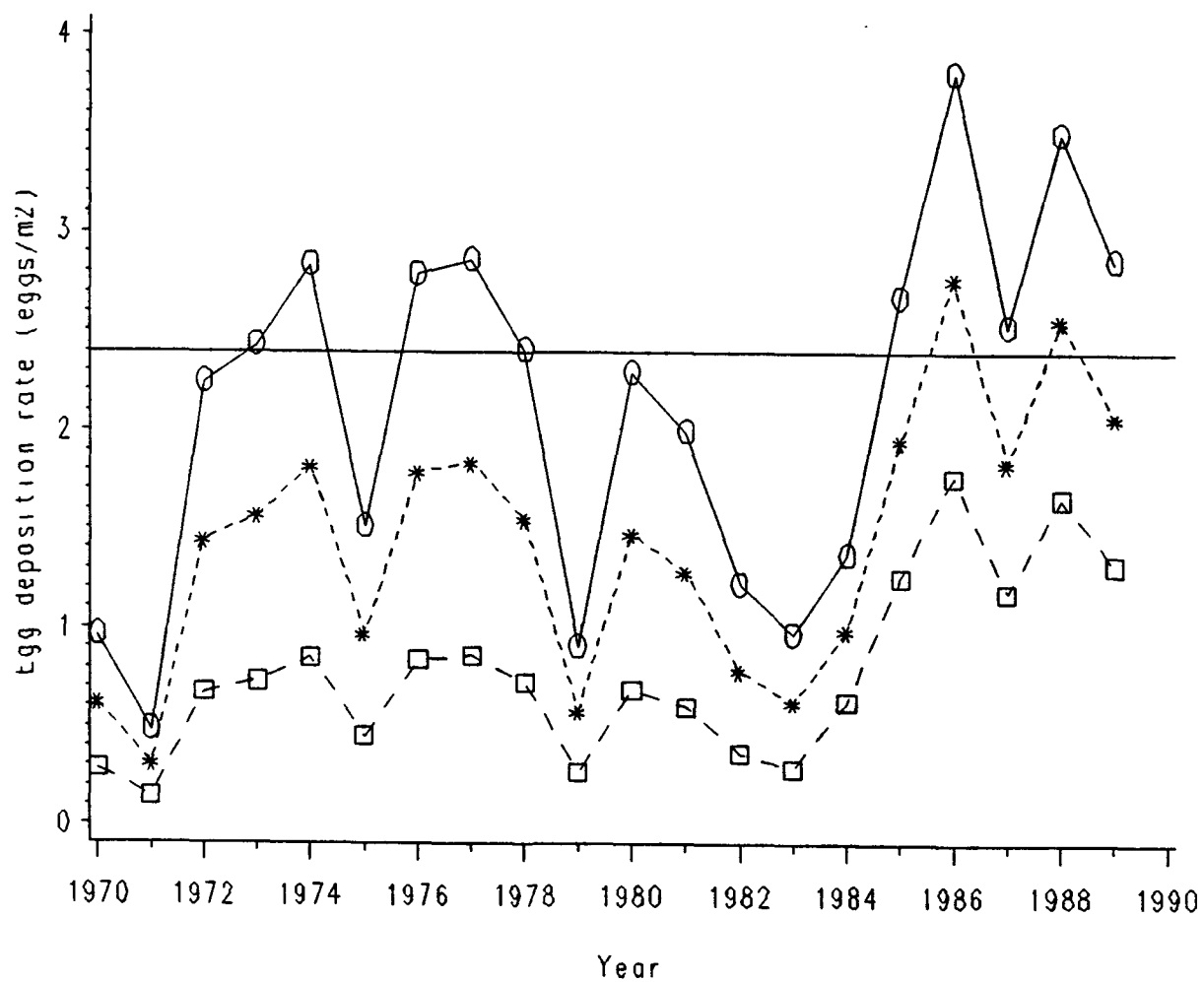


Fig. 6. Estimated egg deposition levels in the Restigouche River, 1970 to 1989, as estimated by Method 2 (spawner to angled fish ratio of 0.7) (squares), and Method 1 with assumed angling exploitation rates 0.4 (asteriks) and 0.3 (circles). Horizontal line indicates target deposition rates.

APPENDIX 1

Spawner Surveys in the Restigouche River

A preliminary attempt was made in 1989 to determine the accuracy of estimating numbers of spawners in the Restigouche River by visual counts from canoe surveys. During October, a known number of 1SW and MSW salmon were counted into two enclosures in the Upsalquitch River immediately above the DNRE protection barrier. The upper enclosed section of river consisted of a large pool (maximum depth about 5 m) about 0.2 km long; river width at the upper enclosure varied from about 20 to 50 m. The lower enclosure was about 3.3 km in length, and varied between about 10 and 100 metres in width. Most areas within the lower enclosure were wadeable (i.e., less than 1 m in depth) with the exception of three pool areas which had maximum depths of about 5 m.

