Fisheries and Oceans Science
Pêches et Océans Sciences

C S A S

Canadian Stock Assessment Secretariat

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Secrétariat canadien pour l'évaluation des stocks

Research Document 2000/004

Document de recherche 2000/004

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Stock Status of Atlantic Salmon (*Salmo salar*) in the Miramichi River, 1999

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ISSN 1480-4883
Ottawa, 2000

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ABSTRACT

Atlantic salmon (*Salmo salar*) in the Miramichi River, New Brunswick, were harvested by two user groups in 1999; First Nations and recreational fishers. The Aboriginal food fishery catches in 1999 represented an increase of 9% for small and 139% for large salmon relative to the previous five years. Harvests of large salmon were 86% from the early-run (prior to Sept. 1) and 96% of the small salmon harvests were taken prior to Sept. 1 in 1999. Recreational fishery catch data for 1999 had not yet been analysed. The Crown Reserve catches decreased from 1998 and the previous five-year mean. For the Southwest Miramichi, 11200 small salmon and 6800 large salmon were estimated to have returned in 1999. After accounting for removals, egg depositions in the Southwest Miramichi by both small and large salmon will be less than 55% of the conservation requirement. For the Northwest Miramichi, 11600 small salmon and 6700 large salmon were estimated to have returned. Egg depositions by small and large salmon in the Northwest in 1999 will be less than 128% of conservation requirement. Egg depositions had exceeded the conservation requirements in each branch prior to 1998 except for the Southwest Miramichi in 1997. Neither branch had achieved conservation requirements in 1998. Large salmon returns in 2000 are expected to be about 9700 fish with a near zero chance of meeting conservation requirements. The increased densities of juvenile salmon, since 1985 for fry and 1986 for parr, at the index sites sampled since 1971, indicate that the long-term prospect for the Atlantic salmon stock of the Miramichi should be good if smolt production is as high as inferred from juveniles and sea survivals improve.

RÉSUMÉ

Le saumon de l'Atlantique (*Salmo salar*) de la rivière Miramichi, Nouveau-Brunswick, a été exploité dans les pêches autochtones et dans les pêches récréatives. En 1999, les captures de grands saumons dans les pêches autochtones ont augmenté de 139% par rapport à la moyenne des années antérieures tandis que les captures de madeleineaux (<63 cm longueur à la fourche) ont augmenté de 9%. Près de 86% des grands saumons et 96% des madeleineaux récoltés par les autochtones provenaient de la remontée d'été (avant le 1^{e} septembre). Pour la pêche récréative, les données de captures en 1999 n'étaient pas disponibles. Dans la pêche sportive des eaux de réserves de la couronne, les captures étaient inférieures à 1998 et à la moyenne des années antérieures. La montaison de saumon dans la rivière Miramichi sud-ouest était de 11 200 madeleineaux et 6 800 grands saumons. Les géniteurs auraient contribué à une ponte d'oeufs maximale de 55% des besoins de la conservation pour la rivière Miramichi sud-ouest. Dans la Miramichi nord-est, la montaison a été estimée à environ 11 600 madeleineaux et 6 700 grands saumons. Les géniteurs de cette montaison auraient contribué une ponte d'oeufs maximale de 128% des besoins de conservation. Avant 1998, les pontes d'oeufs ont été supérieures aux besoins pour les deux affluents principales de la Miramichi, sauf en 1997 pour l'affluent sud-ouest. En 1998, la ponte d'oeufs a été inférieure aux besoins de conservations dans les deux affluents. La prévision de la remontée de grands saumons pour 2000 est d'environ 9 700 poissons. Il est toutefois improbable, à près de 0%, que la remontée soit supérieure au niveau de conservation. Une amélioration des densités de juvéniles depuis 1985 pour les tacons d'age 0+ et de 1986 pour les plus vieux, a été observée aux sites repères échantillonnées annuellement depuis 1971. Les prévisions à long-terme pour le stock de saumon de l'Atlantique de la rivière Miramichi sont de montaisons soutenues voire supérieures si la production relative de saumonneaux est similaire à l'abondance des juvéniles et si les taux de survie en mer s'améliorent.

INTRODUCTION

The Miramichi River, at a maximum axial length of 250 km and draining an area of about 14,000 km^2, has the largest Atlantic salmon run of eastern North America. There are two major branches: the Northwest Branch covers about 3,900 km^2 and the Southwest Branch about 7,700 km^2 of drainage area (Randall et al. 1989). The two branches drain into a common estuary and subsequently drain into the Gulf of St. Lawrence at latitude 47°N (Fig. 1).

Annual assessments of the Atlantic salmon (*Salmo salar*) stock of the Miramichi River have been prepared since 1982 (Randall and Chadwick 1983a, b; Randall and Schofield 1987, 1988; Randall et al. 1985, 1986, 1989, 1990; Moore et al. 1991, 1992). Since 1992, assessments of the Northwest and Southwest branches have been prepared (Courtenay et al. 1993; Chaput et al. 1994b, 1995, 1996, 1997, 1998, 1999).

Two size groups of salmon return to the river to spawn. The small salmon category consists of fish less than 63 cm fork length and are generally referred to as grilse. These fish have usually spent only one full year at sea (one-sea-winter) prior to returning to the river but the size group may also contain some previously spawned salmon. The large salmon category consists of fish greater than or equal to 63 cm fork length. This size group is generally referred to as multi-sea-winter or just salmon and contains varying proportions of one-sea-winter, two-sea-winter and three-sea-winter maiden (first time) spawners as well as previous spawners (Moore et al. 1995). Salmon which have spawned and have not returned to sea in the spring of the year are referred to as kelts or black salmon in contrast to bright salmon which are mature adult salmon moving into freshwater from the ocean.

In addition to the different runs and size groups, the Miramichi River also contains several stocks of Atlantic salmon (Saunders 1981, Riddell and Leggett 1981). Separate branch assessments were introduced to account for some of this diversity and for the differences in exploitation between the Northwest and Southwest branches. Aboriginal fisheries were historically conducted almost exclusively in the Northwest Miramichi (exploitation also occurs in the estuarial waters of the Miramichi River, downstream of the confluence of the two branches) and recreational fisheries exploitation also differs between the Northwest and Southwest branches.

Temporal stock distinctiveness has also been highlighted as an important component of the Atlantic salmon resource (Saunders 1967). The early-run consists of salmon returning to the river up to August 31 whereas the late-run is considered to consist of salmon returning from September 1 onwards. Early runs and late runs have different composition in terms of small and large salmon proportions and sex ratios. The early runs in both branches are also exploited more heavily than the late runs.

The objectives of the assessment are to estimate the returns of salmon, the spawning escapement after removals and to compare the egg deposition to the conservation requirement for the river. The status of the resource is assessed on the basis of whether the conservation requirement was attained/exceeded, on the trends in returns, the juvenile densities, and the prospects. The returns and escapements are estimated on a spatial and temporal scale corresponding to the available data. Returns by size group to the whole river are partitioned into Northwest and Southwest Miramichi returns and when possible into early and late run. The egg depositions in each branch were estimated by incorporating the variability in run composition (sex ratio and size of fish which determines the fecundity) and the uncertainty in the estimates of escapement. Juvenile surveys provide finer spatial scale assessments of spawning activity in the previous year. Finally, using time series of returns, escapements, and juvenile surveys, we provide a prognosis of the future stock status of Atlantic salmon from the Miramichi River.

Input from industry, user groups and other government agencies was obtained during a science assessment workshop held in Miramichi City (NB) on November 23, 1999 (minutes in Appendix 1).

DESCRIPTION OF FISHERIES

A distinction is made between catches and harvests. Catches consist of fish which are caught but not necessarily retained. Harvests represent fish which are caught and retained.

Atlantic salmon were harvested by two user groups in 1999: First Nations and recreational fishers. Aboriginal food fishery harvesting agreements were signed between DFO, the Eel Ground First Nation and the Red Bank First Nation (Table 1). The agreements focused on the selective harvest of small salmon over large salmon through the use of food fishery trapnets. In 1998 and 1999, the Eel Ground First Nation fished one food fishery trapnet in the Northwest Miramichi and two food trapnets in the Southwest Miramichi. A partial counting fence has also been operated at Big Hole Tract for the selective harvest of small and large salmon since 1996 (Table 1). Two food trapnets were fished by Red Bank First Nation at similar locations to previous years (confluence of the Northwest and Little Southwest Miramichi). A communal license was issued to Burnt Church First Nation (Table 1).

There were some changes in recreational fishery regulations in 1999 relative to previous years (Moore et al. MS1995) (Table 2a). There was a partial continuation of the reduced individual recreational quota introduced in 1998. The daily retention limit of one small salmon was maintained but there was no change in the season limit of 8 kept fish for the year. There was mandatory catch-and-release of all large salmon, as has been the case since 1984, with a maximum daily catch-and-release limit of four fish, regardless of size. Fishing for the day was to cease when either one small salmon was retained or four fish of any size were hooked and released. There was a river-wide restriction on angling due to low water conditions and warm temperatures between July 31 and August 10, 1999. Angling for Atlantic salmon was prohibited after 10:00 AM during that period. There were a few localized areas which had longer closures (Table 2b).

Aboriginal Food Fisheries

With the exception of the Burnt Church fishery, which occurred in estuary waters of Miramichi Bay, large salmon harvests were exclusively from the Northwest Miramichi (Table 3). Small salmon harvests were divided 73% from the Northwest Miramichi and 27% from the Southwest Miramichi River. The catches by size and week are summarized in Table 3. Perliminary estimates of harvests from food fisheries in the Northwest Miramichi in 1999 were 655 large salmon and 1739 small salmon. A total of 627 small salmon were harvested from the Southwest Miramichi. The harvests reported in Table 3 are exclusive of those taken off waters specified in the Aboriginal Communal Fishing licenses.

The Aboriginal food fishery harvests in 1999 represented an increase of 9% for small salmon and 139% for large salmon relative to the previous 5-year mean (Table 4).

Based on preliminary harvest data, gillnets accounted for 38% of the large salmon harvest and 12% of the small salmon harvest from the Miramichi River (Table 3). The Eel Ground First Nation released all the large salmon from the food fishery trapnets (654 salmon) and 58% of the small salmon catch (983 of 1703 small salmon, mostly from the fall run). The Red Bank First Nation released 31% of the large salmon catch (187 of 613 large salmon) and 9% of the small salmon catch (131 of 1478 small salmon). The food fisheries mainly targeted the early run for small salmon (96% of harvests were taken prior to September 1) and 86% of the large salmon were harvested from the early-run.

Recreational Fisheries

Angling catch data have in the past been available from two sources: FISHSYS from the New Brunswick Department of Natural Resources and Energy (DNRE), and from the Government of Canada Department of Fisheries and Oceans (DFO) (Moore et al. MS1995). For the Miramichi River system, the DNRE estimates are considered to be more accurate than the DFO estimates (Randall and Chadwick MS1983a). DFO estimates of catch, which have generally been lower than the DNRE estimates, were not collected after 1994.

The FISHSYS survey was not conducted in 1996. FISHSYS catch data for 1998 were not available to date. In 1999, catch report cards were included with the tags as a means of obtaining catch and effort data from the recreational fishery. There was little promotion of the program due in part to the lateness of the decision to include the voluntary report card. The data entry of returned cards is ongoing. There is a likelihood that the catch report cards will be attached to the license in year 2000 and more extensive publicity of the new reporting system will be undertaken. It has not yet been determined if the standard FISHSYS survey will be conducted for the 1999 angling year.

On average (1991 to 1995), 13284 small salmon were harvested, 4666 small salmon were released and 6404 large salmon were released during the bright salmon fishery (Table 5, Fig. 2). The Southwest Miramichi represented 67% of the catch of small salmon and 75% of the large salmon catch. Historical catches from the Miramichi and each branch are summarized in Figure 2. Large salmon catches (kept and released) in the Miramichi peaked in 1986 and declined to 3146 salmon in 1995 (Fig. 2). Small salmon catches have fluctuated annually, having peaked in 1989 at almost 31000 fish and declining to 5622 in 1995. The catches of small and large salmon increased the most in the Northwest Miramichi since the closure of commercial fisheries and the introduction of hook and release angling in 1984 (Fig. 2). Catches of large salmon in the Southwest Miramichi decreased after 1986 and declined to less than 2600 fish in 1995. Catches in 1995 were abnormally low because of numerous closures resulting from warm and low water conditions (Chaput et al. MS1996).

The Crown Reserve waters of the Northwest Miramichi are regulated in terms of effort and catches in these waters represent the best indicator of relative availability and abundance of salmon from the early-run component in the Northwest Miramichi. Total effort in 1999 was reduced 10% of the previous-five year average (Fig. 3; Table 5). Catches of small salmon decreased 59% from the 1991 to 1995 mean and 51% from 1998. Large salmon catches were also decreased relative to the previous five-year mean (37%) and 1998 (42%). Reduced effort and catches were in part the result of the warm water conditions which occurred early in June and persisted into August. At the consultation in November, attendees indicated that fish were in the Miramichi early but angling conditions were fair to poor until mid-September when water levels improved and temperatures cooled.

Summary of fisheries removals

Aboriginal fisheries in the Northwest Miramichi account for the majority of large salmon removed, on average 72% of the annual total (Table 4). In the Southwest Miramichi, there are no aboriginal fisheries for large salmon and all the removals are attributed to the angling fishery. Overall in the Miramichi, aboriginal fisheries account for 55% of the large salmon removals and angling accounts for 45% of the fisheries losses (Table 4). For small salmon, the angling fishery removes the majority of fish in both the Northwest (78%) and Southwest (97%) branches and overall in the Miramichi River (87%).

Illegal removals/seizures

A total of 8 small salmon and 1 large salmon were seized as a result of illegal fishing activities in 1999.

Broodstock collections

In 1999, a total of 68 large salmon and 55 small salmon were collected and spawned at the Miramichi Hatchery Inc. (Table 6). Collections were made from specific tributaries and the number of fish removed corresponded to the intended stocking intensity at the specified locations. The collections in 1999 were greater than those of 1998 and 1997 but fell short of the intended collection. High water conditions in the fall prevented the angling from localized areas of a component of the broodstock (Mark Hambrook, Miramichi Fish Hatchery Inc., pers. comm.). The broodstock collection in 1999 was close to the levels of fish collected for the hatchery prior to 1997.

Disease losses

Atlantic salmon mortalities collected and sent to the DFO Fish Health Unit in Moncton (NB) confirmed again the presence of furunculosis causing bacteria in the river in 1999. The causative agent was found in fish throughout the Miramichi River. There were no changes in the number of mortalities at the DNRE protection barriers in 1999; mortalities were minimal and comparable to those of previous years. *Vibrio* was detected in 2 of 31 fish autopsied in 1999.

Other observed mortalities

The warm water temperatures in July and August resulted in a widespread mortality of fish in both the Northwest and Southwest Miramichi. Reports of dead salmon were received in early July and a concerted effort by enforcement staff indicated that the most important mortalities occurred during the week of July 18 to 23 (Table 7). Although mortalities are reported every year, warm water temperatures may have resulted in a greater loss in 1999 and low water conditions may have contributed to an enhanced visibility of carcasses. A total of nine fish which had previously been tagged at the estuary trapnets were recovered on dead fish upriver (Appendix 2; Table 7). Very few tags off dead fish have been recovered in previous years.

CONSERVATION REQUIREMENT

The conservation spawning requirement for the Miramichi River and each branch separately is based on an egg requirement of 2.4 eggs/m^2 of spawning and rearing habitat area (CAFSAC 1991). Habitat area estimates are from Amiro (MS1983). The objective is to obtain all the egg depositions from large salmon. Fish required are calculated using the average biological characteristics of the Miramichi stock. The small salmon requirement is to provide a theoretical 1:1 sex ratio. The spawning requirements in terms of fish were based on the average biological characteristics of salmon during 1971 to 1983: 86% female and a fecundity of 6816 eggs per female resulting in an average of 5862 eggs per large salmon spawner, 75% male for the small salmon (Randall MS1985).

	Habitat area (million m^2)	Egg requirement (millions)	Fish required	
			Large salmon	Small salmon
Miramichi River	54.6	132	23,600	22,600
Main Miramichi	1.1	3	554	531
Southwest Miramichi	36.7	88	15,730	15,063
Northwest Miramichi	16.8	41	7,316	7,006

Point estimates of the required number of spawners ignore the annual variation in fecundity and the female proportion of the large salmon returning to the Miramichi River. It has been shown that fish returning to the Miramichi since 1984 are larger than prior to 1985 (Moore et al. 1995). Larger fish contribute more eggs which results in fewer fish required to achieve the conservation egg requirements. Based on the biological characteristics of salmon from 1992 to 1996 (corresponding to the most recent significant change in management, the moratorium in the insular Newfoundland commercial salmon fishery), the spawning requirements in terms of fish for the Miramichi are reduced to 21800 large salmon and 21095 small salmon (averaging 86% male). There is no change in the egg requirement.

RESEARCH DATA

Data collected in 1999 are similar to previous years and pertain to the estimation of returns, size distribution, sex ratios, abundance of juvenile salmon, and hatchery stocking. Returns are estimated from mark and recapture experiments. The size distribution and sex ratio data are collected at the tagging and recapture trapnets, from food fishery trapnets and from broodstock seining operations. The abundance of juvenile salmon is estimated from electrofishing surveys.

Estimation of returns

Trapnets were operated below head of tide in both branches of the Miramichi River (Fig. 1). Details of trapnet construction are provided in Chaput et al. (MS1997). The food/science trapnets operated by Eel Ground First Nation (one in the Northwest, two in the Southwest) upstream of the confluence of the Southwest and Northwest branches of the Miramichi River were the main tagging trapnets. An upstream trapnet on the Southwest Miramichi (Millerton, Fig. 1) was used for tagging and recapture. The Red Bank trapnets were the main recapture gear for the Northwest Miramichi. In 1998 and 1999, a trapnet (Cassilis) installed about 5 km below the Red Bank trapnets served for both tagging and recapture of downstream tags. An additional lower trapnet at Hackett’s Beach in the Northwest Miramichi was operated for the first time in 1999. It prinicpally served to recpature smolts during May and June but was also used to place more tags in the Northwest experiment. The trapnets were fished once a day at slack tide, sometimes twice a day at Red Bank. The dates of operation, total fish caught, and total tags released, by size group, are summarized in Table 8. In addition, salmon were sampled at the partial fence at Big Hole tract in the Northwest Miramichi.

Salmon were marked with individually numbered blue Carlin tags (dimensions 9.5 mm by 4.6 mm by 1.0 mm thick) attached to the back just anterior to the dorsal fin with narrow gauge stainless steel wire. Fork length and external sex determination (fall period) were obtained from all salmon at the tagging trapnets. Scale samples, for determination of age, were removed from the standard location (along the imaginary line joining the posterior of the dorsal fin and the anterior of the anal fin, two to four rows above the lateral line) from all large salmon and from every second small salmon. Scale samples were stored dry.

Food fishery catches at Eel Ground and Red Bank were sampled for number of salmon caught (by size) and number as well as sex of salmon harvested (by internal examination). Almost all the large salmon from the Eel Ground trapnets were tagged before being released (Table 8). The number of tags placed and the time and location of recaptures, by size group and month, at each of the tagging facilities in 1999 are summarized in Appendix 2.

Recaptured fish at all trapnets had the tag number recorded, the size (small or large), date and trapnet location where recaptured before being released or when sampled from the food fishery harvests.

Daily counts of salmon, by size, were obtained at several barrier fence and counting fence facilities within the Northwest and Southwest Miramichi (Fig. 1). Tag numbers of marked fish passing through these barriers were recorded prior to release upstream. Broodstock seining also provided samples of size, number of fish, tag numbers of marked fish, and sex ratios.

Juvenile Surveys in the Miramichi River

Electrofishing surveys were conducted at 68 sites (35 in the Northwest Miramichi and 33 in the Southwest Miramichi) between August 16 and September 16, 1999. Thirteen of these sites have been sampled every year since 1970. A combination of open (61 in total) and closed (7 in total) sites were sampled. The density of salmon juveniles at closed sites was estimated using the removal method after enclosing a section of stream with fine mesh barrier nets (Zippin 1956). Open sites provided estimates of abundance based on catch per unit effort. Fishing was conducted bank to bank, in an upstream direction, with three people: one person with the shocker unit, a second person with a meter wide by 0.75 meter high seine, and a third person with the fish holding bucket and dip net. The amount of fishing effort was recorded from a timer on the shocker unit and represented the total seconds of actual shocking time. Catch per unit effort was transformed to density (number of fish per 100 m^2) by calibrating the open site technique within closed sites (see Chaput et al MS1995). Results from calibrations made at 51 sites between 1993 and 1999 are given in Appendix 3. Percent habitat saturation (PHS) values were calculated for each site (Grant and Kramer 1990).

All fish were identified to species and measured for length (fork length except for lamprey and American eel for which total length were recorded). Large eels were counted but not measured. Fish were anesthetized, using sodium bicarbonate salts, before measuring.

ESTIMATION OF STOCK PARAMETERS

Estimation of Returns

Returns are estimated to each branch and to the Miramichi River. The tagging and recapture matrices are summarized in Table 9. Becaue of the sufficient number of recaptures, returns were estimated separately for small and large salmon. In 1997 and 1998, the tagging and recapture matrices were the combined data for small and large salmon and the returns of small and large salmon were estimated using the ratio of small salmon and large salmon in the total recapture trapnet samples. This approach assumed that the trapnet efficiencies were similar for small and large salmon. Emigration of tagged fish between the branches is accounted for in the spatially stratified model (Table 9). Estimates were obtained using the Darroch (Arnason et al. 1995), Schaeffer and Peterson models (Ricker 1975). The population estimates from the Schaeffer model using a seasonal stratification were used in evaluating the status of the stock.

The uncertainty around the estimation of returns in the spatially stratified model consists of two components:

1 - Random variation in the tag loss/tag mortality factor was incorporated as a uniformly distributed function between 0% and 20% (mean of 10%).

2 - Uncertainty in the temporally-stratified recapture matrix was estimated by resampling within the rows of the observed matrix of recaptures at the trapnets. In this case, the prior probabilities for a marked fish in the catches at the trapnets was set at the observed proportion for each tag release stratum. Recoveries were assigned to one of the temporal strata (movement of tagged fish among recovery strata) based on the observed distribution of recoveries.

Returns to each branch were obtained using a resampling technique:
Step 1: select a tag loss/tag mortality factor and define recapture matrix.
Step 2: calculate returns using Schaeffer, Darroch and Petersen, save result.
Step 3: repeat steps 1 and 2 a large number of times (1000 replications were performed)
Step 4: summarize distribution of returns from step 3.

Only marks placed up to and including Oct. 15 are considered to be available for recapture.Tagging in the Southwest finished on Oct. 15 while in the Northwest, the last day of tagging was Oct. 14. The recapture trapnets in the Northwest Miramichi fished until Oct. 14 and the Millerton trapnet on the Southwest Miramichi fished until Oct. 22. Returns are estimated up to the point of the recapture trapnets in each branch (would exclude harvests which occurred downstream of each recapture trapnet) and constitute the returns up to and including Oct. 15. Total returns are obtained by adding downstream removals.

At the recapture traps, both the previously marked fish and the unmarked fish are known without error but the marks available for recapture are not.

1 - As in previous years,, salmon with tagging scars were recorded at the tagging trapnets in the Red Bank trapnets and the marking trapnet in the Southwest Miramichi. The tags may have been shed or could have resulted from anglers removing tags and releasing the fish. This would necessitate a fall-back to tidal waters of angled fish which has been observed in 1995, 1996 and 1997 with the capture of salmon with artificial flies embedded in the jaw. Since all fish at the trapnets are examined for tags and tagging scars, recaptures were considered known without error.

2 - Mortality of tagged fish resulting from tagging and handling has not been estimated although there have not been any recorded mortalities of tagged fish held in hatchery facilities (Chaput et al. MS1994a, Courtenay et al. MS1993). Dead fish with tags were reported upriver of the recapture trapnets therefore some mortality of tagged fish did occur although it is not known how many would have died before being available for recapture in the trapnets. In the absence of survival rate data, a combined tag loss/tagged fish mortality factor of 10% was assumed (varying between 0% and 20%), similar to previous assessments (Randall et al. MS1989).

Returns to the Southwest Miramichi in 1999

Large salmon returns were estimated at 6800 fish with a 90% probability that the returns were at least 5000 fish (Table 10, Fig.5). Small salmon returns were estimated at 10600 fish with a 90% probability that the returns were more than 8600 fish (Table 10, Fig. 5).

The overall efficiency of the Millerton recapture trap for both size groups combined in 1999 was about 7.5%, higher than in 1998 but within the range of efficiencies estimated in previous years. Large salmon efficiencies were similar to previous years but small salmon efficiency was the highest oberved.

	Southwest Millerton Trapnet Efficiency					
	1999	1998	1997	1996	1995	1994
Small salmon	8.7%			7.5%	7.7%	7.9%
Large salmon	6.3%		6.7%	4.8%	8.8%	6.9%
Combined	7.5%	5.5%				

Returns to the Northwest Miramichi in 1999

About 6500 large salmon returned to the Northwest Miramichi in 1999 with a 90% probability that the returns were more than 5100 fish (Table 10, Fig. 5). Small salmon returns were estimated at 11300 fish with a 90% probability that the returns were at least 9600 fish (Table 10, Fig. 5).

The Red Bank trapnets in 1999 had the highest ever estimated efficiencies. A trap design similar to the downstream trapnets was used in 1999 and there were no major washouts or loss days due to high water until late Sepember and October.

	Northwest Red Bank Trapnet Efficiencies					
	1999	1998	1997	1996	1995	1994
Small salmon	11.7%			4.1%	6.5%	6.7%
Large salmon	8.4%		5.3%	4.5%	5.6%	3.9%
Combined	10.4%	3.3%				

In comparison, the Northwest Cassilis trapnet had a lower overall efficiency in 1999 relative to 1998 and was particularly less efficient on large salmon than on small salmon.

Northwest Cassilis Trapnet Efficiency		
	1999	1998
Small salmon	7.4%	
Large salmon	4.3%	
Combined	6.2%	10.4%

Returns to the Miramichi River in 1999

In 1999, an estimted 13400 large salmon and 22000 small salmon returned to the Miramichi River (Table 10, Fig. 5). There was a 5% chance that returns of large salmon to the Miramichi were less than 10500 fish and small salmon returns were less than 18700 fish (Table 10, Fig. 5).

Estimation of Egg Depositions in 1999

The egg contribution in 1999 was calculated for the returns to river since the removals data are to date incomplete.

Escapement in 1999

The escapement of salmon refers to fish which were not harvested in fisheries or otherwise removed from the river. Removals also include broodstock collections, scientific sampling, and incidental mortalities at the tagging trapnets, seizures in nets and reported mortalities in the river.

To date, only part of the total removals in 1999 are known.The known removals from the Miramichi River, excluding the angling harvests, total 2526 small salmon and 826 large salmon (Table 11). Total removals exclusive of angling in the Northwest Branch were 1807 small salmon and 684 large salmon whereas Southwest Branch removals were 693 small salmon and 89 large salmon.

The large salmon removals in the angling fisheries have in previous years (1992-1997, excluding 1996) totalled 218 fish (Table 4). In the Northwest Branch, losses have averaged 60 large salmon and in the Southwest Branch, losses have average 158 large salmon. Losses in 1999 are expected to be of the same relative order of magnitude.

Biological Characteristics of Salmon in 1999

All salmon sampled at the tagging trapnets were measured for fork length. All large salmon and every second small salmon were scale sampled. Sex of large salmon from the early run in the Northwest Miramichi was determined from the internal examinations of the Red Bank food fishery harvests. Sex of small salmon from the early run was determined by internal examinations of food fishery harvests of Eel Ground and Red Bank. In the fall, both internal and external sex determinations of small salmon were obtained from Red Bank and Eel Ground harvests. Only external determinations of sex were obtained for large salmon from the Southwest Miramichi in the fall.

Sex ratios

Large salmon were the majority female in both the Northwest and Southwest branches (Table 13). The proportion female (75%) observed in 1999 was similar to the values observed in recent years except for 1995 when the female salmon comprised 89% of the large salmon returns (Fig. 6). There was the highest proportion of female in the small salmon size group since 1987, 29% (Table 13, Fig. 6). Such high proportion female had been recorded between 1974 and 1983. There tends to be a higher proportion female in the small salmon from the early run, especially in the Northwest Miramichi where 37% of the early-run small salmon were female compared with 17% in the fall run (Table 13).

Size and age

Based on length and proportions at length from recent years, 33% of the large salmon were estimated to have been previous spawners (Table 13). There is a higher proportion of previous spawners in the Southwest Miramichi (37%) than in the Northwest Miramichi (29%).

Egg depositions in 1999

Large salmon accounted for 75% of the total eggs (101 million eggs) in the returns to the Miramichi River in 1999 (Table 14). In the Southwest Miramichi, large salmon contributed 80% of the 48 million eggs while in the Northwest Miramichi, large salmon contributed 70% of the 53 million eggs (Table 14). The egg contribution by small salmon in terms of returns was higher than in recent years. Small salmon had one of the highest fecundities since 1971 because of the higher female proportion and the larger average size (Fig. 7). In 1999, one large salmon returned the equivalent number of eggs of about five small salmon (Table 13). In 1998, one large salmon fecundity was equivalent to that of nine small salmon (Chaput et al. 1999). For the Northwest Miramichi, just over four small salmon were equivalent to one large salmon while in the Southwest Miramichi, more than six small salmon would have been required to equal the egg contribution of one large salmon (Table 13).

STATUS OF STOCK

The point estimate of the eggs in the returns of large salmon to the **Miramichi River** was 57% of conservation requirements with less than 1% chance of having exceeded the conservation requirement (Table 14, Fig. 8). Egg depositions by both small and large salmon returns (before harvests) equalled 76% of requirement, with a 10% probability of having exceeded the conservation requirement (Fig. 8). Actual egg depositions were lower because of the expected loss of as much as 50% of the small salmon return to the river. Egg depositions to the Miramichi River in 1999 would likely be above 50% once harvests are accounted for but with minimal chance of having met the requirement. This is the third consecutive year that the escapements were below requirement and the second consecutive year since 1984 that there were insufficient eggs in the total returns to meet requirement (Fig. 9). Since the 1984 management plan, small salmon have contributed on average 22% of the total egg deposition, the most important contribution by small salmon occurred in 1981 at 58% (Fig. 9).

Returns and escapements of small salmon to the Miramichi peaked in 1992 and have since declined (Table 15, Fig. 10). The return in 1999 of 23000 small salmon was a 30% decrease from 1998 and 45% below the previous 5-year average return to the river (Table 15). The large salmon returns since the closure of the commercial fisheries peaked in 1992. The return in 1999 of 13600 large salmon is the third lowest since 1971 and was 40% below the previous 5-year average (Fig. 10, Table 15). The return in 1999 was a 43% increase from the low return (9500 large salmon)of 1998.

Returns of large salmon to the **Southwest Miramichi** would have contributed about 39 million eggs, equivalent to 44% of the conservation requirement. Returns of small salmon and large salmon combined would have equalled 55% of requirement (Table 14) with no chance of having met the requirement (Table 14, Fig. 8). Egg depositions after accounting for removals would be just over 50% of requirement assuming that up to half of the small salmon would have been removed in the fisheries. This is the third consecutive year that conservation requirements have not been met. Egg depositions had exceeded the conservation requirements between 1992 and 1996 (Fig. 9).

In the **Northwest Miramichi**, the 37 million eggs contributed by the returns of large salmon represent 90% of the conservation requirement (Table 14). The contribution which would have been made by the small salmon returns would have increased the egg depositions to 128% of requirement. There was only a 7% chance that conservation egg requirements were not met in 1999 before accounting for removals (Fig. 8). Egg depositions had previously exceeded the conservation requirements every year since 1992, except for 1998 (Fig. 9).

Headwater Barrier Fences

Large and small salmon have been enumerated at headwater barrier fences on the Southwest branch (Juniper Barrier on the North Branch of SW Miramichi, Dungarvon River) since 1981 and on the Northwest branch (Northwest Miramichi River) since 1988 (Fig. 1; Table 17). The fences are operated for varying periods each year but generally cover the entire migration period. The exception was the Juniper Barrier which was removed on Oct. 12 due to funding pressures. Large numbers of fish had been counted through in the previous two nights (Pam Seymour, DNRE, pers. comm.). Counts of large salmon in 1999 at the Dungarvon barrier fence of the Southwest Miramichi was 30% above the previous 5-year mean and 14% above 1998. Counts of small salmon were down 41% from the previous five-year mean and down 17% from 1998 (Table 17). The count of large salmon at the Clearwater Brook counting fence was up 97% in 1999 relative to 1998 and small salmon counts were down 4**%** from the previous year (Table 18). Based on returns of estuary tagged fish in 1997 through 1999, fish from both the early and late runs migrate into Clearwater Brook.

Returns of large salmon at the Northwest Barrier were up 70% from the previous 5-year average and up 34% from 1998 (Table 17). Small salmon counts were improved 5% from the average but down 32% from 1998. The counts at Catamaran Brook, a mainly fall-run tributary, were among the lowest and lower than in 1998 for small salmon and large salmon. Counts were improved from 1997 (Table 19).

Overall trends in returns/escapements since 1992

Small salmon returns declined from 1998 at the counting facilities in the Southwest Miramichi. The counts of large salmon were improved in the Southwest Miramichi from 1998. Relative to the previous five years, counts of small salmon were down whereas large salmon were improved or unchanged. In the Northwest Miramichi, the count at the early run protection barrier was greatly improved from 1997 and 1998 for large salmon but down for small salmon from 1998. The fall run Catamaran Brook counts were down from 1998 for both small salmon and large salmon but the trapnet estimates were improved from 1998 for both size groups. Counts were down from the previous five-year mean at Catamaran and for the Northwest Miramichi overall. A very early spring may have contributed to the movement of salmon into the early-run headwater areas, especially in the Northwest Miramichi.

	Change in 1999 relative to			
	Small Salmon		Large Salmon	
	1998	1994 - 1998	1998	1994 - 1998
Northwest Miramichi				
Northwest Barrier (early)	-32%	+5%	+34%	+70%
Catamaran Brook (late)	-15%	-5%	-7%	-6%
Trapnet estimate (early & late)	+54%	-23%	+219%	-25%
Southwest Miramichi				
Dungarvon Barrier (early)	-36%	-17%	+14%	+30%
Clearwater Brook (early & late)	-4%		+97%	
Trapnet estimate (early & late)	-52%	-57%	-1%	-47%

The low abundance of large salmon in 1999 was not unexpected given the low returns of small salmon in 1998. The fall returns were weak in 1999 for both small salmon and large salmon (Fig. 11). This contrasted with the small salmon run timing in 1998 which was identical to previous years when about 50% of the total run occurred early. Between 1994 and 1997, catches of large salmon at the trapnet in the Southwest Miramichi were distributed about 25% early (May to August) and 75% late run (September and October). In 1998, the fall run represented only 55% of the total fish sampled (Fig. 11). In 1999, the fall run of large salmon represented 47% of the total catch and only 37% of the small salmon catch occurred after August 31 (Fig. 11). In the Northwest Miramichi at the Cassilis trapnet, 90% of the small salmon catch and 77% of the large salmon catch had occurred by August 31 (Fig. 11). In 1998, the small salmon and large salmon catches by August 31 were 65% and 52%, respectively, of the total catch for the year. In 1999, the early spring may have contributed to a large number of late-run fish returning earlier to the river. Four of nine tag recoveries at the Catamaran Brook fence in the Northwest Miramichi were from fish tagged in July at the estuary trapnets (Appendix 2).

All the indicators suggest that returns of early-run large salmon in 1999 were greatly improved from 1998. Late-run counting facilities had lower returns of small salmon in both the Northwest Miramichi and Southwest Miramichi. The fall-run of large salmon was again weak relative to previous years in both branches.

ECOLOGICAL CONSIDERATIONS

Seasonal and Environmental Conditions

Daily discharge profiles for 1999 are not yet available (Fig. 12). Deficit flows (in the first quartile of the time series) were recorded for the months of May through August in the Southwest Miramichi in 1999 (Caissie 2000). A record low average monthly discharge occurred in the month of June in the Southwest Miramichi. Heavy rains in the last half of September resulted in excessive flows (upper quartile of the time series) in the Southwest Miramichi in 1999.

Water temperatures were warm early in the year in 1999. In the Southwest Miramichi, temperatures were above 24 C in late June and were above 26 C on several days in July and August (Fig. 13). In 1998 over the same time period, water temperatures were above 26 C on only two days in August (Fig. 13). In the Little Southwest Miramichi, daily maximum temperatures were above 23 C on 62 days in 1999 (Caissie 2000). During 1996 to 1998, water temperatures above 23 C were recorded during 10 to 15 days annually.

Spawner Distribution and Habitat Utilization

In 1998, spawning occurred throughout the Northwest and Southwest Miramichi (Fig. 14). Fry densities were high (> 50 per 100 m²) at 23 of the 31 sites sampled in the Northwest Miramichi with low densities (< 10 per 100 m²) at 1 site. In the Southwest Miramichi, fry densities were also high at 26 of the 33 sites sampled (Fig. 14). Low densities were noted at one site in 1999 compared to five sites in 1998. Spawning distribution has been monitored using this method since 1993 and results indicate that spawning has been occurred throughout the basin accessible to Atlantic salmon.

Parr densities were moderate to high at most sites in the Northwest and Southwest Miramichi (Fig. 14).

Fry densities in the Southwest and Northwest were improved in 1999 relative to 1997 and 1998. High fry densities in 1999 were not expected because of the low estimated escapement of salmon in 1998. Egg depositions in 1998 were estimated to have been the lowest of the last ten years yet fry densities were among the highest observed. High densities of parr were also recorded in 1999. Increased abundance of fry and parr in 1999 could be explained by: 1) low water levels which reduced habitat and resulted in higher densities of fish at the sampling sites, 2) improved inter-stage survival from recent years, 3) higher egg depositions in 1998 than estimated, or 4) all of the above. Since parr abundance also improved dramatically from previous years, especially in the Northwest (Fig. 16), the most likely explanation for the higher densities in 1999 appear to be low water levels and improved inter-stage survival.

Percent habitat saturation (PHS) index is a relative measure of the habitat use and potential interaction between juveniles within the stream. It considers both the densities of fish and body lengths. A PHS value of 28 is used as a reference point; it represents the value at which density dependent effects have a 50% probability of being expressed (Grant and Kramer 1990). The median PHS value in the Northwest Miramichi in 1999 was above 28 (5th to 95th percentile range of 12 to 68) (Fig. 17) In the Southwest, the median PHS value in 1999 was also above 28 (5th to 95th percentile range of 14 to 90) (Fig. 17). PHS values in the Southwest Miramichi in 1999 were among the highest observed in the time series and were the highest ever in the Northwest Miramichi (Fig. 17).

Size of adults in 1999

Adults returning to the Miramichi in recent years have been the largest at age for the 28 year time series (Fig. 18). The mean lengths of both age groups in both seasons in 1999 remained well above those of the time series. The abrupt change in size-at-age after 1985 has been attributed to size-selective fisheries on both the 1SW and 2SW salmon which occurred in the early period (Moore et al. 1995). For 1SW salmon, the mean lengths in the summer and fall runs of 1999 were significantly greater ($P < 0.01$) by at least 1.3 cm than in all previous years. The differences were greater in the summer run 1SW salmon. For 2SW salmon, the average lengths of summer fish in 1999 were significantly greater ($P<0.01$) than all other years except for 1987 (Fig. 18). Fall run 2SW salmon in 1999 were also larger than recent years but not significantly different ($P > 0.05$) than 2SW salmon of 1976 and 1979 (Fig. 18).

The larger size of 1SW salmon in 1999 was accompanied by a high proportion female relative to previous years. These two factors accounted for the higher than average egg contribution of small salmon in 1999.

FORECAST/PROSPECTS

The previously used forecast model for large salmon returns was based on a relationship with small salmon returns in the preceding year (Claytor et al. MS1991, Claytor et al. 1992) (Fig. 19). This model has been used to forecast returns since 1992 and its performance is summarized below):

Forecast year	Forecast value (95% C.I.)	Actual return	Performance
1992	29,000	37,000	under predicted by 22%
1993	18,315	35,200	under predicted by 48%
1994	28,200	27,500	over predicted by 3%
1995	30,040	32,583	under predicted by 8%
1996	30,507	24,000	over predicted by 27%
1997	29,933	18,422	over predicted by 62%
	(13,114 to 51,275)		
1998	22,178	9,500	over-predicted by 133%
	(7,055 to 33,835)		
1999	24,475	13,600	over-predicted by 80%
	(8,905 to 42,052)		

The association between small salmon (almost exclusively 1SW salmon) and large salmon returns the subsequent year was examined over the time series from 1985 to 1999. The ratio of small salmon to large salmon for the time period varied between 1.6 and 7.1 with the most recent year ratio (1998 small, 1999 large salmon) at 2.7 (Fig. 19). There was also no significant trend over time. The median ratio model for the recent five-year period (1995 to 1999) would predict returns of large salmon (including previous spawners) between 9,500 and 13,100 fish. Based exclusively on this simple analysis, it is highly improbable that the returns of large salmon in 2000 will meet conservation requirements.

	Miramichi	Northwest	Southwest
Returns of small salmon in 1999	23,000	11,600	11,200
Large salmon returns in 2000 (ratio)			
Median	9,700	4,300	5,600
	(2.38)	(2.70)	(2.01)
Maximum	13,100	9,700	5,800
	(1.75)	(1.19)	(1.93)
Minimum	9,500	2,500	3,200
	(2.43)	(4.66)	(3.48)

The contribution of previous spawners to the returns of salmon and to the egg depositions has increased since 1986 in terms of the proportion of the large salmon returns and the absolute number (Fig. 20). In 1998, there were more previous spawners than 2SW salmon returning to the river. In 1999, the abundance of 2SW salmon improved from 1998 but remained below the abundance observed since 1985 (Fig. 20). The increased egg depositions since 1984 are in large part the result of higher contributions by previous spawners (Fig. 20). Previous spawners also have a higher fecundity per fish than 2SW maiden fish. At the present time, the abundance of previous spawners can not be predicted. Survival of kelts from the Miramichi appears to be naturally high, probably because of large numbers of holding areas in the river and the abundant food supply early in the spring (smelt for example). Survival rates of 1SW maiden salmon to returns as consecutive spawners has been increasing since 1990 with the 1996 1SW maiden spawners having the highest observed consecutive spawning survival (Chaput et al. 1998). Survival as alternate spawners was high in the late 1980's and early 1990's but declined through

1992 to 1994 (Chaput et al. 1998). Previous spawners destined to return to the Miramichi in 2000 were intercepted in the Greenland fishery of 1999: one salmon tag was received in 1999 from Greenland of a salmon originally tagged in Sept. 1998. One tag was also returned from the Burin Peninsula of Newfoundland, apparently removed in the summer of 1999, from a fish originally tagged as a small salmon in August of 1997. No tags were returned from the Québec North Shore (Zone Q9).

A mark and recapture experiment to estimate the smolt production from the Northwest Miramichi was conducted in 1998 and 1999 (Chaput et al. 2000). The smolt run was underestimated in 1998 because of an incomplete sampling of the catch at the recapture trapnet. The estimated output from the Northwest Miramichi in 1998 was 130,000 smolts. The estimated return of small salmon to the Northwest Miramichi in 1999 was 11600 fish (9900 to 13600 fish). The estimated survival rate based on the smolt estimate was about 9%. A more realisitc smolt production level of 250,000 smolts in 1998 would equate to a sea survival of 5%. The 1999 smolt run from the Northwest Miramichi was estimated at 420,000 fish (95% C.I. 340,000 to 546,000 fish). At a sea survival of 5%, this could yield 17000 to 27000 small salmon to the Northwest Miramichi in year 2000. This level of return would be a substantial improvement from the returns of 1997 to 1999 but below the returns from 1992 to 1995 (Table 16). There is no estimate for the Southwest Miramichi but with high sustained juvenile numbers, the run of small salmon should equal the levels of recent years, about 10,000 to 30,000 fish.

<u>Hatchery Stocking</u>

Various life stages are reared and stocked annually to the Miramichi River. Satellite rearing, initiated in 1984, augmented with some releases directly from the hatchery resulted in the stocking of more than 150 thousand fall fingerlings (Table 20). The survivors of these would return three to four years later. Smolt stocking was an important component in previous years but less than 5000 smolts were stocked in 1999. This compares with 45,000 2+ smolts released in 1998 and 60,000 in 1997.

Returns of small salmon from stocking in previous years were expected to decline from the levels observed in 1998. Adipose-clipped fish return mostly as small salmon, the contribution to large salmon returns being less than 0.3% in the 1997 returns and 0% in 1998. In 1999, adipose-clipped large salmon represented less than 2% of the returns in both the Northwest and Southwest Miramichi (Table 21). Adipose-clipped small salmon represented 2% to 3% of the returns in the Northwest and Southwest Miramichi (Table 21). Adipose-clipped small salmon were more abundant in the early returns (Table 21).

CONCLUSIONS AND MANAGEMENT CONSIDERATIONS

Was conservation met in 1999?

The point estimates of the egg depositions were below the conservation requirements for the Southwest Miramichi and the Miramichi River system overall for the third consecutive year. The egg depositions in the Northwest Miramichi were above conservation. There is a higher exploitation rate on the early run small and large salmon but the overall exploitation rate on large salmon in 1999 remained low in the Southwest Miramichi (probably about 3%) and in the Miramichi River overall (6%) but was higher in the Northwest Miramichi at about 10%. Small salmon are more heavily exploited; the 1997 levels were 53% of the total returns in the Northwest, 54% from the Southwest Miramichi and 55% from the Miramichi River.

Were returns to the Miramichi in 1999 before any removals sufficient to meet the conservation requirments?

In the absence of any removals from fisheries, the egg depositions in 1999 would not have been sufficient to meet the conservation requirements in the Southwest Miramichi and Miramichi River overall. In the Miramichi River, returns of small and large salmon would have contributed 76% of the requirement whereas in the Southwest Miramichi, only 55% of requirement would have been met. Returns of small and large salmon to the Northwest Miramichi equated to 128% of the egg requirement.

What caused the low returns of small salmon and large salmon in 1999?

The low returns of large salmon in 1999 were consistent with the low returns of small salmon in 1998. Large salmon returns are following a relatively consistent pattern of about one large salmon for every two small salmon which suggests that it is the smolt class which is being affected, i.e., the constraint is occurring within the first year. Small salmon returns to the Miramichi River have been low in the past three years (22,600 to 33,000 fish). Low small salmon abundance in the last three years corresponds to a larger size at age of 1SW salmon although large size-at-age of 1SW salmon in 1986 and 1992 corresponded to high abundance years. An association between body size and abundance requires further analysis.

Will the returns of large salmon in 2000 exceed the conservation requirements for the Miramichi River?

The trend in returns of large salmon and small salmon in recent years and the lower abundance of small salmon in 1999 relative to 1998 suggest that the returns of large salmon in 2000 will be less than the conservation requirement for the river. It will be especially so for the Southwest Miramichi but the Northwest Miramichi may achieve its conservation requirement dependent upon the strength of the small salmon return in 2000.

What are the options for inseason assessments of the risk of not meeting conservation requirements?

The 1999 approach to an inseason assessment for the Miramichi was based on counts at the DNRE barrier fences. The approach was qualitative, focusing on whether the counts of fish at the barriers can provide an indication of the kind of year (good, fair, poor) it will be relative to what was observed in the past. The assumptions of the approach were:

- barrier fence counts are indicators of escapement rather than returns,
- run-timing over that time period is variable but generally predictable,
- objective escapement of 20000 salmon to the Miramichi. This level of escapement should provide the conservation egg requirement for the river and in recent years based on the level of exploitation on salmon represents about 22000 large salmon returns to the river.
- objective escapement of 30000 small salmon would represent a return of about 45000 to 50000 small salmon to the Miramichi. Much higher numbers of small salmon have been observed previously although this is the level observed between 1994 and 1996.

Generally, counts at the end of the year relate to the estimated escapement of small salmon and large salmon to the Miramichi River, especially for the Juniper and Dungarvon barriers (Fig. 21). High end of year counts at the barriers generally correspond to high escapements whereas low end of year counts correspond more frequently with low escapement years. The Northwest Barrier counts are not as closely associated but the time series is shorter and excludes the low escapements of 1981 to 1985 which have not been observed since 1985 (Fig. 21). The same strong association is noted for the small salmon counts and total small salmon escapement (Fig. 21).

The vertical lines in figures 21 to 23 represent a visual evaluation of possible criteria counts which provide the highest probability of predicting end-of-year escapements relative to the objectives. For example, by July 15, if counts of large salmon at Dungarvon were greater than 100 fish, there was a very good chance that escapements of large salmon would be better than 20000 fish (Fig. 22). If there were less than 100 large salmon by this date, it was uncertain what the escapement level would be.

The counts of small salmon and large salmon at the Southwest Miramichi (Millerton) trapnet are summarized in Figure 23.

By July 15, 1999, all three barriers were indicating a good escapement year for small salmon. For large salmon, the indicators were less certain. Catches of small and large salmon also suggested a good return year. But the advanced timing of the run in 1999 and the weak return of fall-run fish resulted in an over-optimistic outlook (Fig. 22).

This inseason approach was not effective in the last two years and should be used cautiously for relaxing fisheries measures.

What are the risks to meeting conservation egg depositions in 2000 if fisheries occur?

The probability of meeting conservation requirements in 2000 was estimated from the predicted return of large salmon in 2000 based on the small:large salmon ratio of 1995 to 1999 and assuming that small salmon returns in 2000 would be similar to the previous five-year average. The model to assess the risk to conservation if fisheries were to occur in year 2000 can account for seasonal differences in harvest levels, catch-and-release mortality, and biological characteristics of the adults (Table 22). In the fisheries scenario presented, no distinction is made as to the harvest allocation (aboriginal fisheries versus recreational fisheries) and it is assumed that the fisheries harvested small and large salmon in direct proportion to run-timing such that the integrated values for catch-and-release mortality and the biological characteristics apply. Risk is quantified in terms of the probability of meeting conservation and the egg loss resulting from the fisheries harvests as a percentage of total eggs in the returns of adult salmon to the river (Fig. 24 to 26).

For the Miramichi River overall, there is near zero probability of meeting conservation in year 2000, even in the absence of fisheries. Egg loss as a percentage of total eggs in the returns would be less than 6% if large salmon losses due to fisheries were less than 500 fish and small salmon losses less than 7000 fish (Fig. 24).