Each enclosure was surveyed twice by two different teams from the upstream barrier to the lower barrier. The actual numbers of fish in each enclosure was unknown to the survey teams. For each of the two replicates, the sections were first surveyed by canoe and then by two people snorkelling in tandem. Each team included one experienced and one inexperienced surveyor, and each surveyor estimated the numbers of 1SW and MSW salmon in the enclosures independent of the other surveyors. Results are given below:

1. Experienced surveyors:

Upper enclosure		Snorkelling		Canoe		Actual
		1	2	1	2	
	1SW	19	16	13	13	10
	MSW	7	8	9	9	11
	Total	26	24	22	22	21
Lower enclosure	1SW	4	3	2	2	16
	MSW	3	3	5	2	2
	Total	7	6	7	4	18
Both	1SW	23	19	15	15	26
	MSW	10	11	14	11	13
	Total	33	30	29	26	39
	% of actual	85	77	74	67	

2. Inexperienced surveyors

Upper enclosure	1SW	24	16	18	12	10
	MSW	6	7	8	6	11
	Total	30	23	26	18	21
Lower enclosure	1SW	3	4	3	2	16
	MSW	2	3	4	3	2
	Total	5	7	7	5	18
Both	1SW	27	20	21	14	26
	MSW	8	10	12	9	13
	Total	35	30	33	23	39
	% of actual	90	77	85	59	

All surveyors underestimated the total numbers of fish in the survey area. For the experienced surveyors, the estimates were 81% of the actual numbers for snorkelling survey and 71% of the actual numbers for the canoe survey. Results were not consistent between the two sections. Surveyors consistently overestimated the numbers of 1SW salmon in the upper enclosure, but significantly underestimated the numbers in the lower enclosure. On average, the results were similar for both experienced and inexperienced surveyors. However, the difference in estimates between replicates was larger for the inexperienced crew.

APPENDIX 2

Commercial salmon landings from Baie des Chaleurs and Restigouche River, 1951 to 1989. Data sources given in Appendix 7.

Year	New Brunswick			Québec			TOTAL
	1SW	MSW	TOTAL	1SW	MSW	TOTAL	
1951		17,718	17,718		24,735	24,735	42,453
1952		19,207	19,207		20,412	20,412	39,619
1953		16,868	16,868		15,025	15,025	31,893
1954		17,081	17,081		14,246	14,246	31,327
1955		8,221	8,221		10,135	10,135	18,356
1956		7,513	7,513		7,654	7,654	15,167
1957		9,639	9,639		10,277	10,277	19,916
1958		15,380	15,380		11,411	11,411	26,791
1959		16,159	16,159		15,876	15,876	32,035
1960		13,537	13,537		17,081	17,081	30,618
1961		12,119	12,119		9,851	9,851	21,970
1962		16,443	16,443		10,985	10,985	27,428
1963		13,820	13,820		10,277	10,277	24,097
1964		15,876	15,876		12,899	12,899	28,775
1965		22,750	22,750		16,797	16,797	39,547
1966		17,789	17,789		15,521	15,521	33,310
1967		21,404	21,404		13,324	13,324	34,728
1968		15,734	15,734		10,985	10,985	26,719
1969		10,206	10,206		8,150	8,150	18,356
1970		9,100	9,100		9,080	9,080	18,180
1971		3,949	3,949		5,018	5,018	8,967
1972	36	23	59	0	0	0	59
1973	723	168	891	549	127	676	1,567
1974	31	16	47	101	52	153	200
1975	144	906	1,050	19	120	139	1,189
1976	3,674	162	3,836	1,433	63	1,496	5,332
1977	1,134	168	1,302	0	0	0	1,302
1978	1,522	156	1,678	0	0	0	1,678
1979	83	671	754	0	0	0	754
1980	1,986	9	1,995	0	0	0	1,995
1981	3,045	3,534	6,579	0	0	0	6,579
1982	2,118	2,545	4,663	84	1,892	1,976	6,639
1983	1,467	2,227	3,694	85	2,342	2,427	6,121
1984	7,161	2,026	9,187	0	0	0	9,187
1985	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0

APPENDIX 3

Angling salmon landings from Restigouche River, 1951 to 1989. Data sources given in Appendix 7.

Year	New Brunswick			Québec			TOTAL
	1SW	MSW	TOTAL	1SW	MSW	TOTAL	
1951			3,511	25	160	185	3,696
1952			5,662	104	373	477	6,139
1953			2,963	75	111	186	3,149
1954			2,855	127	374	501	3,356
1955			2,018	99	232	331	2,349
1956			2,328	107	227	334	2,662
1957			3,387	124	259	383	3,770
1958			9,135	220	350	570	9,705
1959			3,161	108	209	317	3,478
1960	621	2,406	3,027	6	21	27	3,054
1961	117	3,103	3,220	8	32	40	3,260
1962	202	3,236	3,438	1	0	1	3,439
1963	1,617	5,788	7,405	4	5	9	7,414
1964	0	6,480	6,480	136	308	444	6,924
1965	3,860	3,050	6,910	211	476	687	7,597
1966	1,710	1,687	3,397	199	451	650	4,047
1967	1,084	2,440	3,524	257	580	837	4,361
1968	408	617	1,025	57	128	185	1,210
1969	1,352	1,200	2,552	137	312	449	3,001
1970	1,340	1,716	3,056	166	326	492	3,548
1971	999	757	1,756	173	259	432	2,188
1972	978	3,870	4,848	111	1,171	1,282	6,130
1973	1,423	3,746	5,169	147	1,146	1,293	6,462
1974	1,038	4,785	5,823	129	1,163	1,292	7,115
1975	1,130	2,160	3,290	149	741	890	4,180
1976	2,345	4,481	6,826	377	1,029	1,406	8,232
1977	2,333	5,128	7,461	459	1,579	2,038	9,499
1978	1,322	3,373	4,695	282	1,652	1,934	6,629
1979	1,990	997	2,987	556	826	1,382	4,369
1980	2,833	4,098	6,931	409	2,059	2,468	9,399
1981	3,010	2,832	5,842	635	1,408	2,043	7,885
1982	2,449	1,620	4,069	402	962	1,364	5,433
1983	715	1,481	2,196	181	587	768	2,964
1984	1,474	0	1,474	348	570	918	2,392
1985	3,258	0	3,258	259	752	1,011	4,269
1986	4,915	0	4,915	498	1,418	1,916	6,831
1987	4,414	0	4,414	591	873	1,464	5,878
1988	6,084	0	6,084	692	1,007	1,699	7,783
1989	2,993	0	2,993	662	1,033	1,695	4,688

APPENDIX 4

Angling salmon landings from Restigouche River System, 1970-1989. Data sources given in Appendix 7.

Year	Metapedia		Upsalquitch		Patapedia		Kedgwick		Little Main		Main Restigouche	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
1970	162	290	270	122	4	24	323	205	---	---	747	1401
1971	153	217	344	90	20	40	128	67	---	---	527	602
1972	102	1010	362	984	7	144	165	425	---	---	453	2478
1973	147	1098	498	512	0	43	128	548	---	---	797	2691
1974	124	1083	433	579	5	63	80	289	---	---	525	3934
1975	131	692	462	262	18	31	136	316	---	---	532	1600
1976	296	922	767	753	80	88	209	348	---	---	1370	3399
1977	278	1312	554	901	181	227	368	684	---	---	1411	3583
1978	251	1457	449	507	31	158	143	423	---	---	730	2480
1979	466	754	507	135	90	60	316	123	---	---	1167	751
1980	311	1784	1178	592	95	229	284	468	---	---	1374	3084
1981	485	1176	1234	221	148	175	356	473	---	---	1422	2195
1982	259	841	818	214	143	112	322	190	59 ¹	50 ¹	1250	1175
1983	154	456	203	218	27	103	68	224	14	0	430	1067
1984 ²	318	527	483	0	45	33	149	10	102	0	725	0
1985	208	708	1175	0	103	32	329	12	163	0	1539	0
1986	387	1293	1397	0	162	89	565	36	481	0	2421	0
1987	498	817	819	0	193	40	582	16	407	0	2506	0
1988	580	948	1296	0	188	27	807	32	524	0	3381	0
1989	622	989	898	0	61	28	232	16	99	0	1743	0

¹ Prior to 1982 Little Main landings included in Main Restigouche.

² Hook and release of MSW salmon began in New Brunswick.

APPENDIX 5

Native salmon landings from Baie des Chaleurs and Restigouche River, 1975 to 1989. Data sources given in Appendix 7.

Year	New Brunswick			Québec			TOTAL
	1SW	MSW	TOTAL	1SW	MSW	TOTAL	
1975	3	132	135				135
1976	13	124	137	0	1,517	1,517	1,654
1977	19	212	231	0	2,738	2,738	2,969
1978	23	129	152				152
1979	84	148	232	85	748	833	1,065
1980	34	264	298	24	1,563	1,587	1,885
1981	20	211	231				231
1982	12	155	167	148	1,521	1,669	1,836
1983	0	260	260	32	1,216	1,248	1,508
1984	1	213	214	177	1,070	1,247	1,461
1985	0	241	241	35	976	1,011	1,252
1986	26	431	457	4	1,145	1,149	1,606
1987	95	916	1,011	5	986	991	2,002
1988	70	509	579	3	921	924	1,503
1989	151	568	719	12	1,079	1,091	1,810

APPENDIX 6

Operating dates of Native fisheries in Baie des Chaleurs and Restigouche River, 1979 to 1989. Data sources given in Appendix 7.