For the Northwest Miramichi, there is a modest chance (37%) that the conservation requirement will be met in year 2000. With fisheries harvests at the level of previous years (see Table 4; 6800 small salmon, 350 large salmon), as much as 20% of the total eggs in the returns would be lost and the probability of meeting conservation would decrease to less than 25% (Fig. 25).

For the Southwest Miramichi, there is near zero probability of meeting conservation in year 2000 even in the absence of fisheries. With fisheries harvests at the level of previous years (see Table 4; 10500 small salmon, 200 large salmon), just under 20% of the total eggs in the returns would be lost.

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Table 1. Food fishery agreements for First Nations on the Miramichi River, 1992 to 1999.

Eel Ground First Nation					
1992	May 1-Dec 31	Northwest	1400	100	trapnet and up to 18 gillnets
1993	May 1-Dec 31	Northwest	1400	100	trapnet and up to 18 gillnets
1994	May 1-Aug 31	Southwest	1000	0	1 trapnet
	May 1-Aug 31	Northwest	1400	0	2 trapnets, up to 14 gillnets, and recreational
	May 1 to Dec 31	Northwest	0	100	up to 14 gillnets
1995	May 1- Aug 31	Southwest	1420	0	1 trapnet and recreational
	Sept 1- Oct 31	Southwest	800	0	1 trapnet and recreational
	May 1- Aug 31	Northwest	1980	100	2 trapnets, up to 10 gillnets, and recreational
	Sept 1- Oct 31	Northwest	800	0	2 trapnets, up to 10 gillnets, and recreational
1996	May 1- Aug 31	Southwest	1320	0	2 trapnets and recreational
	Sept 1- Oct 31	Southwest	780	0	2 trapnets and recreational
	May 1- Aug 31	Northwest	1880	195	2 trapnets, up to 12 gillnets, and recreational
	Sept 1- Oct 31	Northwest	780	0	2 trapnets, up to 12 gillnets, and recreational
	April 15- July 31	Northwest	200	5	counting fence
	Aug 1- Oct 31	Northwest	40	0	counting fence
1997	May 1- Aug 31	Southwest	1320	0	2 trapnets and recreational
	July 22 - Aug 31	Southwest			1 gillnet
	Sept 1- Oct 31	Southwest	780	0	2 trapnets and recreational
	May 1- Aug 31	Northwest	1880	195	2 trapnets, up to 11 gillnets, and recreational
	Sept 1- Oct 31	Northwest	780		2 trapnets, up to 11 gillnets, and recreational
	April 15- July 31	Northwest	200	5	counting fence
	Aug 1- Oct 31	Northwest	40		counting fence
1998	May 1- Aug 31	Southwest	1320	0	2 trapnets, 1 gillnet, and recreational
	Sept 1- Oct 31	Southwest	780	0	2 trapnets and recreational
	May 1 - Oct 31	Both SW and NW		190	gillnets and native recreational fishing
	May 1- Aug 31	Northwest	1880	0	2 trapnets, up to 11 gillnets, and recreational
	Sept 1- Oct 31	Northwest	780	0	2 trapnets, up to 11 gillnets, and recreational
	April 15- July 31	Northwest	200	5	counting fence
	Aug 1- Oct 31	Northwest	40	0	counting fence
1999	May 25- Aug 31	Southwest	1320	0	2 trapnets, 1 gillnet, and recreational
	Sept 1- Oct 31	Southwest	780	0	2 trapnets and recreational
	May 25 - Oct 31	Both SW and NW		195	gillnets and native recreational fishing
	May 25- Aug 31	Northwest	1880	0	2 trapnets, up to 11 gillnets, and recreational
	Sept 1- Oct 31	Northwest	780	0	2 trapnets, up to 11 gillnets, and recreational
	May 25- July 31	Northwest	200	5	counting fence
	Aug 1- Oct 31	Northwest	40	0	counting fence

Table 1 (continued). Food fishery agreements for First Nations on the Miramichi River, 1992 to 1999.

Red Bank First Nation					
1992	May 1 - Dec 30	NW and LSW	5000	10	2 trapnets and recreational
1993	May 1 - Dec 31	NW and LSW	5000	10	2 trapnets and recreational
1994	June 1- Aug 31	Little Southwest	1000	5	1 trapnet and recreational
	Sept 1- Oct 31	Little Southwest	1000	5	1 trapnet and recreational
	June 1- Aug 31	Northwest	1000	5	1 trapnet and recreational
	Sept 1- Oct 31	Northwest	1000	5	1 trapnet and recreational
1995	June 1- Aug 31	Little Southwest	1320	60	1 trapnet and recreational
	Sept 1- Oct 31	Little Southwest	680	10	1 trapnet and recreational
	June 1- Aug 31	Northwest	1320	60	1 trapnet and recreational
	Sept 1- Oct 31	Northwest	680	10	1 trapnet and recreational
1996	June 1- Aug 31	Little Southwest	1320	71	1 trapnet and recreational
	Sept 1- Oct 31	Little Southwest	680	141	1 trapnet and recreational
	June 1- Aug 31	Northwest	1320	70	1 trapnet and recreational
	Sept 1- Oct 31	Northwest	680	141	1 trapnet and recreational
1997	June 1- Aug 31	Little Southwest	1320	100	1 trapnet, 2 gillnets, and recreational
	Sept 1- Oct 31	Little Southwest	680	100	1 trapnet, 2 gillnets, and recreational
	June 1- Aug 31	Northwest	1320	150	1 trapnet, 4 gillnets, and recreational
	Sept 1- Oct 31	Northwest	680	150	1 trapnet, 4 gillnets, and recreational
1998	June 1- Aug 31	Little Southwest	1320	100	1 trapnet, 2 gillnets (June 8 -17 only), and angling
	Sept 1- Oct 31	Little Southwest	680	100	1 trapnet, 2 gillnets, and recreational
	June 1- Aug 31	Northwest	1320	150	1 trapnet, 2 gillnets (June 8-17 only), and angling
	Sept 1- Oct 31	Northwest	680	150	1 trapnet, 2 gillnets, and angling
1999	May 25- Aug 31	Northwest	2640	250	1 trapnet, 2 gillnets (May 25-17 only), and angling
	Sept 1- Oct 31	Northwest	1360	250	1 trapnet, 2 gillnets, and recreational
	May 25-June 17	Little Southwest			1 gillnet and recreational (included in allocation from Northwest)
Burnt Church First Nation					
1992	May 1- Dec 31	Miramichi Bay	2000	25	up to 25 gillnets plus angling
1993	May 1- Dec 31	Miramichi Bay	2000	25	up to 25 gillnets plus angling
1994	May 1- Dec 31	Miramichi Bay	2000	25	up to 25 gillnets plus angling
1995	May 1- July 31	Miramichi Bay	1300	80	up to 25 gillnets plus angling
	Aug 1- Oct 15	Miramichi Bay	700	120	up to 25 gillnets plus angling
1996	May 1- July 31	Miramichi Bay	1300	80	up to 25 gillnets plus angling
	Aug 1- Oct 15	Miramichi Bay	700	120	up to 25 gillnets plus angling
1997	May 1- July 31	Miramichi Bay	1300	80	up to 25 gillnets plus angling
	Aug 1- Oct 15	Miramichi Bay	700	120	up to 25 gillnets plus angling
1998	April 15- July 31	Miramichi Bay	1300	80	up to 25 gillnets plus angling
	Aug 1- Oct 15	Miramichi Bay	700	120	up to 25 gillnets plus angling
1999	May 1- July 31	Miramichi Bay	1300	80	up to 25 gillnets plus angling
	Aug 1- Oct 15	Miramichi Bay	700	120	up to 25 gillnets plus angling

Table 2a. Bright salmon angling seasons and quotas for 1999.

General Season : April 15 - October 31
General Quota: Daily: Retain 1 grilse Release 4 fish (grilse and salmon combined)
Season: Retain 8 grilse, 0 salmon

Exceptions to General Season:

Opens April 15; Closes August 31
- NW Miramichi River upstream from Little River
- Rocky Brook, tributary of SW Miramichi River

Opens April 15; Closes September 15
- All tributaries of SW Miramichi River upstream of the Cains River except Rocky Brook
- Big Sevogle River upstream from Square Forks
- Dungarvon River upstream of the Furlong Bridge
- LSW Miramichi River upstream of Catamaran Brook
- North and South Branches of the SW Miramichi River
- North and South Branches of the Renous River

Opens April 15; Closes September 30:
- SW Miramichi River upstream of the mouth of Burnt Land Bk. to the forks of the North and South Branches at Juniper

Opens April 15; Closes October 15:
- Big Sevogle River, downstream from Square Forks
- Bartholowmew River
- Cains River
- Dungarvon River, downstream from the Furlong Bridge
- LSW Miramichi River downstream from Catamaran Bk.
- NW Miramichi River, downstream from Little River
- Renous River, downstream from the confluence of the North and South Branches.
- Southwest Miramichi River downstream from Burnt Land Bk.
- Southwest Miramichi River tributaries downstream of the Cains River which are not mentioned above

Hook and Release Only Angling (salmon angling licence)

Opens October 1; Closes October 15:
- Southwest Miramichi River upstream from Burntland Bk to the forks of the North and South Branches at Juniper

Opens September 16; Closes October 15:
- Little Southwest Miramichi River upstream from Catamaran Bk to and including Cleland's Pool

Opens September 1; Closes September 15:
- Northwest Miramichi River upstream from Little River to a point 200m upstream of the forks of the North and South Branches of the Northwest Miramichi River

Hook and Release Only Angling (with a Hook and Release Licence)

Opens July 1; Closes September 15:
- North Pole Stream from its mouth upstream to Lizard Bk
- Little Southwest Miramichi River , from and including Big Rock Pool upstream to include the east and west branches, not including tributaries or lakes

Opens June 1; Closes September 15:
- Lower North Branch of the LSW Miramichi River, from and including
- Rocky Rapids Pool upstream to its source including all tributaries
- Cains River, from the river ford located approximately 3/4 km upstream from Hopewell Lodge to and including Lower Otter Brook Pool exclusive of all tributaries

Table 2b. Variation orders affecting bright salmon angling seasons and quotas for 1999.

1999-102 **Dated July 23, 1999**

Angling Closed in the following areas

-Bartholomew River from its mouth to Highway # 8

-Southwest Miramichi River from 100 meters downstream to 300 meters upstream of the Quarryville bridge.

-Indian Brook from its mouth to Highway # 108

-Southwest Miramichi River from 200 meters downstream to 50 meters upstream of the mouth of the Bartholomew River.

1999-112 **Dated July 30, 1999**

Variation order 1999-102 revoked but angling was again closed in areas specified in 1999-102 plus angling was closed after 10:00 AM each day beginning July 31, 1999.

1999-117 **Dated August 10, 1999**

Variation order 1999-112 revoked effective August 10 at 18:00 hours however angling remained closed in the following areas.

-Southwest Miramichi River from 100 meters downstream to 300 meters upstream of the Quarryville bridge.

-Indian Brook from its mouth to Highway # 108

1999-134 **Dated September 8, 1999**

Angling remained closed in the areas designated in 1999-117 plus angling was closed in an additional area effective September 9.

Southwest Miramichi River from 100 meters upstream to 200 meters downstream of the mouth of MacKenzie Brook, including MacKenzie Brook from its confluence to the South Cains River Road.

1999-157 **Dated September 28, 1999**

Effective September 28, 1999 all previous variation orders are revoked and angling seasons and quota’s reverted to those specified in Table 2a.

Table 3. Harvest and effort (net days) for aboriginal food fisheries on the Miramichi River in 1999 by early and late runs. Harvests are reported by band councils.

	Burnt Church		Eel Ground							Red Bank				
	Gillnets		Gillnets			SW Trapnets	NW Trapnets	Big Hole counting fence		Gillnets			Trapnets	
	Small	Large	Effort	Small	Large	Small	Small	Small	Large	Effort	Small	Large	Small	Large
Early run														
May 24- May 30	0	0	n.a.	n.a.	n.a.	0	0	0	0	n.a.	n.a.	n.a.	0	0
May 31 - 6	0	0	n.a.	n.a.	n.a.	0	0	0	0	n.a.	n.a.	n.a.	19	3
June 7 - 13	3	7	n.a.	n.a.	n.a.	14	2	12	0	n.a.	n.a.	n.a.	37	2
June 14 - 20	0	0	n.a.	n.a.	n.a.	9	1	18	0	n.a.	n.a.	n.a.	58	9
June 21- 27	0	0	n.a.	n.a.	n.a.	23	3	4	0	n.a.	n.a.	n.a.	75	6
June 28 - July 4	0	0	n.a.	n.a.	n.a.	133	20	1	0	n.a.	n.a.	n.a.	179	34
July 5 - 11	8	8	n.a.	n.a.	n.a.	177	26	4	3	n.a.	n.a.	n.a.	303	92
July 12 - 18	15	18	n.a.	n.a.	n.a.	69	10	8	1	n.a.	n.a.	n.a.	132	63
July 19 - 25	0	1	n.a.	n.a.	n.a.	52	8	0	0	n.a.	n.a.	n.a.	110	56
July 26 - Aug 1	0	0	n.a.	n.a.	n.a.	52	8	0	0	n.a.	n.a.	n.a.	137	0
Aug. 2 - 8	0	0	n.a.	n.a.	n.a.	17	3	0	0	n.a.	n.a.	n.a.	50	61
Aug. 9 - 15	0	0	n.a.	n.a.	n.a.	59	9	0	0	n.a.	n.a.	n.a.	96	0
Aug. 16 - 22	0	0	n.a.	n.a.	n.a.	15	2	0	0	n.a.	n.a.	n.a.	23	4
Aug. 23 - 31	0	0	n.a.	n.a.	n.a.	7	1	0	0	n.a.	n.a.	n.a.	42	0
Subtotal	26	34	n.a.	222	195	627	93	47	4	n.a.	30.	30	1261	330
Late run														
Sept. 1 - 5	0	0	0	0	0	0	0	0	0	0	0	0	15	14
Sept. 6 - 12	0	0	0	0	0	0	0	0	0	0	0	0	6	15
Sept. 13 - 19	0	0	0	0	0	0	0	0	0	0	0	0	4	6
Sept. 20 - 26	0	0	0	0	0	0	0	0	0	0	0	0	28	32
Sept. 27 - Oct 3	0	0	0	0	0	0	0	0	0	0	0	0	30	25
Oct 4 - 10	0	0	0	0	0	0	0	0	0	0	0	0	3	4
Oct. 11 - 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oct. 18 - 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	86	96
Total season	26	34	n.a.	222	195	627	93	47	4	n.a.	30	30	1347	426
% Early run	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	78%

Note: Underlined values are preliminary estimates.

Table 4. Removals of salmon in aboriginal and recreational fisheries of the Miramichi River, 1992 to 1999. Data for 1999 are preliminary.

Fisheries Removals of Atlantic Salmon in the Miramichi River

Northwest Miramichi		1992	1993	1994	1995	1996	1997	1998	1999	Mean 1993-1995, 1997
Small salmon	Aboriginal	1616	477	2921	1795	1504	871	782	1739	1536
	Angling	7985	5569	4131	5636	*5636*	3153	?	?	5295
Large salmon	Aboriginal	580	54	81	172	317	548	195	655	287
	Angling	78	61	56	60	*60*	46	?	?	60
Total losses	Small	9601	6046	7052	7431	7140	4024			6831
	Large	658	115	137	232	377	594			347
% aboriginal	Small	17%	8%	41%	24%	21%	22%			22%
	Large	88%	47%	59%	74%	84%	92%			72%

Southwest Miramichi		1992	1993	1994	1995	1996	1997	1998	1999	Mean 1993-1995, 1997
Small salmon	Aboriginal	0	0	0	1170	1074	326	378	627	299
	Angling	17608	9702	7072	11258	*11258*	5158	?	?	10160
Large salmon	Aboriginal	0	0	0	0	0	0	0	0	0
	Angling	245	151	98	189	*189*	106	?	?	158
Total losses	Small	17608	9702	7072	12428	12332	5484			10459
	Large	245	151	98	189	189	106			158
% aboriginal	Small	0%	0%	0%	9%	9%	6%			3%
	Large	0%	0%	0%	0%	0%	0%			0%

Miramichi River		1992	1993	1994	1995	1996	1997	1998	1999	Mean 1993-1995, 1997
Small salmon	Aboriginal	1652	601	2977	3004	2583	1197	1180	2392	1886
	Angling	25593	15271	11203	16893	*16894*	8311	?	?	15454
Large salmon	Aboriginal	608	208	124	185	372	548	214	689	335
	Angling	323	212	154	249	*249*	152	?	?	218
Total losses	Small	27245	15872	14180	19897	19477	9508			15787
	Large	931	420	278	434	621	700			553
% aboriginal	Small	6%	4%	21%	15%	13%	13%			13%
	Large	65%	50%	45%	43%	60%	78%			55%

Table 5. Recreational Atlantic salmon fishery statistics from the Miramichi River, 1999. % change represents 1999 minus mean divided by mean. Detailed catches are in Moore et al. (MS1995) of which 1995 data have been finalized. FISHSYS data for 1997 have been finalized (Hooper and Dryden 1998). Fishsys data for 1998 and angling estimates for 1999 are not yet available. Fishsys data for 1996 were not collected.

		Miramichi River		**Northwest**		**Southwest**	
Black salmon fishery							
Effort (rod days)	1999						
	1998						
	1997	9080		1751		7329	
	1991-1995 mean	8563		1461		7101	
	% change						
		Harvest	*Released*	*Harvest*	*Released*	*Harvest*	*Released*
Small salmon	1999						
	1998						
	1997	1723	3300	437	876	1286	2424
	1991-1995 mean	1666	3098	270	580	1396	2517
	% change						
Large salmon	1999						
	1998						
	1997		3365		1363		2002
	1991-1995 mean		3175		541		2634
	% change						
Bright salmon fishery							
Effort (rod days)	1999						
	1998						
	1997	102851		33563		69288	
	1991-1995 mean	100973		32667		68306	
	% change						
		Harvest	*Released*	*Harvest*	*Released*	*Harvest*	*Released*
Small salmon	1999						
	1998						
	1997	8311	3181	3153	899	5158	2282
	1991-1995 mean	13284	4666	4405	1525	8879	3141
	% change						
Large salmon	1999						
	1998						
	1997		5078		1432		3646
	1991-1995 mean		6404		1602		4802
	% change						

Northwest Miramichi crown reserve angling

			Individual stretches		
		Total	Little Southwest	Sevogle	Northwest
Effort (rod days)	1999	2177	436	625	1116
	1998	2488	493	722	1273
	1997	2494	523	728	1243
	1991-1995 mean	2407	524	773	1109
	% change	-10%	-17%	-19%	1%
Small salmon (catch)	1999	514	59	134	321
	1998	1044	179	196	669
	1997	868	95	191	582
	1991-1995 mean	1256	165	332	760
	% change	-59%	-64%	-60%	-58%
Large salmon (released)	1999	73	14	22	37
	1998	125	20	40	65
	1997	115	16	43	56
	1991-1995 mean	116	30	34	53
	% change	-37%	-53%	-35%	-30%

Table 6. Summary of broodstock collections in 1999.

Stock Collected	Date Collected	Female Large	Female Small	Male Large	Male Small	Collection Site
Northwest Miramichi						
Little Southwest	Sept. 15	7	3	1	7	Moose Landing, seined
Northwest	Sept. 22	10	0	0	8	NW Barrier Pool, seined
Subtotal		**17**	**3**	**1**	**15**	
Southwest Miramichi						
SW Miramichi	Sept. 23	0	0	0	2	Mountain Channel, angled
	Oct. 1	0	0	0	1	Big Hole Brook, angled
	Oct. 5	2	0	0	1	Salmon Brook, angled
	Oct. 6	1	0	0	1	Salmon Brook, angled
	Oct. 6	1	0	0	0	Tuckaway Lodge, angled
	Oct. 6	0	0	1	0	Ledges Inn, angled
	Oct. 7	13	0	1	6	Juniper Barrier, seined
	Oct. 8	1	0	0	0	Salmon Brook, angled
	Oct. 8	0	0	0	1	Big Hole Brook , angled
	Oct. 10	0	0	0	2	Ledges Inn
	Oct. 11	1	0	1	0	Black Brook, angled
	Oct. 14	2	0	1	0	Black Brook, angled
	Oct. 15	0	0	1	0	Black Brook, angled
	Oct. 30	1	0	0	0	Black Brook, angled
	Oct. 30	0	0	0	4	Mountain Channel, angled
Clearwater	Sept. 28	5	0	1	9	Irving Fence
	Sept. 29	4	0	0	1	Irving Fence
	Oct. 1	2	0	0	0	Irving Fence
Rocky Brook	Sept. 29	2	0	0	3	Cold Spring
	Oct. 6	3	0	0	2	Cold Spring
Cains	Sept. 28	1	0	0	0	Island pool - Angled
	Sept. 30	1	0	0	1	Island pool - Angled
	Oct. 12	1	0	0	0	Island pool - Angled
Dungarvon	Sept. 14	0	0	0	3	Furlong Bridge
	Oct. 11	3	0	0	0	Furlong Bridge
Subtotal		**44**	**0**	**6**	**37**	
Total		**61**	**3**	**7**	**52**	

Table 7. Reports of dead salmon associated with warmwater conditions in July and August, 1999.

Location	Date	Report	Comment
Southwest Miramichi			
Quarryville	July 18, 2030	2 salmon reported jigged and killed at mouth of Indiantown Brook	
Main Southwest	July 18 and 19	42 fish	
Quarryville to Upper Blackville	July 20 and 21	10 large salmon, mostly decomposed	
Quarryville to Upper Blackville	July 22 and 23	9 salmon	
Below Cains	July 24	2 grilse, 1 salmon	
Mouth of Indiantown Brook	July 25	1 salmon	Science tag 85183
Doaktown	July 25	1 salmon	
Quarryville to Upper Blackville	July 26	4 salmon, 2 grilse	
Quarryville to Upper Blackville	July 27	1 salmon, 2 grilse	
Main Southwest	July 31	6 salmon	
Main Southwest	Aug. 1	3 salmon	
Downstream Donnelly Brook	Aug. 2	11 salmon	
Main Southwest	Aug. 4 to 5	6 salmon, 1 grilse	1 salmon with science tag 85097 at Black Brook
Main Southwest	Aug. 6	8 salmon	
Main Southwest	Aug. 7	6 salmon	2 science tags retrieved
Main Southwest	Aug. 8	4 salmon	
Renous River			
lower end (below Bailey bridge)	July 20 and 21	6 salmon	
	July 22 and 23	1 salmon	
below bridge	July 24	1 salmon	
Mouth	Aug. 2	1 salmon	
Northwest Miramichi			
Northwest	July 18 and 19	31 salmon	
Sevogle	July 18 and 19	25 dead (mostly large)	
Sevogle	July 20 and 21	14 salmon	
Little Southwest	July 18 and 19	14 salmon	

Table 8. Summary of trapnet operation dates, catch, and tags applied in the Miramichi River, 1999. Catch represents all fish sampled, including recaptures.

		Catch		Tagged	
Trapnets	Time Period	Small	Large	Small	Large
NW Miramichi					
Eel Ground Lower	June 11 to Aug. 21	157	39	0	33
Red Bank NW	June 6 to Oct. 14	706	204	0	0
Red Bank LSW	May 31 to Oct. 14	771	409	0	0
Cassilis	June 10 to Oct. 15	883	296	794	273
Hackett's Beach	May 28 to Oct. 26	312	85	204	76
SW Miramichi					
Eel Ground Lower	June 1 to Aug. 27	505	142	383	116
Eel Ground Upper	June 9 to Oct. 15	1041	473	409	418
Millerton	May 27 to Oct. 22	1011	471	899	395

Note: Millerton trapnet was brailled September 23 at 13:30 and reset September 26 at 15:00 due to heavy rain.
Cassilis trapnet was brailled September 23 at 10:30 and reset September 26 at 13:00 due to heavy rain.

Table 9. Mark and recapture matrices used in the estimation of returns of small salmon and large salmon to the Miramichi River and each branch in 1999.

Small salmon			To recapture trapnets							
		Tags	NW		SW			Tags	To	
From		Placed	Early	Late	Early	Late	From	Placed	NW	SW
NW	Early	860	96	1	4	4	NW	998	105	9
	Late	138	0	8	0	1	SW	790	19	40
SW	Early	430	12	4	8	3				
	Late	360	0	3	0	29	Catch		1330	921
Catch			1235	95	606	315				

Large salmon			To recapture trapnets							
		Tags	NW		SW			Tags	To	
From		placed	Early	Late	Early	Late	From	Placed	NW	SW
NW	Early	240	25	1	1	1	NW	343	31	3
	Late	103	0	5	0	1	SW	537	13	15
SW	Early	302	11	0	4	0				
	Late	235	0	2	0	11	Catch		545	425
Catch			433	112	239	186				

Small and Large Salmon			To recapture trapnets							
		Tags	NW		SW			Tags	To	
From		Placed	Early	Late	Early	Late	From	Placed	NW	SW
NW	Early	1100	121	2	5	5	NW	1341	136	12
	Late	241	0	13	0	2	SW	1327	32	55
SW	Early	732	23	4	12	3				
	Late	595	0	5	0	40	Catch		1875	1346
Catch			1668	207	845	501				

Table 10. Summary of estimated returns **to upper trapnets** in the Northwest Miramichi, Southwest Miramichi, and Miramichi River, by size group in 1999. For 1999, the estimates from the Schaeffer model using the branch and season matrices for small salmon and large salmon separately were used.

				Small			Large		
	Hypothesis	Matrix	Model	Median	5th	95th	Median	5th	95th
Northwest	Size-stratified	Branch and Season	Schaeffer	**11,300**	**9,600**	**13,300**	**6,500**	**5,100**	**8,500**
			Darroch	8,400	5,500	11,100	4,000	-1,600	8,100
	Pooled	Branch and Season	Schaeffer	13,000	11,000	15,100	5,600	4,700	6,700
	Size-stratified	Branch	Schaeffer	11,600	9,900	13,900	6,200	5,000	7,900
			Darroch	9,200	7,400	11,400	3,700	1,500	5,900
Southwest	Size-stratified	Branch and Season	Schaeffer	**10,600**	**8,600**	**13,600**	**6,800**	**5,000**	**9,800**
			Darroch	19,300	9,300	42,400	15,800	7,200	54,000
	Pooled	Branch and Season	Schaeffer	12,500	10,300	15,500	5,800	4,750	7,300
	Size-stratified	Branch	Schaeffer	11,400	9,200	14,400	6,700	5,200	9,300
			Darroch	13,400	10,000	18,800	10,400	6,700	19,500
Miramichi	Size-stratified	Branch and Season	Schaeffer	**22,000**	**18,700**	**26,300**	**13,400**	**10,500**	**17,700**
			Darroch	27,700	19,000	49,600	19,800	12,000	55,700
	Pooled	Branch and Season	Schaeffer	26,700	23,700	30,300	11,800	10,400	13,800
	Size-stratified	Branch	Schaeffer	23,100	19,500	27,600	13,100	10,500	16,700
			Darroch	22,700	18,900	28,100	14,300	10,800	21,900
			Peterson	21,000	17,900	24,500	12,400	9,900	15,700

Table 11. Removals of Atlantic salmon by size and season from the Northwest Miramichi, Southwest Miramichi and total Miramichi River system in 1999. No angling removal estimates are available to date.

	Northwest Miramichi			Southwest Miramichi			Miramichi River		
	Early	Late	Total	Early	Late	Total	Early	Late	Total
Small salmon									
Food fisheries[1]	252	0	252	0	0	0	278	0	278
Food fisheries[2]	1401	86	1487	627	0	627	2028	86	2114
Angling	?	?	?	?	?	?	?	?	?
Seizures	?	?	8	0	0	0	?	?	8
Broodstock	18	0	18	23	14	37	41	14	55
Incidental mortalities	48	0	48	10	2	12	58	2	60
Furunculosis[3]	1	0	1	0	0	0	1	0	1
Vibrio[4]	1	0	1	0	0	0	1	0	1
Total	1721	86	**1815**	660	16	**676**	2407	102	**2517**
Large salmon									
Food fisheries[1]	225	0	225	0	0	0	259	0	259
Food fisheries[2]	334	96	430	0	0	0	334	96	430
Angling	?	?	?	?	?	?	?	?	?
Seizures	?	?	1	0	0	0	?	?	1
Broodstock	18	0	18	35	15	50	53	15	68
Incidental mortalities	6	0	6	31	0	31	37	0	37
Furunculosis[3]	5	0	5	7	0	7	12	0	12
Vibrio[4]	0	0	0	1	0	1	1	0	1
Total	588	96	**685**	74	15	**89**	696	111	**808**

1 Gillnet fisheries (preliminary)
2 Fence and trapnet fisheries
3 Furunculosis mortalities only include cases confirmed by the DFO Fish Health Unit (13 of 31 fish tested in 1999).
4 Vibrio mortalities only include cases confirmed by the DFO Fish Health Unit (2 of 31 fish tested in 1999).

Table 12. Estimated returns, removals (partial, exclusive of angling removals), and escapements (unaccounting for angling removals) of small salmon and large salmon to the Northwest Miramichi, Southwest Miramichi and Miramichi River in 1999.

		Returns to recapture trapnets	Harvest below recapture trapnets	Total returns	Total removals	Escapement
Northwest Miramichi						
Small	Median	11,300	315	11,600		
	5th	9,600		9,900		
	95th	13,300		13,600		
Large	Median	6,500	195	6,700		
	5th	5,100		5,300		
	95th	8,500		8,700		
Southwest Miramichi						
Small	Median	10,600	627	11,200		
	5th	8,600		9,200		
	95th	13,600		14,200		
Large	Median	6,800	0	6,800		
	5th	5,000		5,000		
	95th	9,800		9,800		
Miramichi River						
Small	Median	22,000	968	23,000		
	5th	18,700		19,700		
	95th	26,300		27,300		
Large	Median	13,400	229	13,600		
	5th	10,500		10,700		
	95th	17,700		17,900		

Table 13. Biological characteristics (fork length, sex ratio, and fecundity[1]) of small salmon and large salmon for the Southwest and Northwest Miramichi and Miramichi River system for 1999.

		Small salmon		Large salmon	
		Estimate	Std. Dev.	Estimate	Std. Dev.
Northwest Miramichi					
% Female	early	36.8		82.0	
	late	16.7		60.6	
	total	35.2		76.8	
Fork length (cm)	early	56.8	2.73	78.1	9.05
	late	58.9	2.70	76.5	9.08
	total	57.0	2.80	77.8	9.07
Fecundity[1]	early	1407		6101	
	late	717		4379	
	total	1361		5683	
% Previous spawners	early			28.4	
	late			30.3	
	total			28.9	
Southwest Miramichi					
% Female	early	22.6		83.5	
	late	21.8		63.2	
	total	22.2		73.6	
Fork length (cm)	early	56.9	2.58	80.8	10.11
	late	58.6	2.45	77.3	9.60
	total	57.5	2.66	79.2	10.02
Fecundity[1]	early	869		6519	
	late	920		4635	
	total	883		5586	
% Previous spawners	early			42.9	
	late			30.5	
	total			37.2	
Miramichi River					
% Female	early	29.7		82.8	
	late	19.2		61.9	
	total	28.7		75.2	
Fork length (cm)	early	56.9		79.5	
	late	58.8		76.9	
	total	57.3		78.5	
Fecundity[1]	early	1142		6317	
	late	819		4506	
	total	1128		5636	
% Previous spawners	early			35.7	
	late			30.4	
	total			33.1	

1 Fecundity (eggs per fish) calculated using fecundity-length relationship (Randall 1989) and sex ratios.

Fecundity (small salmon) = % female * exp(3.1718*Ln(fork length) - 4.5636)
Fecundity (large salmon) = % female * exp(1.4132*Ln(fork length) + 2.7560)

Table 14. Egg deposition (millions of eggs) by small salmon, large salmon and both size groups combined in the Northwest Miramichi, Southwest Miramichi and Miramichi River system in 1999. The % of conservation requirement refers to the egg depositions from the returns (before any removals).

	Small	Large	Total	Contribution by large	% of conservation requirement
Northwest Miramichi					
Total	15.4	36.8	52.6	70%	
90% Conf. Int.	11.2 to 20.5	24.8 to 54.0	39.6 to 69.9		
Conservation requirement			41.0	90%	128%
					97% to 171%
Southwest Miramichi					
Total	9.3	38.5	48.1	80%	
90% Conf. Int.	6.8 to 13.1	24.2 to 60.8	33.4 to 71.0		
Conservation requirement			88.0	44%	55%
					38% to 81%
Miramichi River					
Total	24.7	75.6	100.9	75%	
90% Conf. Int.	18.3 to 33.2	51.8 to 113.0	75.0 to 140.9		
Conservation requirement			132.0	57%	76%
					57% to 107%

Table 15. Estimated returns and escapement to the Miramichi River (to Millbank 1971 to 1991; to Enclosure area 1992 to 1999) of small and large salmon. % change is 1999 minus mean relative to the mean.

	Small Salmon				Large Salmon			
		90% Confidence Interval				90% Confidence Interval		
Year	Return	Lower	Upper	Escapement	Return	Lower	Upper	Escapement
1971	35,673			21,946	24,407			4,347
1972	46,275			27,135	29,049			17,671
1973	44,545			30,668	27,192			20,349
1974	73,418			55,186	42,592			34,445
1975	64,902			48,469	28,817			21,448
1976	91,580			62,380	22,801			14,332
1977	27,743			13,247	51,842			32,917
1978	24,287			14,353	24,493			10,829
1979	50,965			30,848	9,054			4,541
1980	41,588			26,894	36,318			18,873
1981	65,273			39,929	16,182			4,608
1982	80,379			56,000	30,758			13,258
1983	25,184			14,849	27,924			8,458
1984	29,707			18,929	15,137			14,687
1985	60,800			41,815	20,738			20,122
1986	117,549			89,398	31,285			30,216
1987	84,816			62,777	19,421			18,056
1988	121,919			90,278	21,745			20,980
1989	75,231			48,385	17,211			15,540
1990	83,500	68,000	113,100	59,524	28,574	21350	35583	27,588
1991	60,900	45,700	76,000	48,269	29,949	22400	37333	29,089
1992	152,600	128,000	184,000	129,288	37,000	31,056	44,643	35,927
1993	95,000	61,500	153,800	76,416	35,000	19,732	76,695	34,702
1994	57,000	40,500	83,000	42,479	27,544	18,278	47,023	27,147
1995	54,000	17,800	75,600	33,347	32,627	19,703	50,304	32,093
1996	44,400	36,000	65,000	24,180	24,812	17,341	32,455	23,478
1997	22,600	17,800	30,200	12,980	18,381	13,952	25,014	17,606
1998	33,000	27,500	41,000		9,500	7,500	12,500	
1999	23,000	19,700	27,300		13,600	10,700	17,900	
%change in 1999 relative to								
1998	-30%				43%			
1994 to 1998	-45%				-40%			
1984 to 1998	-68%				-45%			
1971 to 1983	-55%				-52%			
Means								
1994 to 1998	42,200				22,573			
1984 to 1998	72,868				24,595			
1971 to 1983	51,678				28,571			

Table 16. Estimated returns of small and large salmon to the Southwest Miramichi and the Northwest Miramichi, 1992 to 1999.

	Small salmon		Large salmon	
	Median	5th to 95th Percentile	Median	5th to 95th Percentile
Southwest Miramichi				
1992	120,700	85,300 to 157,800	25,000	17,7007 to 32,700
1993	42,600	22,700 to 73,800	21,900	10,800 to 58,900
1994	33,800	23,500 to 54,200	14,000	9,100 to 22,900
1995	31,700	10,400 to 45,300	17,100	5,700 to 24,200
1996	30,200	20,200 to 44,900	15,700	9,500 to 27,200
1997	13,500	10,400 to 18,700	11,000	8,500 to 14,600
1998	24,000	19,000 to 32,000	7,000	6,000 to 9,500
1999	11,200	9,200 to 14,200	6,800	5,000 to 9,800
Northwest Miramichi				
1992	30,300	23,000 to 40,900	10,000	-
1993	46,200	27,700 to 97,500	10,500	3,700 to 37,500
1994	20,600	11,700 to 38,500	12,600	6,500 to 31,300
1995	22,400	7,100 to 32,600	15,200	7,800 to 31,500
1996	18,900	13,300 to 28,000	7,900	4,800 to 13,300
1997	9,800	6,500 to 17,300	7,000	4,400 to 13,100
1998	7,900	6,200 to 10,700	2,200	2,100 to 3,100
1999	11,600	9,900 to 13,600	6,700	5,300 to 8,700

Table 17. Number of large salmon and small salmon counted at barriers in three tributaries of the Miramichi River, 1981 to 1999.

Tributary	Year	Large	Small	Total	Dates Operated	No. of Days
North Branch of SW Miramichi River						
	1981	54	671	725	Jul. 5-Oct. 4	92
	1982	282	621	903	Jun. 30-Oct. 8	101
	1983	219	290	509	Jul. 4-Oct. 10	99
	1984	297	230	527	Jul. 10-Oct. 16	99
	1985	604	492	1096	Jul. 1-Oct. 20	112
	1986	1138	2072	3210	Jun. 30-Oct. 19	110
	1987	1266	1175	2441	Jul. 2-Oct. 19	110
	1988	929	1092	2021	Jun. 30-Oct. 24	117
	1989	731	969	1700	Jul. 1-Oct. 24	116
	1990	994	1646	2640	Jun. 29-Oct. 14	108
	1991	476	495	971	Jun. 30-Oct. 21	107
	1992	1047	1383	2430	Jun. 30-Oct. 20	113
	1993	1145	1349	2494	Jun. 30-Oct. 22	115
	1994	877	1223	2100	June 29-Oct. 30	124
	1995	1019	811	1830	June 15-Oct. 28	136
	1996	819	1388	2207	June 20-Oct. 27	130
	1997	519	566	1085	June 23-Oct. 29	131
	1998	698	981	1679	June 1 - Oct. 25	147
	1999	745	574	1319	July 1- Oct. 12	104
1993-98	Mean	786	994	1780		134
Change (99-mean)/mean		-5%	-42%	-26%		
Change (99-98)/98		7%	-41%	-21%		
Dungarvon River						
	1981	112	550	662	Jun. 24-Oct. 8	107
	1982	122	483	605	Jun. 28-Oct. 15	110
	1983	126	330	456	Jun. 28-Oct. 14	109
	1984	93	315	408	Jul. 5-Oct. 12	100
	1985	162	536	698	Jun. 25-Oct. 10	108
	1986	174	501	675	Jun. 25-Oct. 21	119
	1987	202	744	946	Jun. 25-Oct. 14	112
	1988	277	851	1128	Jun. 2-Oct. 25	151
	1989	315	579	894	Jun. 1-Oct. 10	132
	1990	318	562	880	Jun. 1-Oct. 11	133
	1991	204	296	500	Jun. 4-Oct. 14	133
	1992	232	825	1057	Jun. 4-Oct. 16	135
	1993	223	659	882	Jun. 14-Oct. 27	131
	1994	153	358	511	June 7-Oct. 20	136
	1995	95	329	424	May 31-Oct. 13	136
	1996	188	616	804	June 4-Oct. 24	143
	1997	115	391	506	June 10-Oct. 30	143
	1998	163	592	755	June 2 - Oct. 29	150
	1999	186	378	564	June 3-Oct. 14	126
1993-98	Mean	143	457	600		142
Change (99-mean)/mean		30%	-17%	-6%		
Change (99-98)/98		14%	-36%	-25%		
Northwest Miramichi River						
	1988	234	1614	1848	Jun. 27-Oct. 26	122
	1989	287	966	1253	May 30-Oct. 12	136
	1990	331	1318	1649	May 29-Oct. 18	143
	1991	224	765	989	Jun. 4-Oct. 18	137
	1992	219	1165	1384	Jun. 3-Oct. 16	136
	1993	216	1034	1250	Jun. 14-Oct. 27	136
	1994	228	673	901	June 5-Oct. 14	132
	1995	252	548	800	June 1-Oct. 12	134
	1996	218	602	820	June 3-Oct. 24	144
	1997	152	501	653	June 3-Oct. 29	149
	1998	289	1038	1327	June 2 - Oct. 28	149
	1999	387	708	1095	June 1-Oct. 19	141
1993-98	Mean	228	672	900		142
Change (99-mean)/mean		70%	5%	22%		
Change (99-98)/98		34%	-32%	-17%		

Table 18. Counts of small salmon and large salmon at the Clearwater Brook counting fence, 1997 to 1999. Data are courtesy of Chris Connel, J.D.Irving Ltd. and Fred Whoriskey, Atlantic Salmon Federation.

	Salmon count				
Year	Small	Large	Total	Operating dates	No. of days
1996[1]	62	16	78		
1997	365	313	678	June 10 to Oct. 24	136
1998[2]	508	208	716	May 21 to Oct. 25	158
1999	486	410	896	June 4 to Oct. 21	140

[1] Fence counts in 1996 are probably low due to fence location and operating dates
[2] High water levels on Aug. 12 and Oct. 2-3 may have permitted salmon to bypass the fence

Table 19. Counts of salmon of various life stages migrating upstream and downstream at Catamaran Brook, Little Southwest Miramichi River, 1990 to 1999. Data courtesy of R. Cunjak (University of New Brunswick, Fredericton, N.B.) and P. Hardie (DFO – Science Branch , Moncton, N.B.). Survival of smolts to small and large adults are calculated assuming small salmon are 1SW adults and large salmon are 2SW adults.

	Downstream		By Size		By Age			% Smolt Survival to		
Year	Parr	Smolts	Small	Large	1SW	2SW	PS	1SW	2SW	Total
1990	1269	1086	166	56	166	32	24	8.1	4.1	12.2
1991	2446	1664	88	53	88	28	25	8.5	2.0	10.5
1992	1396	2483	141	74	141	44	30	4.6	0.9	5.4
1993	1400	533	113	46	113	34	12	10.5	13.3	23.8
1994	2523	1020	56	24	56	21	3	12.8	3.3	16.2
1995	2175	1166	131	80	131	71	9	6.9	1.0	7.9
1996	602	569	80	43	80	34	9	7.2	3.2	10.4
1997	2495	1019	41	28	46	12	16	8.6	2.8	11.4
1998	958	393	88	44	88	18	26	19.1		
1999	n.a.	593	75	41	75	28	13			
							median	8.5	3.0	11.0

Note: Numbers at age for 1999 are estimated from average age composition of large and small salmon for 1994-98.

Table 20. Distribution of salmon juveniles in the Miramichi River in 1999. AC = adipose-clip, NM = unmarked.

River	Life stage	Mark	Number of fish stocked	Absolute difference from 1998 (%)
Northwest Miramichi	2+ smolts	AC	4,723	-377 (-7%)
	1+ parr (May)	AC	7,330	+7,330
	0+ parr (June - Aug.)	NM	9,500	+9,500
	0+ parr (Sept.-Nov.)	AC	20,288	+8918 (+78)
	Non-feeding fry	NM	0	-30,505
Southwest Miramichi	2+ smolts	AC	0	-40,000
	0+ parr (June - Aug)	NM	12,030	+12,030
	0+ parr (Sept.-Nov.)	AC	133,792	+42,418 (+46%)
	0+ parr (Sept.-Nov.)	NM	4,000	+4,000
	Non-feeding fry	NM	0	-80,714
Miramichi (total)	2+ smolts	AC	4,723	-40,377 (-89%)
	1+ parr (May)	AC	7,330	+7,330
	0+ parr (June - Aug.)	NM	21,530	+21,530
	0+ parr (Sept.-Nov.)	AC	154,080	+51,336 (+50%)
	0+ parr (Sept.-Nov.))	NM	4,000	+4,000
	Non-feeding fry	NM	0	-111,219

Table 21. Relative contribution of wild and adipose-clipped salmon to the returns in 1999.

	Small salmon			Large salmon		
	Wild	Adipose-clip	% wild	Wild	Adipose-clip	% wild
Southwest Miramichi (received 38,500 smolts in 1997 and 40,000 in 1998.)						
Sampling at Millerton trapnet						
June to Aug.	591	16	97.4%	247	1	99.6%
Sept. to Oct.	363	8	97.8%	216	6	97.3%
Total	954	24	97.5%	463	7	98.5%
Dungarvon River (received smolt stocking in 1997 and 1998.)						
Seining at Furlong Bridge						
Sept. 14	10	0	100.0%	0	0	0.0%
Rocky Brook (received satellite-reared fall fingerlings annually since 1984)						
Seining at various pools in Rocky Brook						
Sept. 29	2	1	66.7%	2	0	100.0%
Oct. 6	8	0	100.0%	8	0	100.0%
Oct. 8	7	0	100.0%	7	1	87.5%
Northwest Miramichi (received 21,000 smolts in 1997 and 5,100 in 1998.)						
Sampling at Hackett's Beach trapnet.						
June to Aug.	183	5	97.3%	33	0	100.0%
Sept. to Oct.	60	1	98.4%	46	1	97.9%
Total	243	6	97.6%	79	1	98.8%
Sampling at Red Bank trapnets						
June to Aug.	751	22	97.2%	310	5	98.4%
Sept. to Oct.	70	0	100.0%	93	1	98.9%
Total	821	22	97.4%	403	6	98.5%
Sampling at Cassilis trapnet						
June to Aug.	735	25	96.7%	218	5	97.8%
Sept. to Oct.	86	0	100.0%	68	0	100.0%
Total	821	25	97.0%	286	5	98.3%

Table 22. Model parameters and assumptions for evaluating the probability of meeting conservation in year 2000 and the egg loss resulting from fisheries.

Assumptions of the fisheries risk analysis model		**Southwest Miramichi**		**Northwest Miramichi**		**Miramichi River**	
		Large	Small	Large	Small	Large	Small
Proportion of angling catch occurring early							
Based on FISHSYS results (1984 to 1994)		60.0%	64.0%	80.0%	86.0%		
Assumed exploitation rates in angling fishery		30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
Hook and release mortality estimates							
By season	Early	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
	Late	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Season weighted		3.4%	3.6%	4.2%	4.4%		
Integrated value used in assessments		3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Fecundity of fish by season (average 1994 to 1998)							
	Early	6,542	738	6,659	1,099	6,527	913
	Late	5,695	475	5,619	471	5,467	451
	Integrated	6,036	591	6,152	861	6,069	714
First Nations Harvests (maximum harvests achieved 1994 to 1998)							
	Early	0	1148	358	2447		
	Late	0	209	190	583		
Ratios (small / large) (1995 to 1999)							
	Min.	1.93		1.19		1.75	
	Max.	3.48		4.66		2.43	
	Median	2.01		2.70		2.38	
Small salmon returns (1995 to 1999)							
	Mean		22,180		14,282		35,400
	Std. Dev.		9,329		6,142		13,696

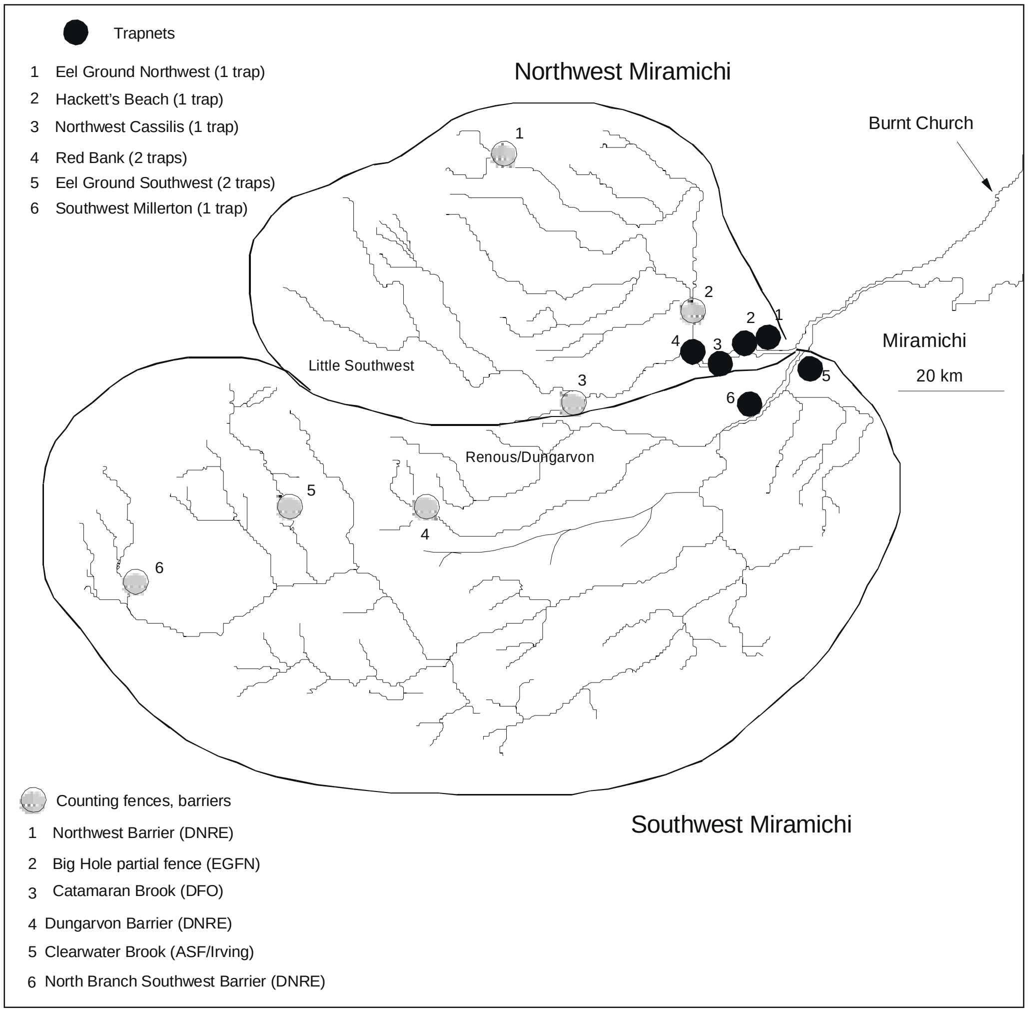


Figure 1. The Miramichi River indicating major branches, major tributaries and location of trapnets and counting fences operated in 1999.