Year	New Brunswick		Québec
	Gillnet	Trap net	Gillnet
1979	May 14 - October 24		June 6 - August 1
1980	May 19 - July 13		June 2 - July 28
1981	May 15 - August 30		
1982	May 17 - August 1		June 9 - August 2
1983	May 16 - August 28		June 3 - August 7
1984	May 14 - August 27		June 5 - August 10
1985	May 20 - August 25		June 3 - July 31
1986	May 19 - August 10	May 26 - July 20 ¹	June 2 - June 26
1987	May 24 - July 27	May 24 - July 15 ²	June 1 - June 30
1988	May 16 - August 26	May 16 - August 14	June 6 - July 6
1989	May 15 - August 20	May 29 - August 20	June 5 - June 30

¹ One trap net in 1986.

² Two trap nets in 1987 to 1989.

APPENDIX 7

Salmon landings for Baie des Chaleurs and Restigouche River given in Appendices 2 to 6 are from the following sources:

1. Commercial data

New Brunswick: Districts 63, 64 and 65

Québec: Districts 12, 13, 14 and 15

New Brunswick and Québec commercial data for 1951 to 1969 from May and Lear (1971) and assume salmon average 6.4 kg.

New Brunswick commercial for 1970 to 1984 from Redbooks (compiled by Department of Fisheries and Oceans, Science Branch, Halifax).

Québec commercial for 1970 to 1981 from Bureau de la Statistique du Québec (G. Ouellet and J.P. Lebel, pers. comm.), and assume average weight and MSW/1SW ratio same as calculated from Redbooks.

Québec commercial for 1982 to 1983 from Ministère du Loisir, de la Chasse et de la Pêche, Québec (G. Ouellet and G. Landry, pers. comm.).

2. Angling data

New Brunswick angling data for 1951 to 1959 from Smith (1981); 1960 to 1969 from Swetnam and O'Neil (1985); 1970 to 1979 from O'Neil and Swetnam (1984); 1980 to 1983 from Swetnam and O'Neil (1984); 1984 from O'Neil et al. (1985); 1985 from O'Neil et al. (1986); 1986 from O'Neil et al. (1987); and 1987 to 1988 from O'Neil (pers. comm.).

Québec angling from 1951 to 1969 from New Brunswick Department of Natural Resources and Energy files (A. Madden, pers. comm.). Angling data for 1970 to 1988 from Ministère du Loisir, de la Chasse et de la Pêche, Québec (G. Ouellet, J.P. Lebel and G. Landry, pers. comm.).

3. Native data

New Brunswick Native data for 1975 to 1982 from Department of Fisheries and Oceans, Protection and Regulations Branch files (R. Roy and M. Sullivan, pers. comm.); 1983 to 1986 from Department of Fisheries and Oceans, Resource Allocation and Development Branch, (K. Atwin, F. Ring and R. Hébert, pers. comm.); and 1987 to 1988 from Department of Fisheries and Oceans, Protection and Regulations Branch, (R. Roy, R. MacNair and R. Senechal, pers. comm.).

Québec Native data for 1976 to 1984 from Gaudreault (1984); 1985 to 1988 from Ministère du Loisir, de la Chasse et de la Pêche, Québec (G. Landry, pers. comm.).

4. All 1989 data are preliminary as described in text.

APPENDIX 8

Adult salmon trap, Restigouche River, 1989

An adult salmon trap was operated by contract at Dalhousie, New Brunswick from 27 June to 22 July, 1989. The trap was installed about 315 m south of Bon Ami Rocks, which was the exact location of the trap operated by DFO for monitoring salmon from 1972 to 1980 (Pepper 1983). The trap consisted of a 330' shore leader (mesh size of 12.7 cm), and a single spearhead trap (mesh size 3.2 cm). The original trapping facility at Dalhousie included four interconnected traps and adjoining leaders (total length of 702 m, with 15.2 cm mesh in the leaders and 6.4 cm mesh in the traps). During the 1972 to 1980 trapping period, however, most salmon were captured in the shore trap (> 50%; R. Stewart, personal comm.) During 1989, the objective was to tag about 500 1SW salmon using Carlin tags. Recaptures from angling camps within the Restigouche River were then going to be used to estimate angling exploitation rate. During the period 1972 to 1980, most of the total numbers of 1SW salmon trapped were caught within the period the trap was operated in 1989 (usually greater than 70%).

The 1989 trapping operation was unsuccessful. A total of 34 1SW salmon and 14 MSW salmon were captured. Only 26 1SW salmon were tagged, and none were subsequently recaptured within the river by anglers.