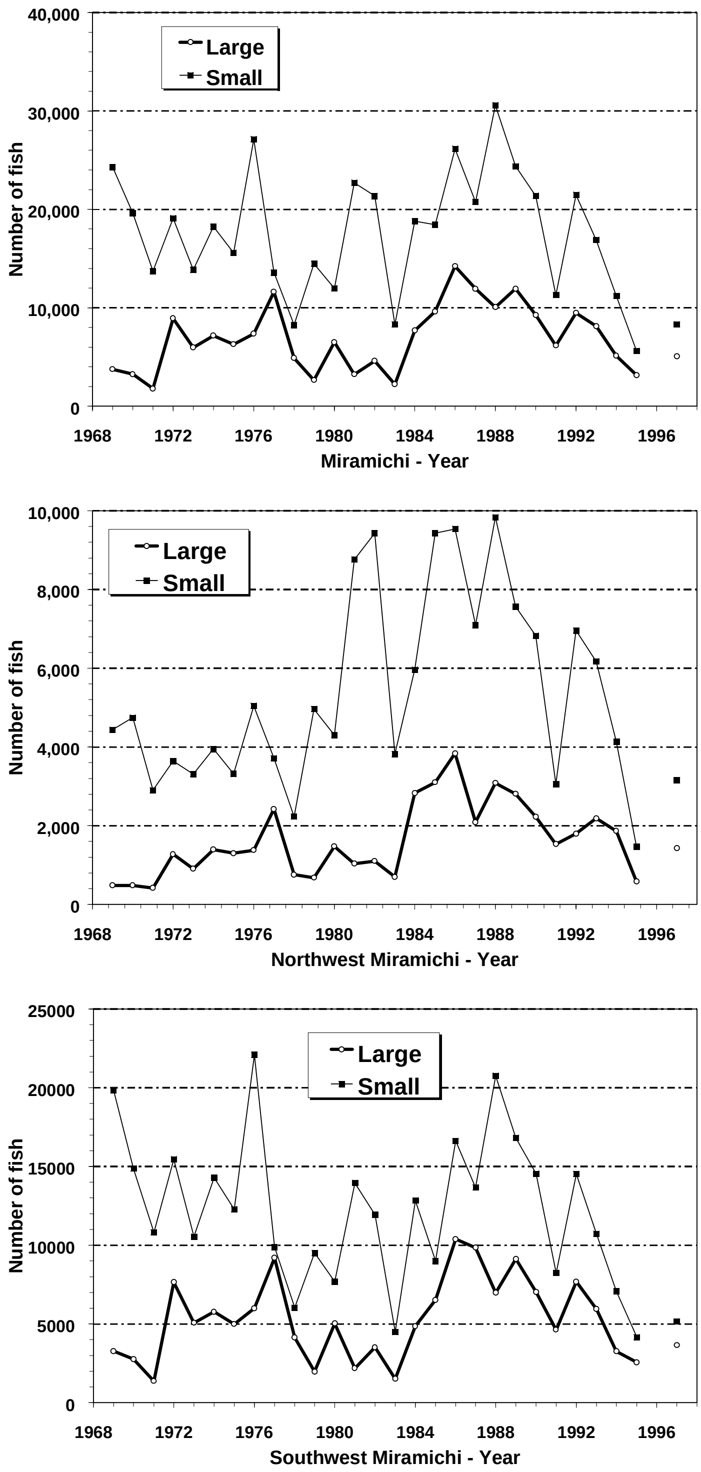


Figure 2. Angling trends of small (harvest) and large (catch) salmon from the Miramichi River (top), Northwest Miramichi (middle) and Southwest Miramichi (bottom) rivers. 1996 data are not available. 1997 data have been finalized. 1998 and 1999 data are not yet available.

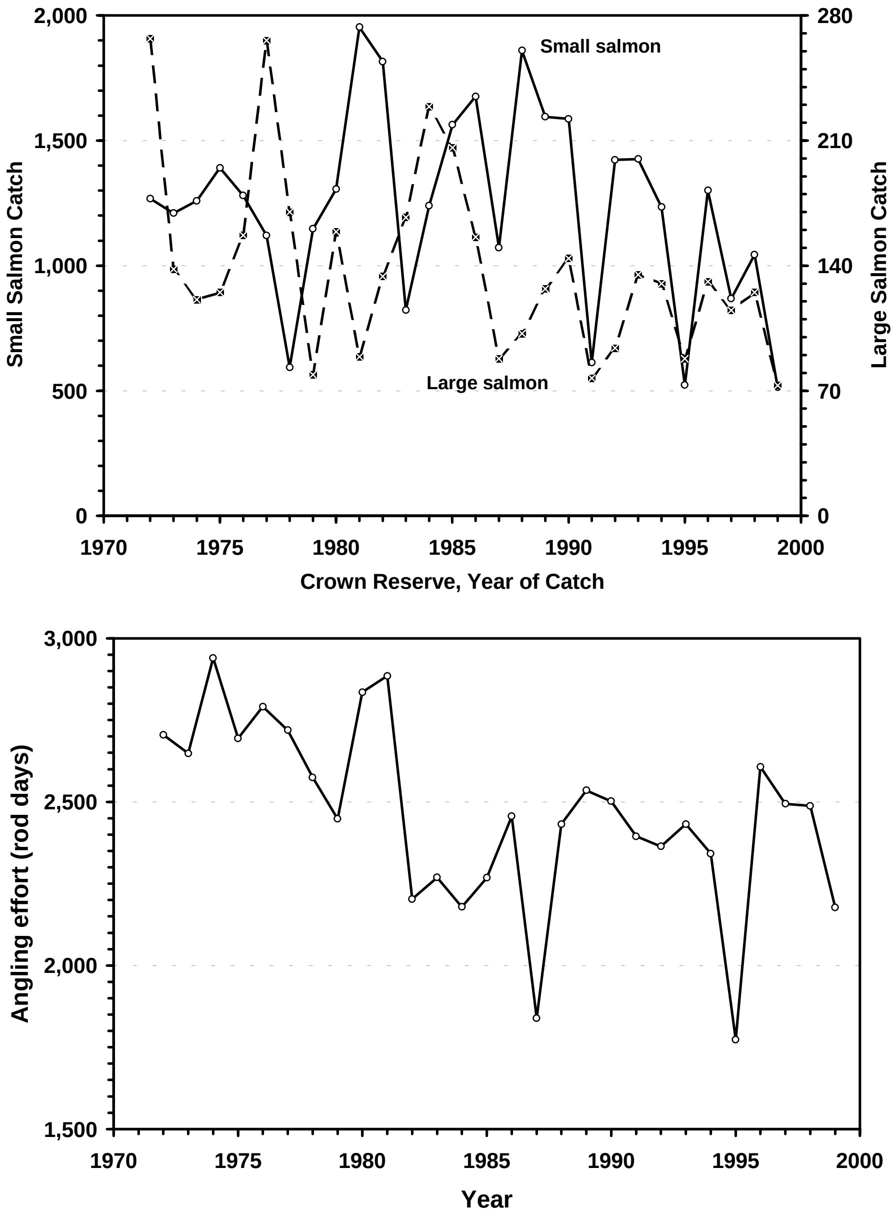


Figure 3. Trends in catches of small salmon and large salmon (upper panel) and angling effort (lower panel) from the Crown Reserve waters of the Northwest Miramichi, 1972 to 1999.

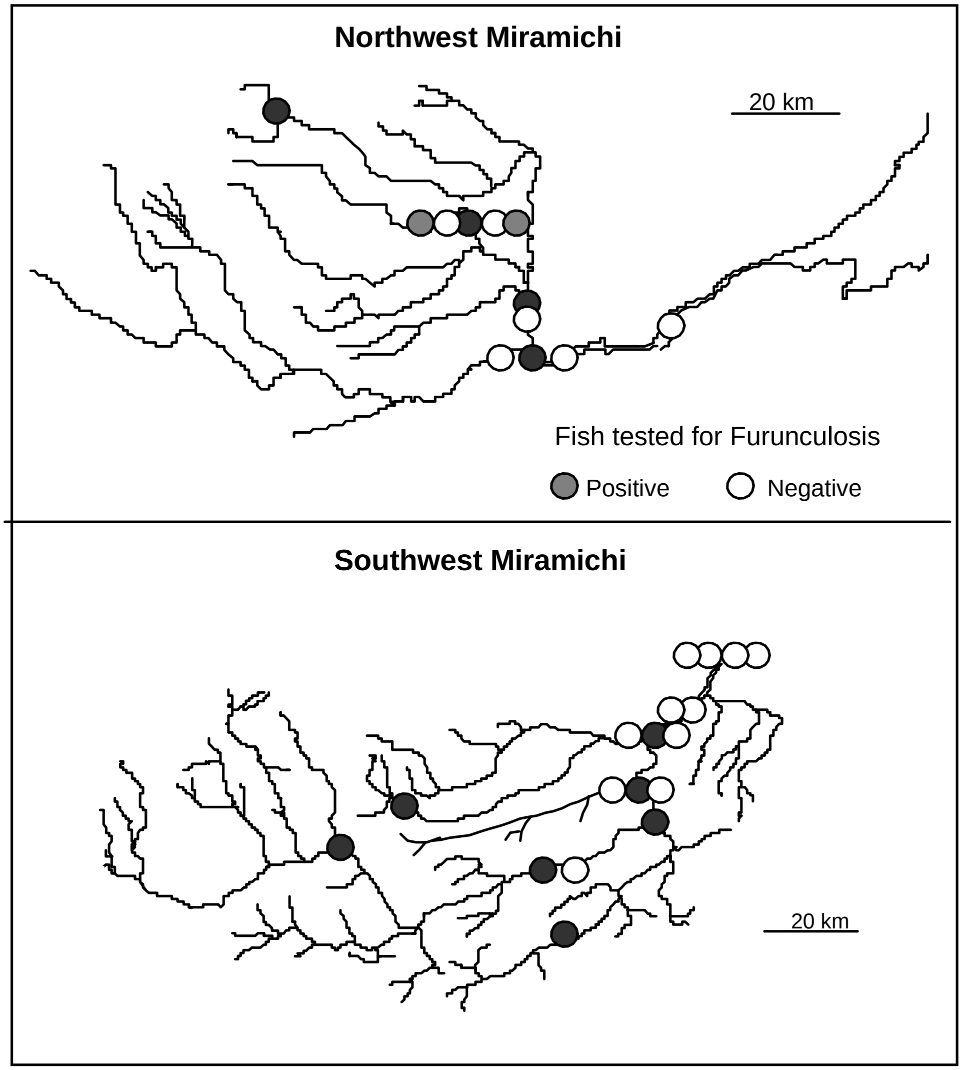


Figure 4. Distribution of positive tests for the disease causing agent of furunculosis from Atlantic salmon, Miramichi River, 1999.

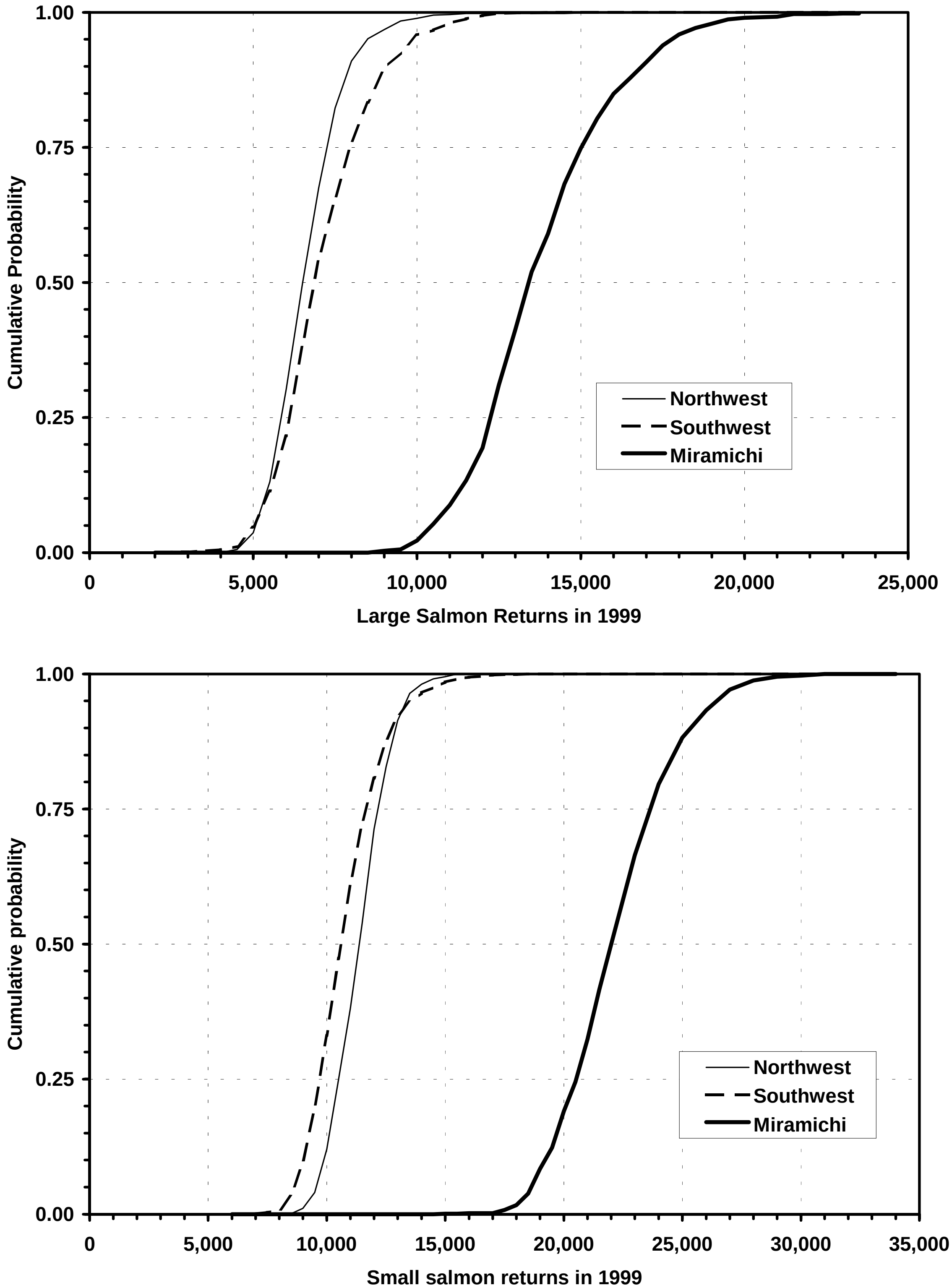


Figure 5. Estimated returns of large salmon (upper) and small salmon (lower) for the Miramichi River and to the Northwest and Southwest branches in 1999.

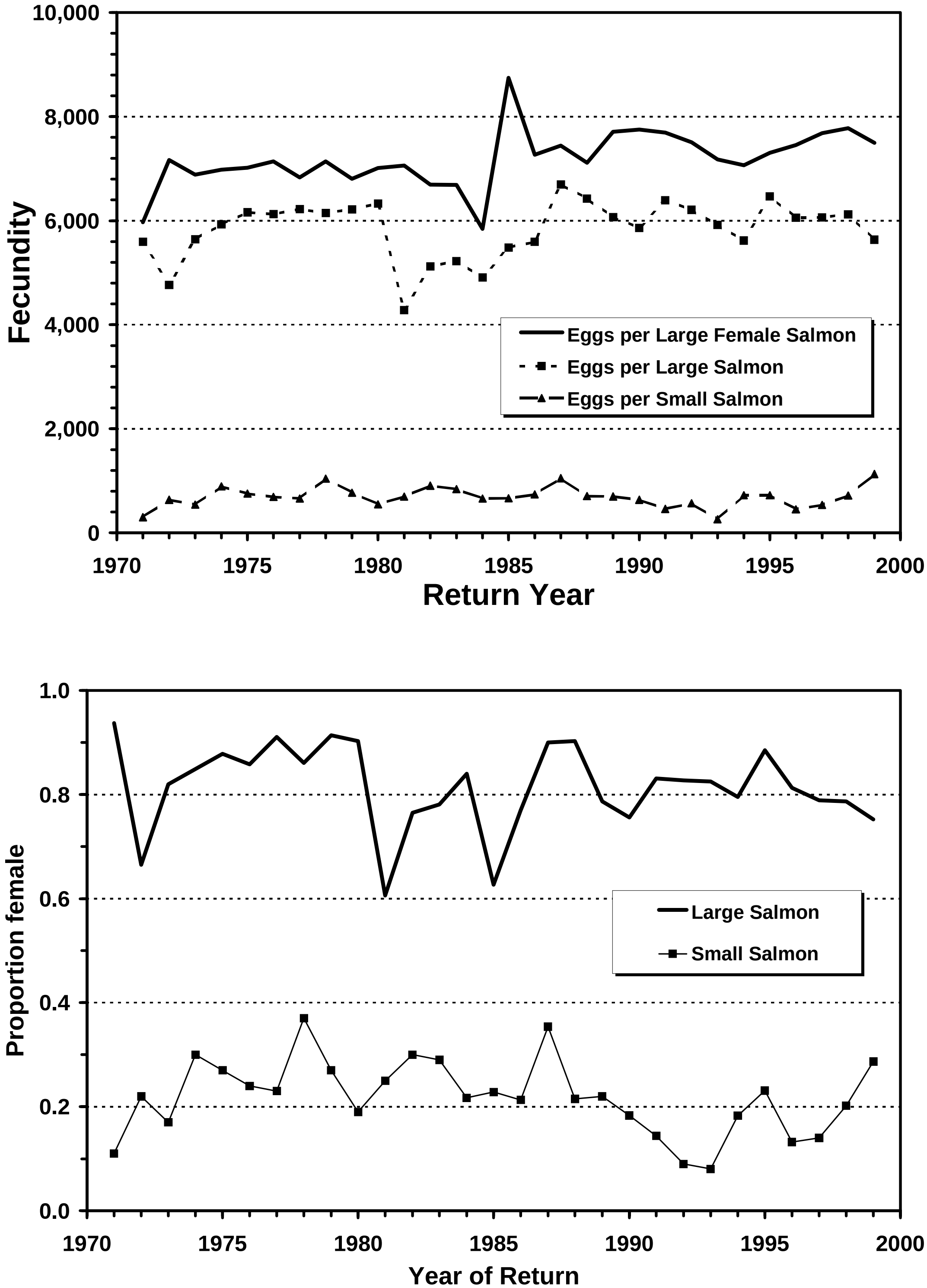


Figure 6. Annual variation in the fecundity (upper, number of eggs) and proportions female (lower) of small and large salmon from the Miramichi River, 1971 to 1999.

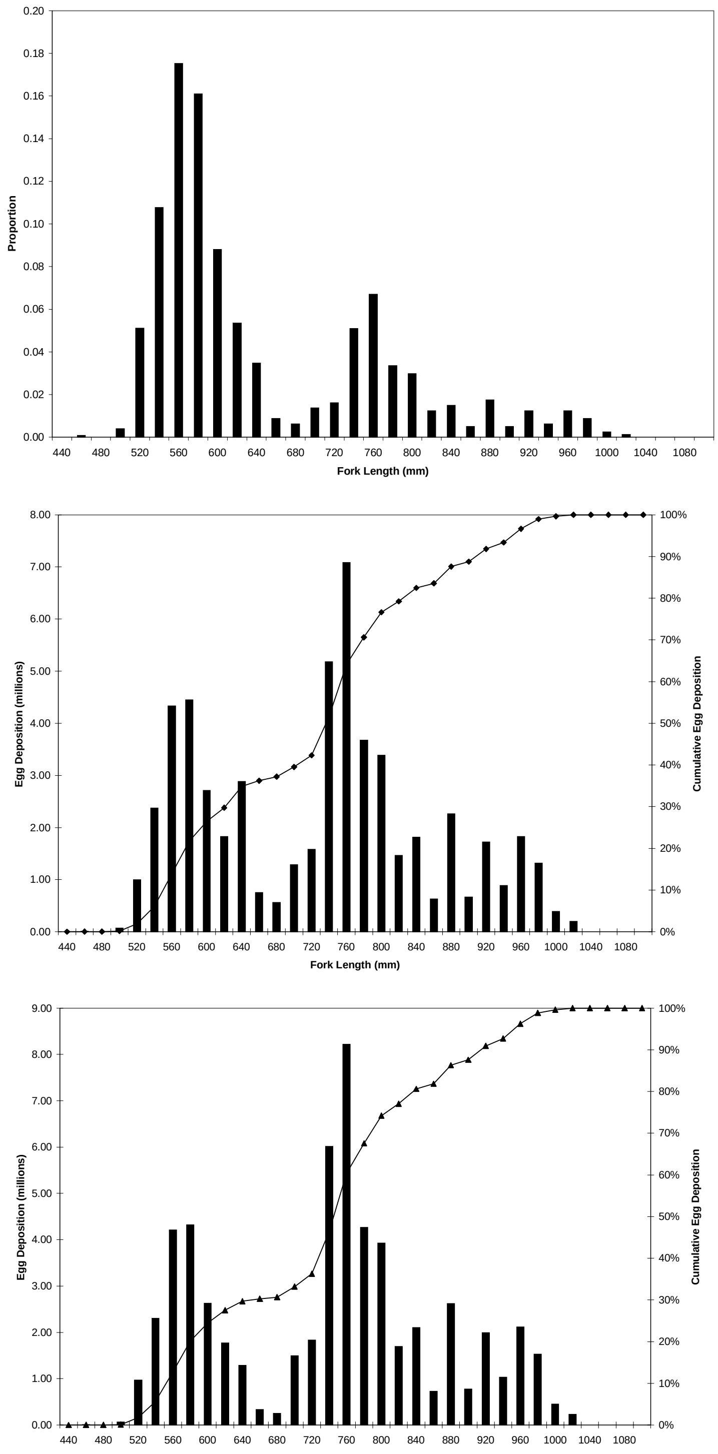


Figure 7a. Proportion at length (upper), egg deposition at length and cumulative egg deposition at length for the total returns of salmon of the **Northwest Miramichi**. Middle panel is egg depositions at length for sex ratios of salmon in two groups: less than 630 mm FL and >= 630 mm FL. Lower panel is the egg depositions at length for sex ratios of salmon in two groups: less than 700 mm FL and >= 700 mm FL.

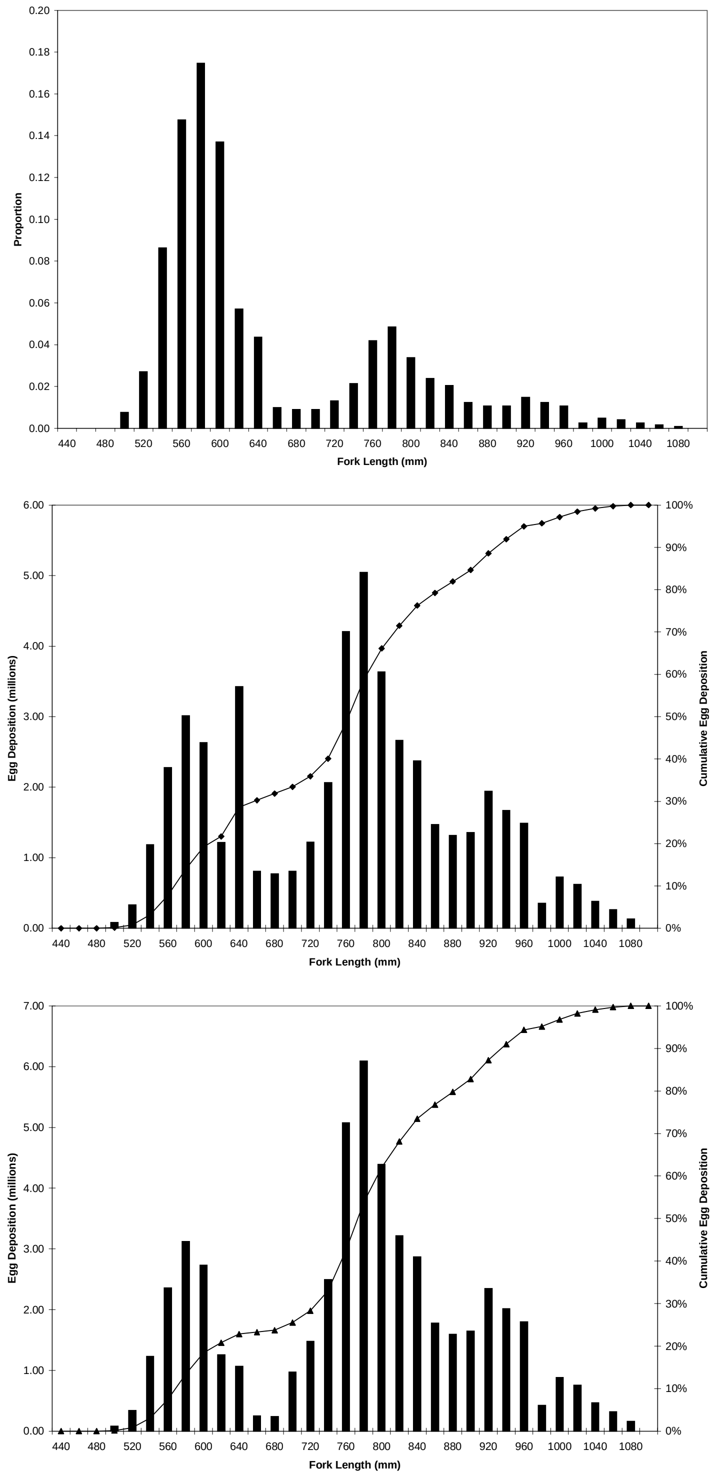


Figure 7b. Proportion at length (upper), egg deposition at length and cumulative egg deposition at length for the total returns of salmon of the **Southwest Miramichi**. Middle panel is egg depositions at length for sex ratios of salmon in two groups: less than 630 mm FL and >= 630 mm FL. Lower panel is the egg depositions at length for sex ratios of salmon in two groups: less than 700 mm FL and >= 700 mm FL.

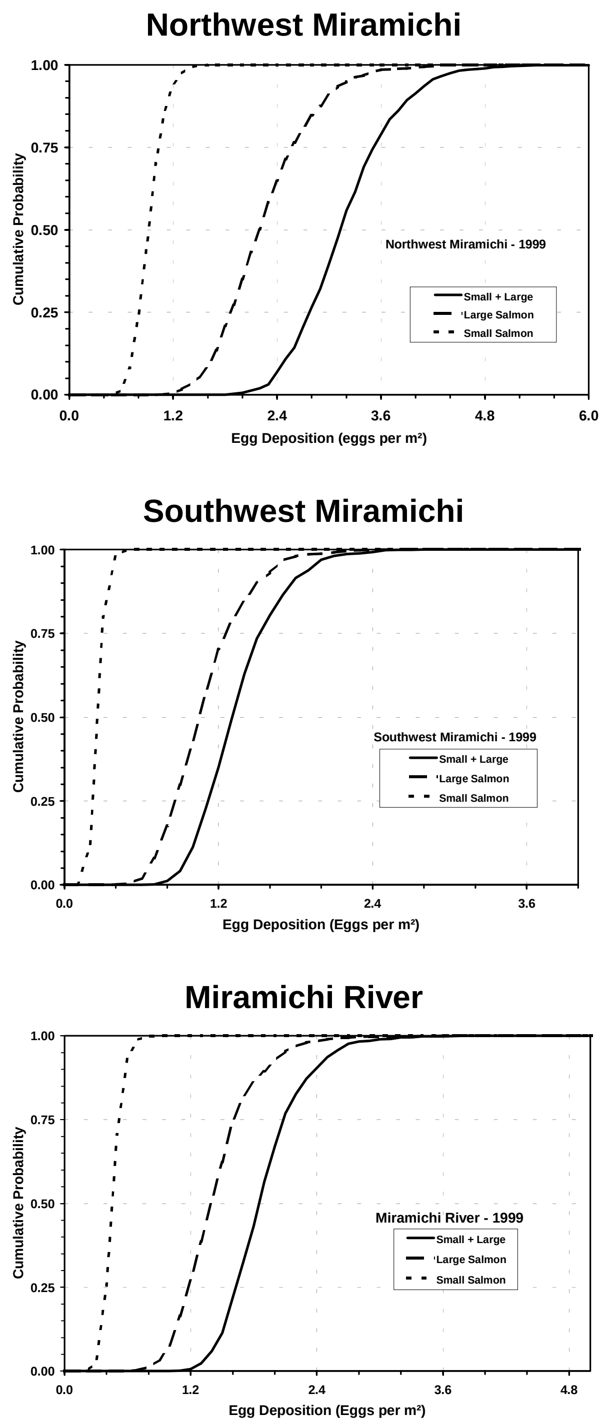


Figure 8. Probable egg depositions (eggs per m^2) in the Northwest Miramichi (top), Southwest Miramichi (middle) and Miramichi River (bottom) by small salmon, large salmon, small and large combined in 1999. Egg depositions are plotted for the estimated returns (assuming no removals had occurred in 1999).

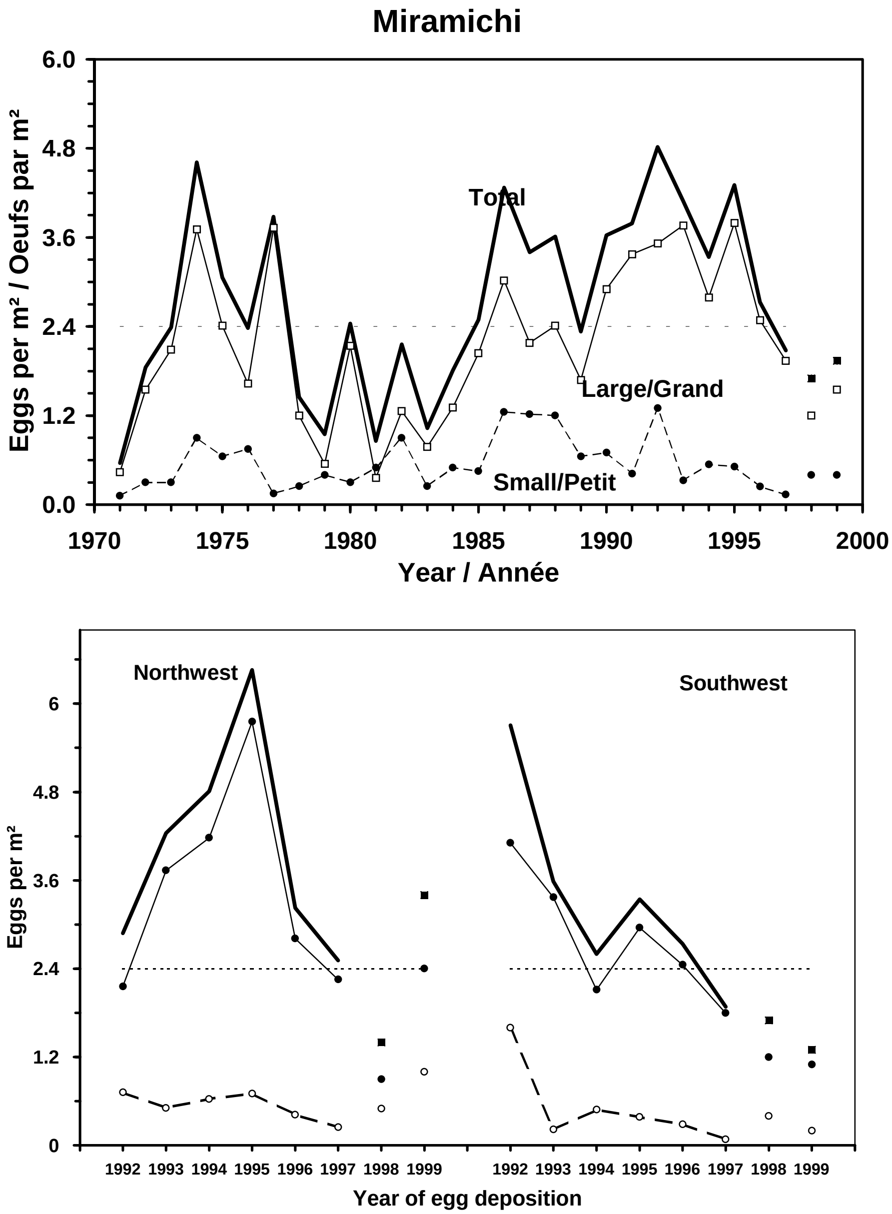


Figure 9. Point estimate annual egg depositions (eggs per m^2) by small (circle dashed line), large (dots and narrow line) and combined (thick line) for the Miramichi River, 1971 to 1999 (upper panel) and for the Northwest and Southwest branches, 1992 to 1999 (lower). The 1998 and 1999 egg depositions are for the total returns of salmon before removals. Egg depositions from estimated escapement (total removals for 1998 and 1999 are not completely tabulated) in 1998 and 1999 would be lower, especially for small salmon. Dashed line is the conservation egg requirement of 2.4 eggs per m^2.

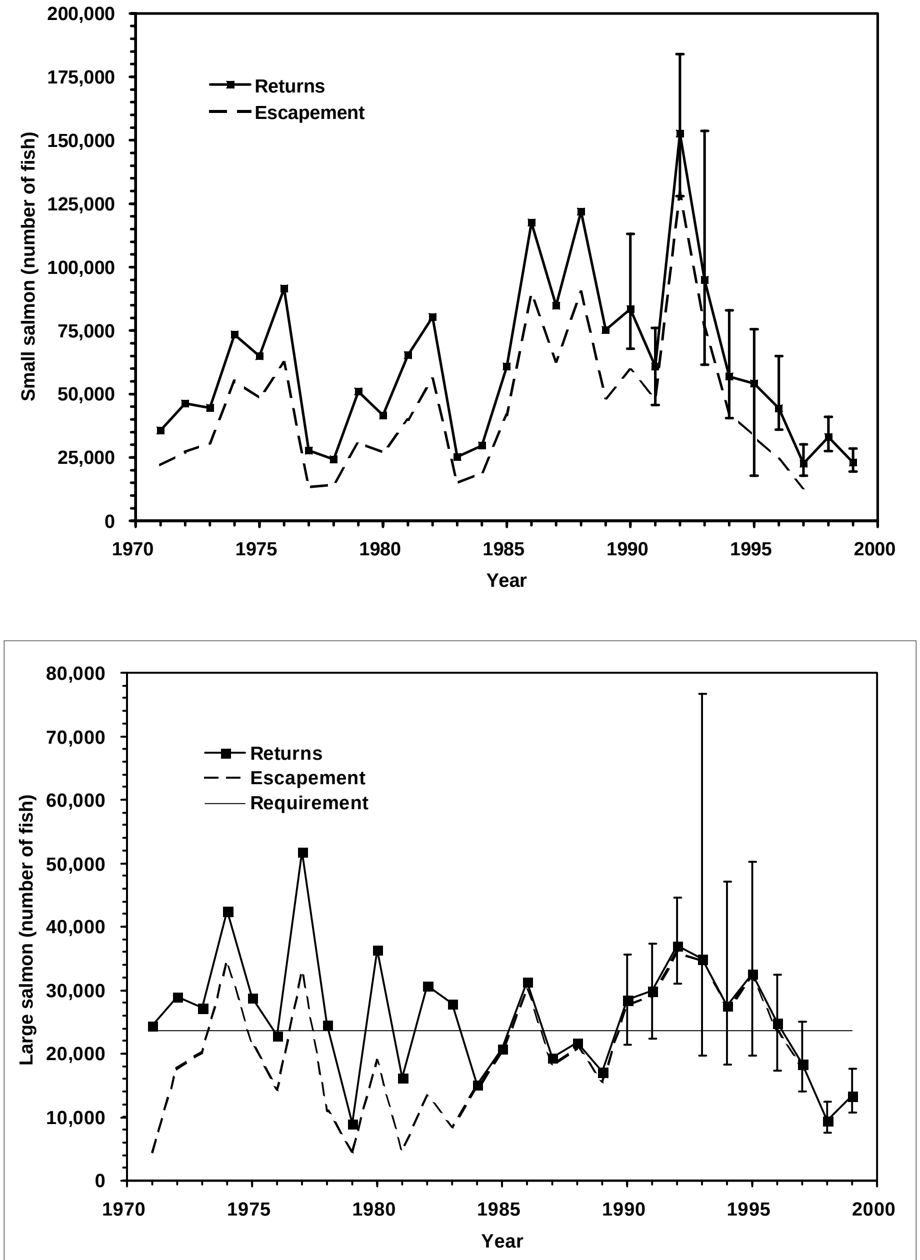


Figure 10. Estimates of total returns to the Miramichi River estuary and number of spawners for small salmon (upper) and large salmon (lower), 1971 to 1999. The vertical lines represent the 90% confidence limit range of the estimated returns.

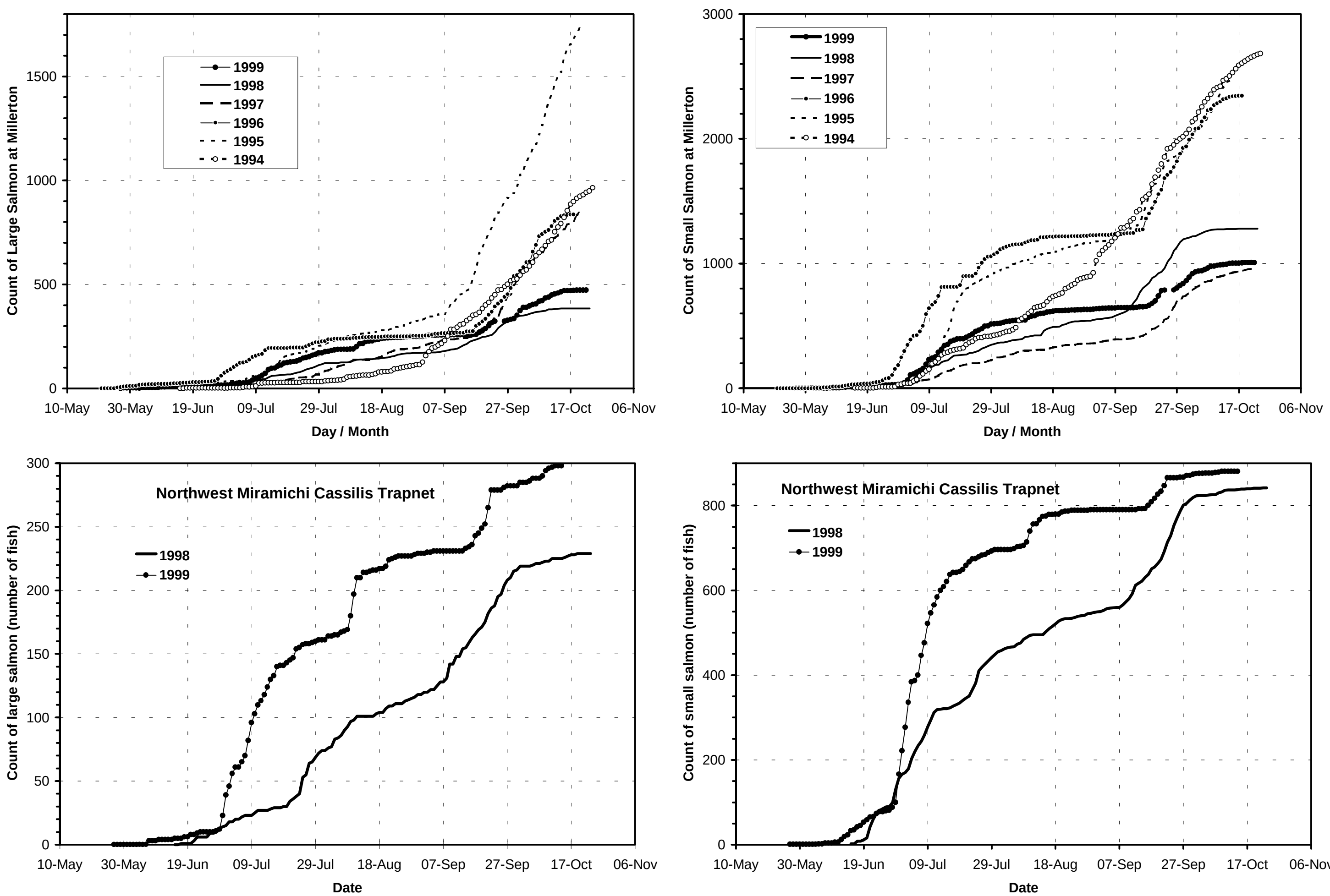


Figure 11. Timing of large salmon (left panels) and small salmon (right panels) catches at the Millerton trapnet in the Southwest Miramichi (upper panels) and at the Cassilis Northwest Miramichi trapnet (lower panels) during 1994 to 1999.

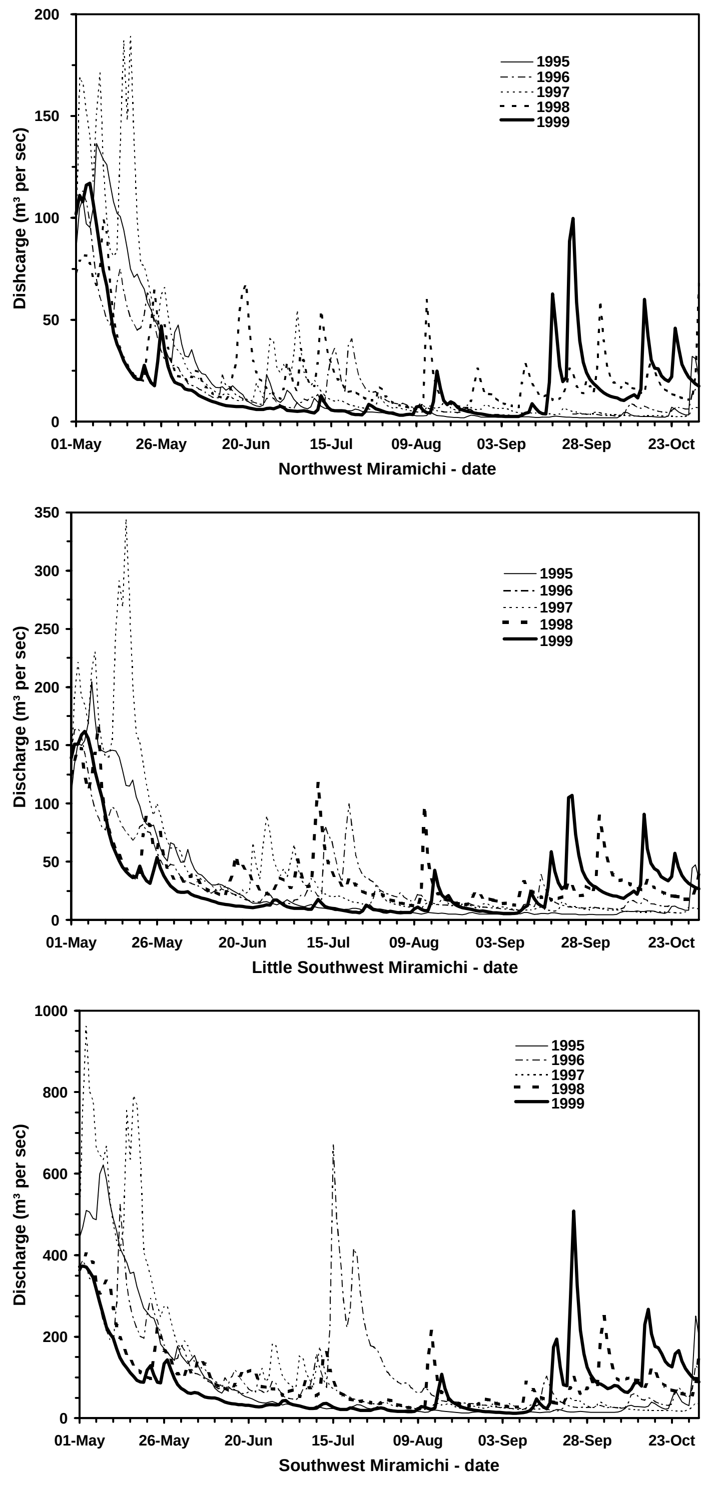
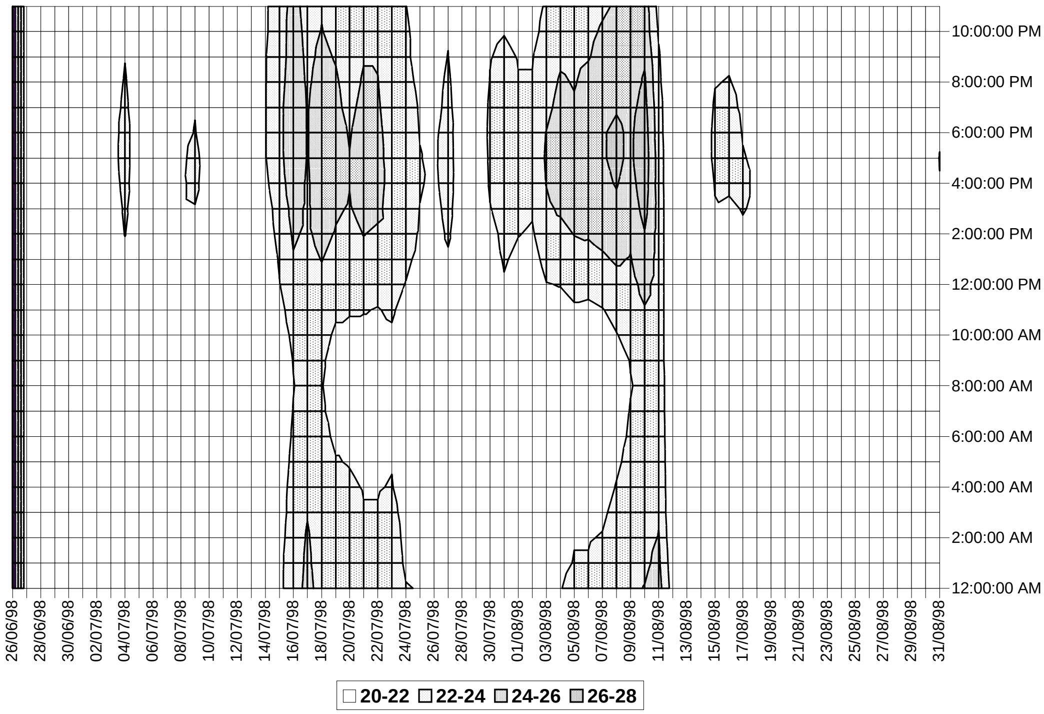


Figure 12. Discharge (m^3 per sec) profiles for the Northwest Miramichi (upper), Little Southwest Miramichi (middle) and Southwest Miramichi (lower) from May 1 to October 31, 1995 to 1999.



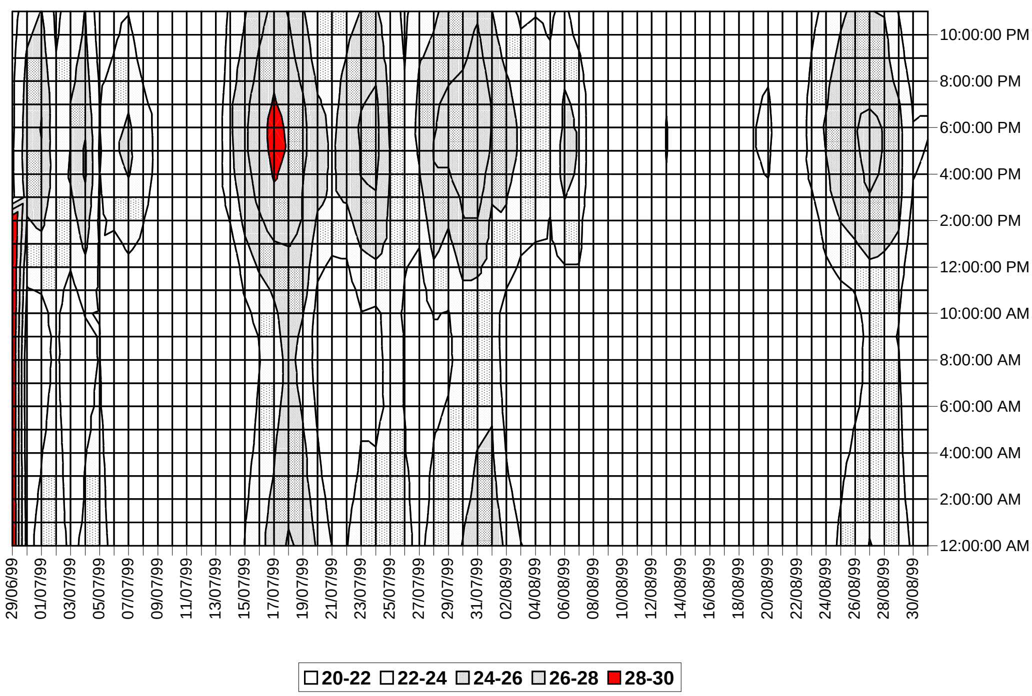


Figure 13. Water temperatures in the Southwest Miramichi (at Wade's) between June 26 and August 31, 1998 (upper) and 1999 (lower).

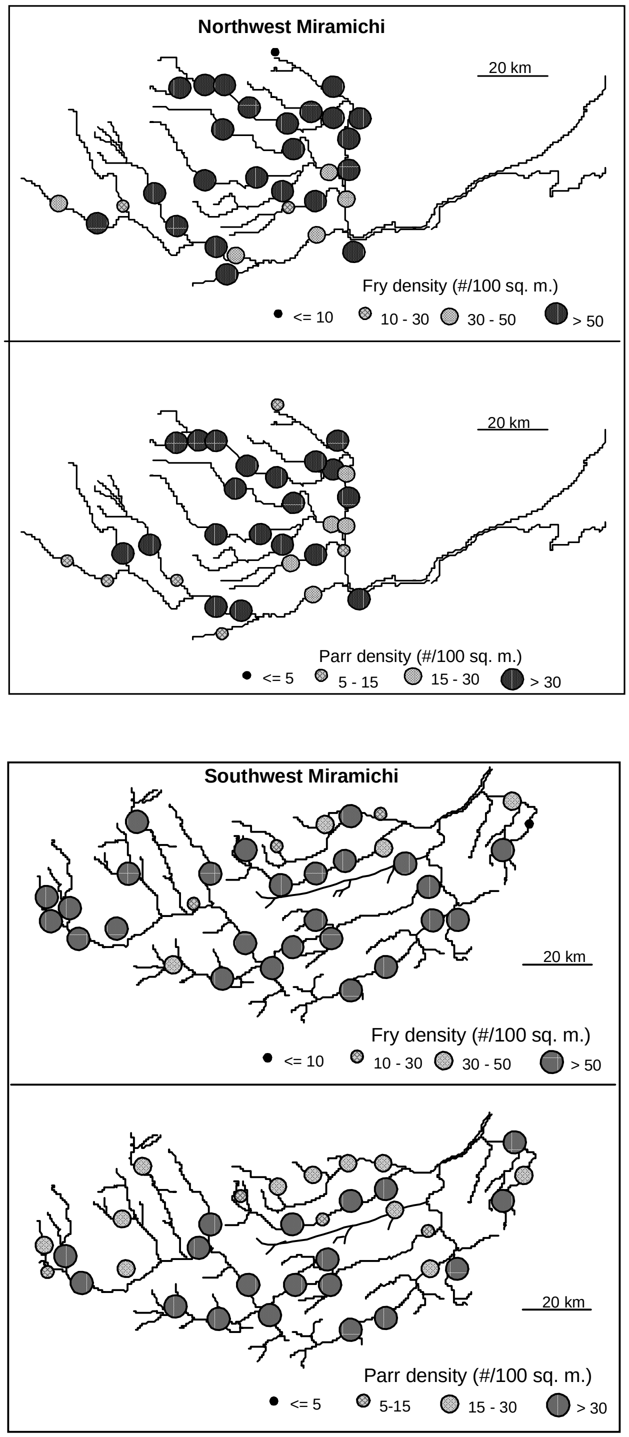


Figure 14. Observed fry and parr densities in the Northwest Miramichi (upper) and Southwest Miramichi sites sampled in 1999.

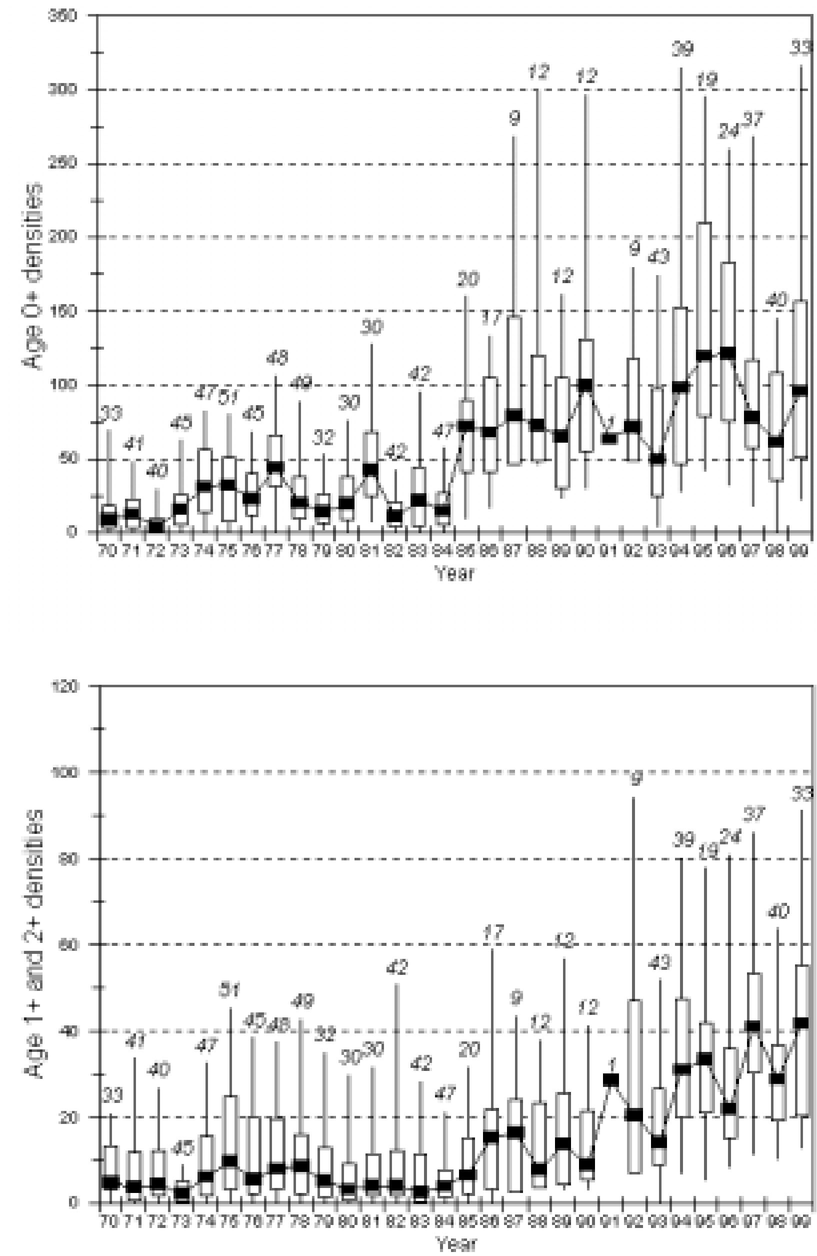
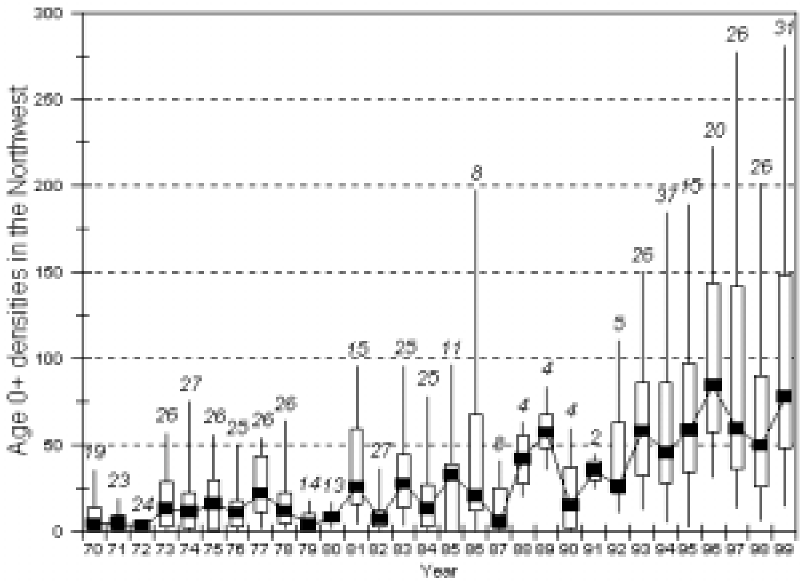


Figure 15. Atlantic salmon fry (upper) and parr (lower) densities at all sampled sites in the Southwest Miramichi, 1970 to 1999. Box plots are interpreted as follows: vertical line = 5th to 95th percentile range, box = 25th to 75th percentile range, square = median value. Number above the vertical line is the number of sites sampled.



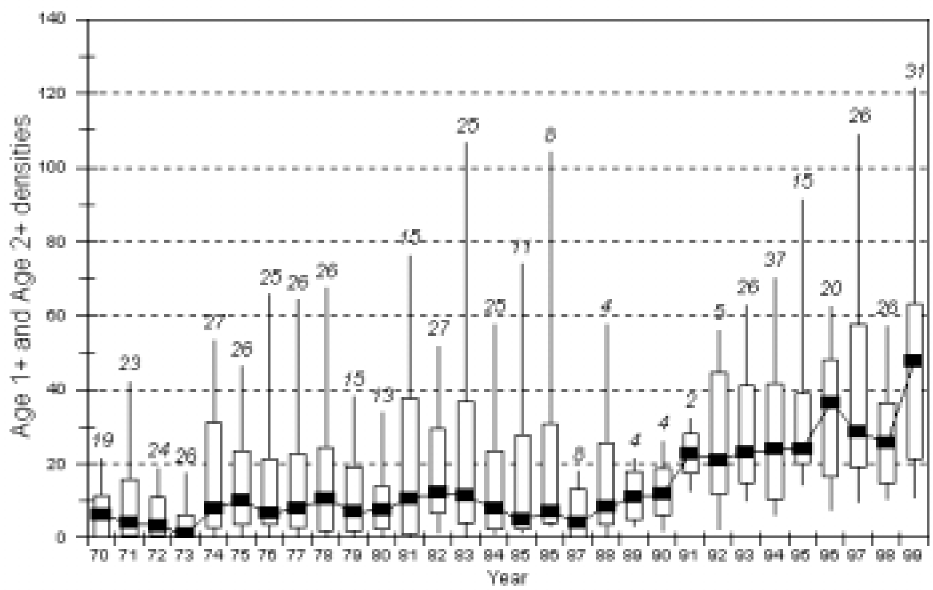


Figure 16. Atlantic salmon fry (upper) and parr (lower) densities at all sampled sites in the Northwest Miramichi, 1970 to 1999. Box plots are interpreted as in Figure 14.

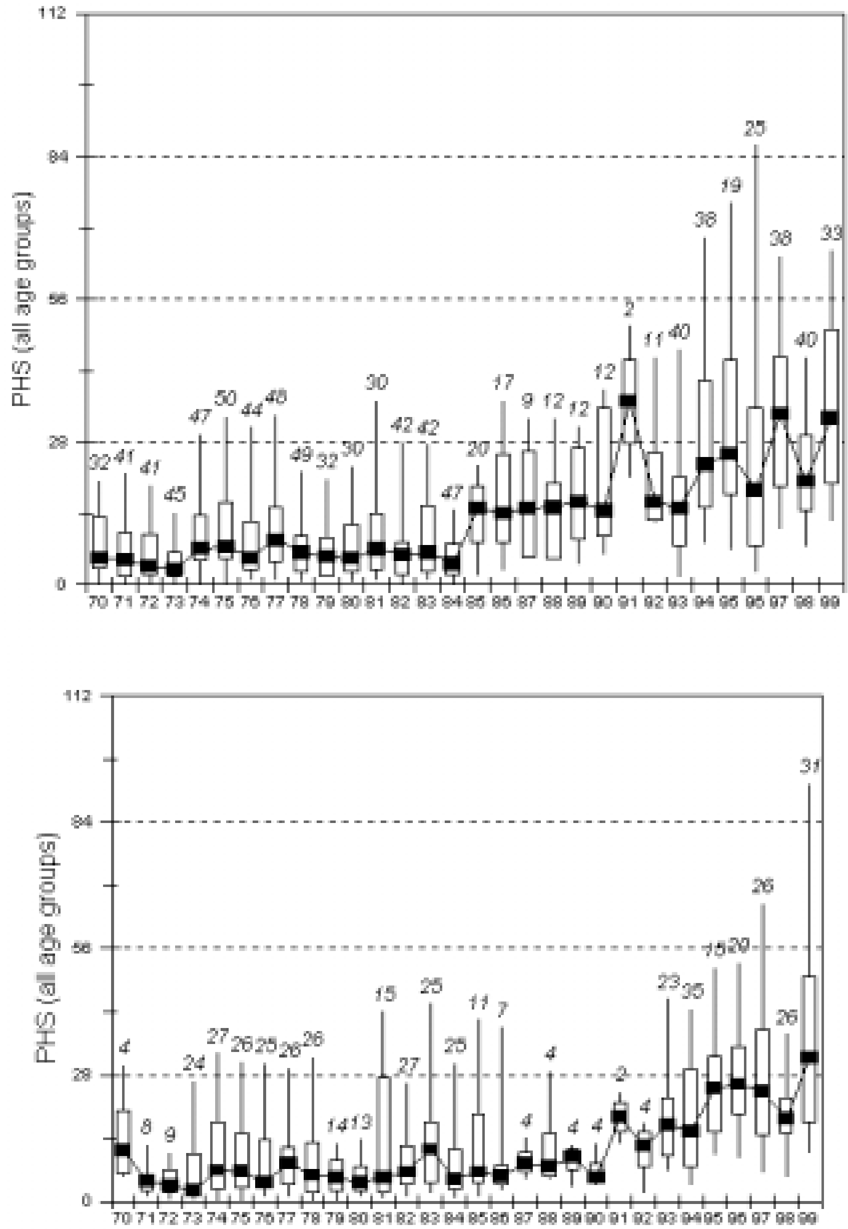


Figure 17. Percent habitat saturation (PHS) index of juvenile Atlantic salmon at all sampled sites in the Southwest Miramichi (upper) and four index sites in the Northwest Miramichi (lower) for 1970 to 1999. Box plots are interpreted as in Figure 14.

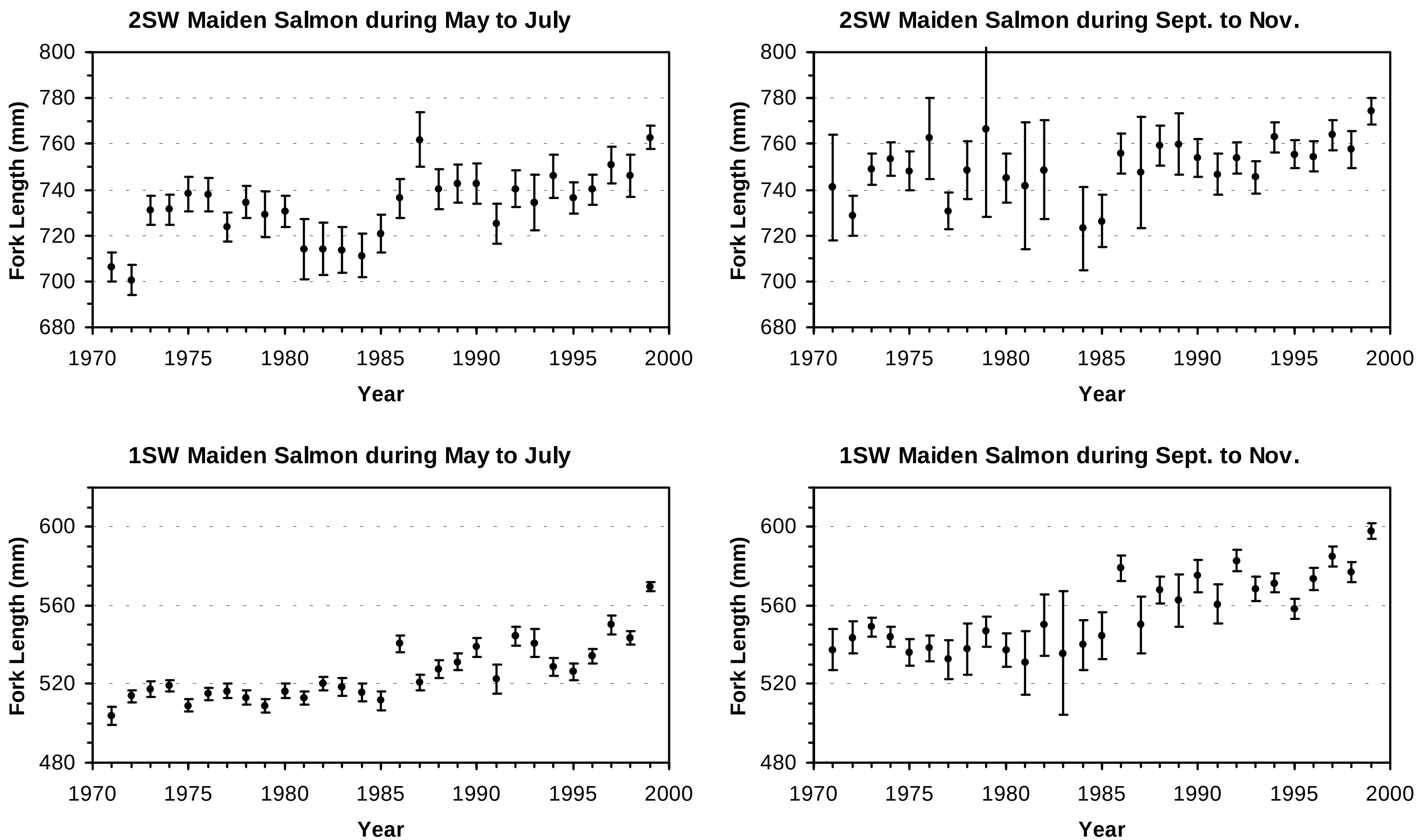


Figure 18. Fork length (mean ± 2 standard errors) of 2SW maiden salmon (upper panels) and 1SW maiden salmon (lower panels) for the summer run (May to July - left panels) and the fall run (Sept. to Nov. - right panels) from the Miramichi River, 1971 to 1999.

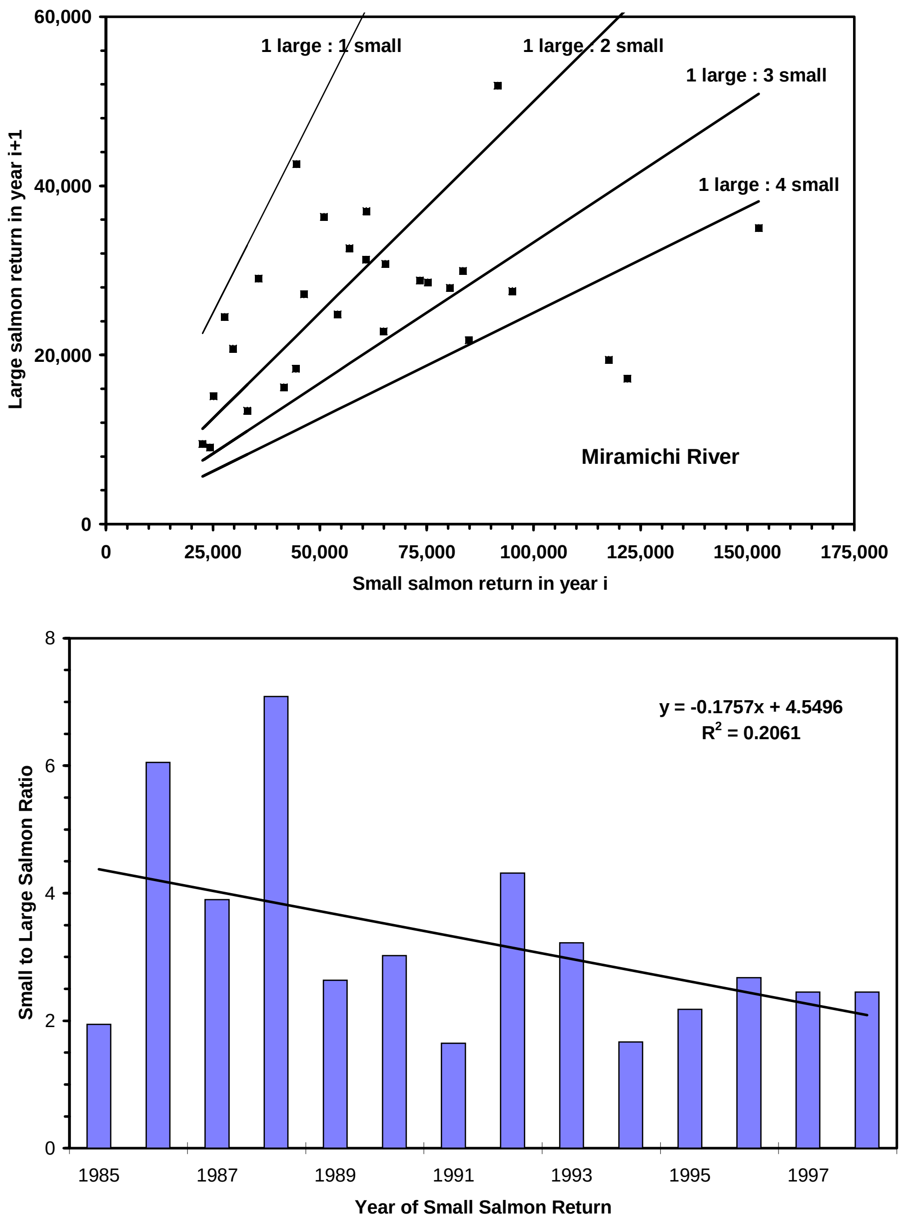


Figure 19. Small salmon returns in year i to large salmon returns in year I+1 for the Miramichi River (upper) and the ratio for the period 1985 to 1998. The median small salmon to large salmon ratio for the recent five years is is 2.4. The trend does not have a significant slope (P = 0.10).

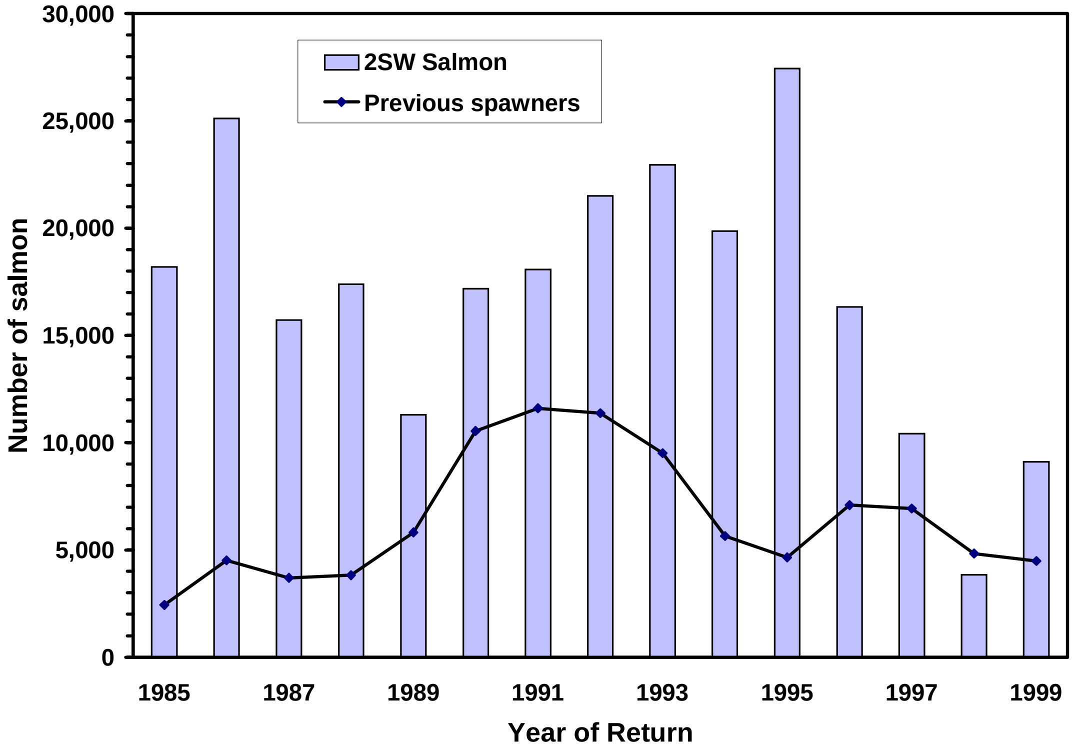


Figure 20. Estimates of abundance of 2SW maiden salmon and previous spawner salmon in the annual returns of large salmon to the Miramichi River for 1971 to 1999. Estimates of 2SW and previous spawner abundance in 1998 and 1999 are based on proportion at lengths, pending completion of ageing.

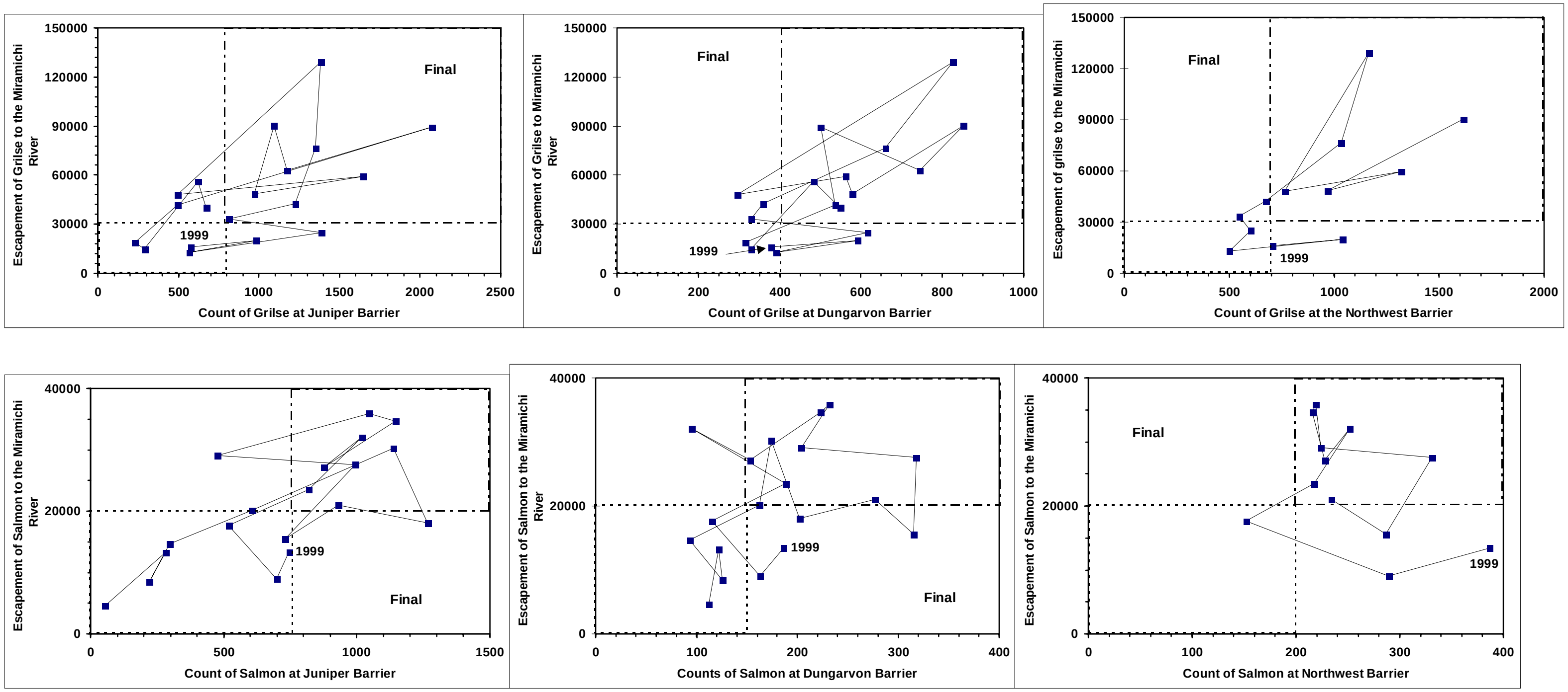


Figure 21. End of year counts of small salmon (upper panels) and large salmon (lower panels) to the Juniper Barrier (left panels), Dungarvon River Barrier (middle panels) of the Southwest Miramichi and at the Northwest Barrier (right panels) of the Northwest Miramichi River relative to end of year escapement estimates of small salmon and large salmon to the Miramichi River, 1981 to 1999. Quadrat lines were defined using 1981 to 1997 data.

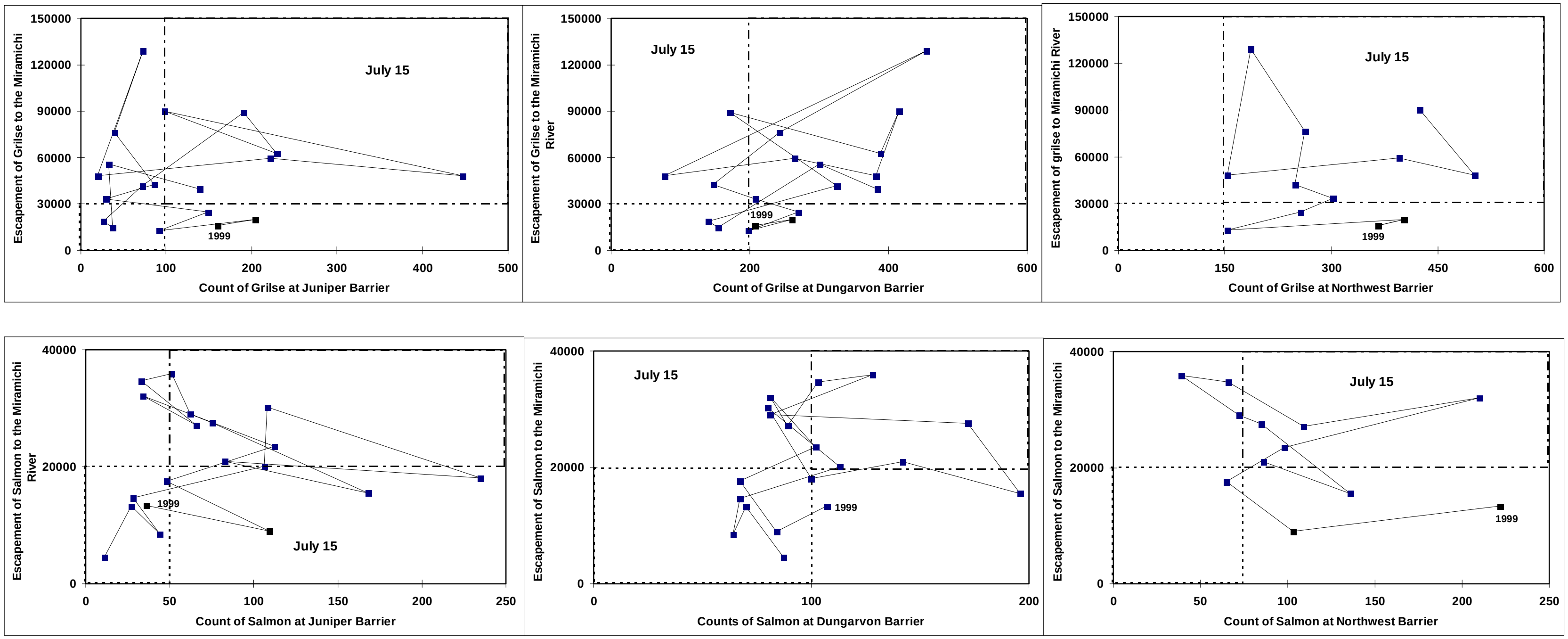


Figure 22. Counts of small salmon (upper panels) and large salmon (lower panels) to July 15 at the Juniper Barrier (left panels), Dungarvon River Barrier (middle panels) of the Southwest Miramichi and at the Northwest Barrier (right panels) of the Northwest Miramichi River relative to end of year escapement estimates of small salmon and large salmon to the Miramichi River, 1981 to 1999. Quadrat lines were defined using 1981 to 1997 data.

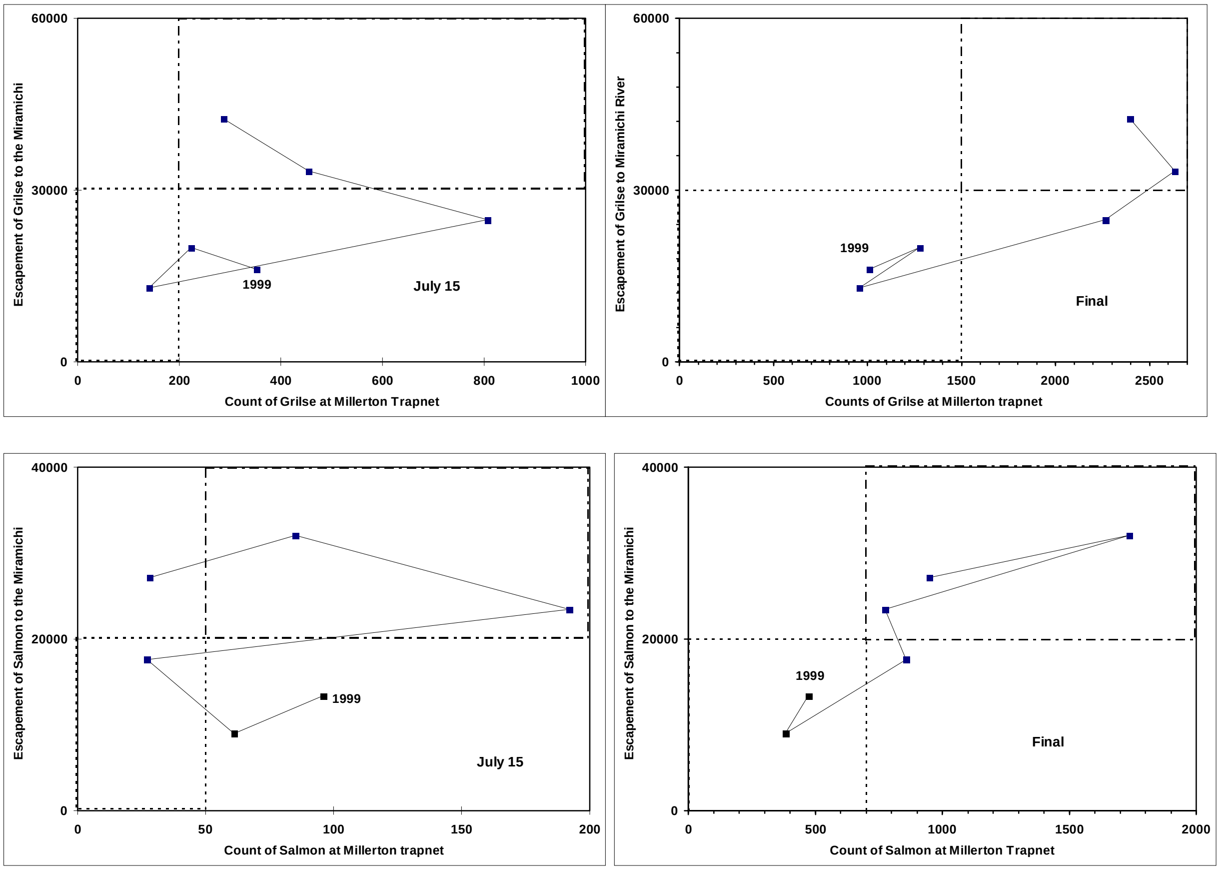


Figure 23. Counts of small salmon (upper panels) and large salmon (lower panels) to July 15 (left panels), and end of year (right panels) at the Millerton trapnet, Southwest Miramichi relative to end of year escapement estimates to the Miramichi River, 1994 to 1999. Quadrat lines were arbitrarily defined using 1994 to 1997 data.

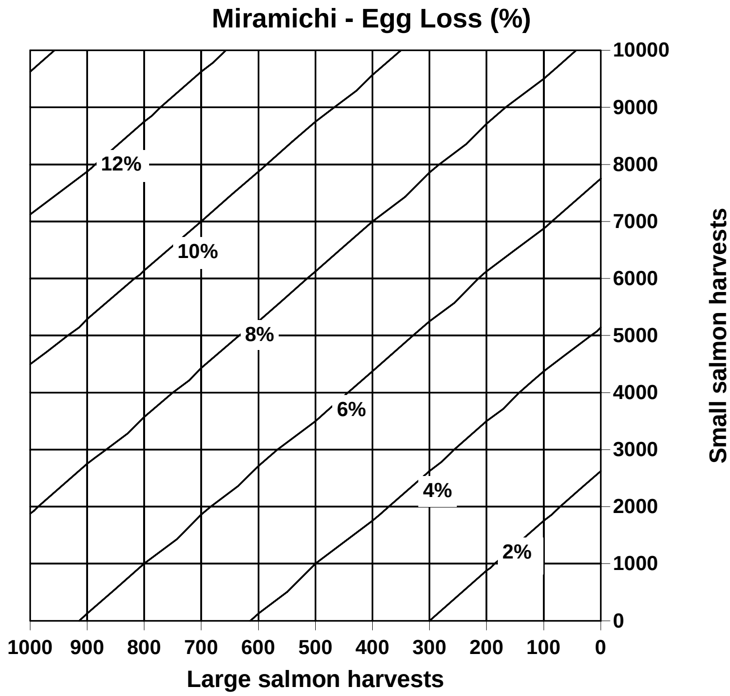
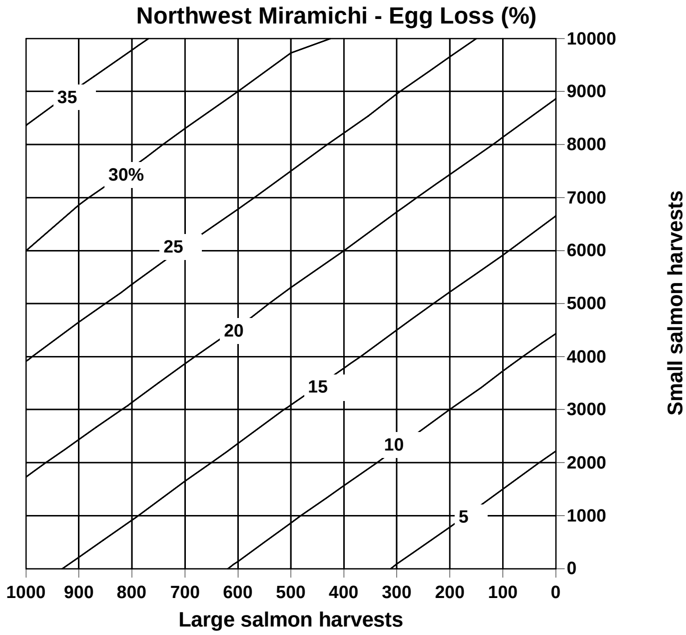


Figure 24. Egg loss expressed as the percentage of the eggs in the total returns of Atlantic salmon to the Miramichi River in year 2000 relative to harvests of small salmon and large salmon.



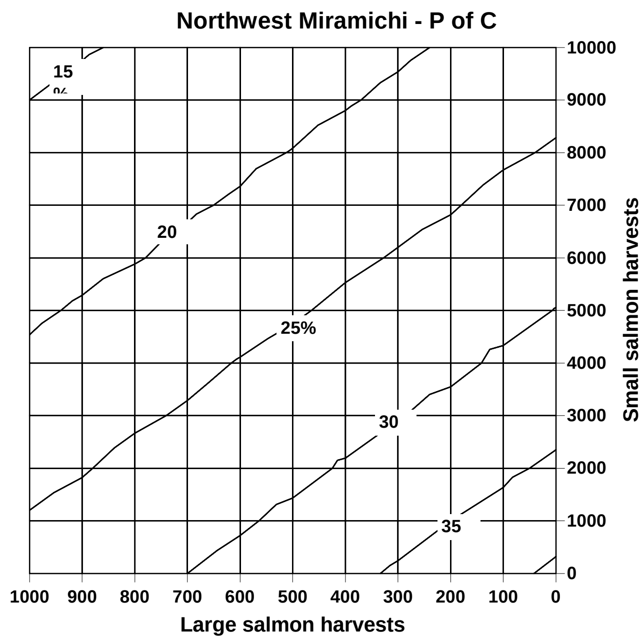


Figure 25. Egg loss expressed as the percentage of the eggs in the total returns of Atlantic salmon to the Northwest Miramichi River (upper) and probability of meeting conservation (lower) in year 2000 relative to harvests of small salmon and large salmon.

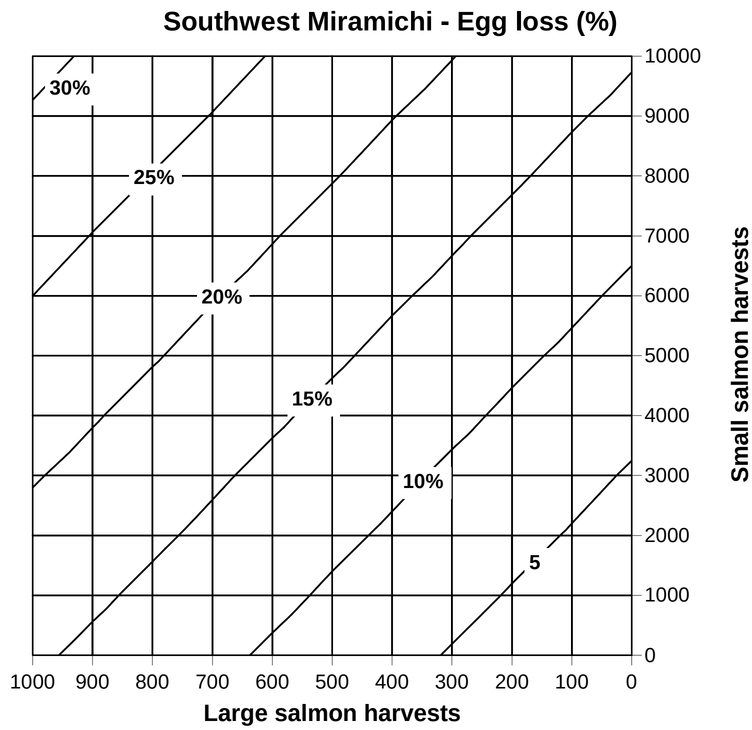


Figure 26. Egg loss expressed as the percentage of the eggs in the total returns of Atlantic salmon to the Southwest Miramichi River (upper) and probability of meeting conservation (lower) in year 2000 relative to harvests of small salmon and large salmon.

Appendix 1. Record of client consultation for the Atlantic salmon stock of the Miramichi River.

1. SPECIES / STOCK:
- **Atlantic salmon - Miramichi River**

2. ARRANGEMENTS:

DATE: November 23, 1999
TIME: 9:30 to 16:00
LOCATION: REPAP Building, Newcastle (Miramichi City), New Brunswick

3. FORM OF CONSULTATION (Science Workshop, ZMAC, ETC..)
- **Science workshop**

4. PARTICIPANTS (Name and Affiliation)
- **Stephen Adams, DFO Conservation and Protection, Miramichi**
- **Bud Bird, MSA, Fredericton, NB**
- **Danny Bird, Atlantic Salmon Federation, St. Andrews, NB**
- **Fred Butler, DFO Conservation and Protection, Renous**
- **Gérald Chaput, DFO Science, Moncton**
- **Harry Collins, MREAC, Miramichi**
- **Chris Connell, J.D. Irving Ltd., Fredericton**
- **Peter Cronin, Director of Fisheries, Dept. of Natural Resources and Energy (DNRE), Fredericton**
- **Jerry Doak, WW Doak Fishing Tackle, Doaktown**
- **Bill Donald, Chair, Miramichi Watershed Management Committee, Miramichi City**
- **Bernie Dubee, Regional Biologist, DNRE, Miramichi City**
- **Wayne Fairchild, DFO, Moncton, NB**
- **Shelley Hackett, J.D. Irving Ltd., Fredericton**
- **Mark Hambrook, Miramichi Fish Hatchery Inc., South Esk**
- **John Hayward, DFO Science, Miramichi City**
- **Lloyd Jardine, DFO Conservation and Protection, Renous**
- **Firmin LeBlanc, Kouchibouguac National Park, Kouchibouguac**
- **Léophane LeBlanc, Kouchibouguac National Park, Kouchibouguac**
- **Rhonda McLaughlin, Rocky Brook / Bowater Canada, Boiestown**
- **Dave Moore, DFO Science, Moncton**
- **Lisa Perley, J.D. Irving Ltd., Fredericton**
- **Myles Porter, DFO Conservation and Protection, Renous**
- **Manley Price, Rocky Brook Camp / Avenor inc., Boiestown, New Brunswick**
- **Grant Ross, Miramichi Salmon Association, Boiestown**
- **Sue Scott, Atlantic Salmon Federation, St. Andrews, NB**
- **Pam Seymour, DNRE, Islandview, NB**
- **Joe Shaesgreen, DFO Science, Miramichi City**
- **John Sock, Kouchibouguac National Park, Kouchibouguac**
- **Norman Stewart, White Rapids Brook and Other Streams Enhancement Association, Lockstead**
- **Vince Swazey, Miramichi Salmon Association, Boiestown, New Brunswick**
- **Bob Weir, Cains River Enhancement Association**
- **Fred Whoriskey, Atlantic Salmon Federation, St. Andrews**

5. NEW INFORMATION BROUGHT FORWARD (what? by who?)-*(Only a brief description is required)*
- **Angling was generally good early in the season (June) but poor in July and August. Angling conditions and catches improved in Sept. and Oct.**
- **Crown Reserve angling catches and barrier fence counts (Benie Dube, DNRE NB)**
- **Update on Clearwater Brook project, Chris Connell (ASF/Irving) – new project in 1999 was the PIT tagging of adults to monitor movements within the stream, particularly whether clipped adults resulting from satellite stocking returned to the location of stocking as juveniles**

- **Presentation by Rhonda McLaughlin and Manley Price, Bowater Canada: continued nursery area research initiative (habitat mapping, juveniles) on Taxis River, juvenile surveys on Rocky, Sisters, Clearwater, Taxis and Salmon, adult transfer above big roll (previous inaccessible to salmon) to colonize barren habitat**
- **Grant Ross: Continuation of MSA juvenile surveys for monitoring satellite stocking areas, brook survey to assess availability of habitat to adults (33 brooks surveyed), 41 sites electrofished, 27 sites with adipose-clipped fish.**

6. CONCERNS RAISED BY CLIENTS (include concerns, plus follow-up action/response made or committed). - (*Only a brief description is required)*

- **Partial closure to angling after 10:00 AM in early August: was this measure effective? What information needs to be collected to address whether fish are angled under warm water conditions? Proposal to use angling camp reports to address this question.**
- **Some people feel that seal predation in Miramichi Bay is negatively impacting adult salmon especially in years with low water conditions that hold fish back in the bay. Some preliminary work addressing seal diet and population characteristics started in the fall of 1999 and is anticipated to continue in 2000. This research is being conducted by marine mammal scientists from Laurentian Region.**
- **How to improve, make reliable, the estimates of mortalities of salmon during warm water conditions. Estimates in 1999 were considered to be ad hoc but still provided an indication of unusual rates of mortality compared to previous years.**

7. RECOMMENDATIONS: (*Only a brief description is required)*

a.) Pertaining to Assessment

- **Angling statistics are incomplete. Voluntary license stub return initiated in 1999 to be continued in 2000. Eventually, the stub will be attached to the license.**
- **Have to show the consequences of warm water conditions on Atlantic salmon especially the trade-off between angler presence on the river versus increased illegal activities when rivers are closed.**

b.) Pertaining to next year's workplans

- **Continued assessment is required**
- **Estimates of smolt production from the Miramichi River (not just the Northwest Miramichi) would be a valuable addition to the assessment**

__Various__________________ _Gérald Chaput___________________

NAME OF PRESENTER NAME OF RAPPORTEUR

Appendix 2. Marking, recapture and fish sampling from Miramichi in 1999.

Northwest Miramichi - Small Salmon

Tagging Area

		Hackett's Trapnet - Northwest Miramichi							**Cassilis Trapnet - Northwest Miramichi**						
		June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
	Tags Placed	65	80	0	39	20	1	**205**	85	537	93	71	8	.	**794**
Recapture Data															
Percent reported															
Angling	Total	.	3.8%	.	2.6%	5.0%	0.0%	3.4%	2.4%	5.0%	6.5%	1.4%	0.0%	.	4.5%
Traps	NW	.	16.3%	.	2.6%	5.0%	0.0%	7.3%	3.5%	16.9%	14.0%	14.1%	0.0%	.	14.7%
	SW	.	3.8%	.	5.1%	5.0%	0.0%	2.9%	0.0%	1.7%	5.4%	2.8%	0.0%	.	2.0%
Angling Recaptures															
In Southwest		0	1	0	1	0	0	**2**	0	3	5	1	0	0	**9**
	Unknown	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	July	.	1	.	.	.	.	1	.	.	.	.	.	.	0
	August	.	.	.	.	.	.	0	.	2	1	.	.	.	3
	Sept.	.	.	.	.	.	.	0	.	.	.	1	.	.	1
	Oct.	.	.	.	1	.	.	1	.	1	4	.	.	.	5
In Northwest		2	2	0	0	1	0	**5**	2	24	1	0	0	0	**27**
	Unknown	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	June	1	.	.	.	.	.	1	.	.	.	.	.	.	0
	July	.	2	.	.	.	.	2	1	14	.	.	.	.	15
	August	1	.	.	.	.	.	1	1	8	.	.	.	.	9
	Sept.	.	.	.	.	.	.	0	.	2	1	.	.	.	3
	Oct.	.	.	.	.	1	.	1	.	.	.	.	.	.	0
Miramichi		.	.	.	.	.	.	0	.	.	.	.	.	.	0
Mortalities recovered upriver (in freshwater)															
Northwest		.	.	.	.	.	.	0	.	2	.	.	.	.	2
Southwest		.	.	.	.	.	.	0	.	.	.	.	.	.	0
Unmarked fish recovered at facility above		97	94	41	41	21	1	**295**	98	563	94	71	8	.	**834**
Mortalities at facility above		23	3	.	.	.	.	**26**	3	9	.	.	.	.	**12**
Fish with tagging scars recovered at facility above		.	.	.	.	.	.	**0**	.	.	.	1	.	.	**1**
Recaptured fish lost before reading tag number at facility above		.	.	.	.	.	.	**0**	.	.	.	.	.	.	**0**

Red Bank Trapnets - Northwest Miramichi

	June	July	August	Sept.	Oct. 1-15	Total
Unmarked fish recovered at facility	226	797	212	81	14	**1330**
Fish with tagging scars recovered at facility	1	.	.	.	.	**1**
Recaptured fish lost before reading tag number at fac	.	.	.	.	.	**0**

Big Hole Partial Fence

	June	July	August	Sept.	Oct. 1-15	Total
Unmarked fish recovered at facility	.	.	.	.	.	**0**
Fish with tagging scars recovered at facility	.	.	.	.	.	**0**
Recaptured fish lost before reading tag number at fac	.	.	.	.	.	**0**

Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

Northwest Miramichi - Small Salmon

Tagging Area	Cassilis Trapnet - Northwest Miramichi							Cassilis Trapnet - Northwest Miramichi						
	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
Tags Placed	65	80	0	39	20	1	**205**	85	537	93	71	8	.	**794**
Recoveries of tags at facility														
Northwest Hackett's Trapnet	1	1	0	0	0	0	**2**	1	3	2	0	0	0	**6**
June							0							0
July	1						1	1	1					2
August							0		2	1				3
Sept.		1					1			1				1
Oct. 1-15							0							0
> Oct. 15							0							0
Northwest Cassilis Trapnet	0	4	0	1	0	0	**5**	1	16	2	3	0	0	**22**
June							0							0
July		4					4	1	15					16
August							0			1				1
Sept.				1			1		1	1	3			5
Oct. 1-15							0							0
> Oct. 15							0							0
Red Bank Traps	0	9	0	0	1	0	**10**	2	75	11	7	0	0	**95**
June							0	1						1
July		9					9	1	68					69
August							0		7	10				17
Sept.							0			1	6			7
Oct. 1-15					1		1				1			1
Big Hole Partial Fence	0	0	0	0	0	0	**0**	0	0	0	0	0	0	**0**
June							0							0
July							0							0
August							0							0
Sept.							0							0
Oct. 1-15							0							0
> Oct. 15							0							0
Southwest Food/Science Lower	0	0	0	0	0	0	**0**	0	1	0	0	0	0	**1**
June							0							0
July							0		1					1
August							0							0
Sept.							0							0
Southwest Food/Science Upper	0	1	0	2	1	0	**4**	0	4	3	1	0	0	**8**
June							0							0
July							0		1					1
August							0							0
Sept.		1		2			3		2	3	1			6
Oct. 1-15					1		1		1					1
Southwest Millerton Trapnet	0	2	0	0	0	0	**2**	0	4	2	1	0	0	**7**
May							0							0
June							0							0
July		2					2		2					2
August							0							0
Sept.							0		1	2	1			4
Oct. 1-15							0		1					1
> Oct. 15							0							0
Barrier Fences	0	0	0	0	1	0	**1**	1	4	0	2	0	0	**7**
Dungarvon June-Aug.							0		1					1
Sept.-Oct.							0							0
SW Miramichi June-Aug.							0							0
Sept.-Oct.							0							0
NW Miramichi June-Aug.							0							0
Sept.-Oct.							0							0
Catamaran June-Aug.							0							0
Sept.-Nov.					1		1		1					1
Clearwater June-Aug.							0							0
Sept.-Nov.							0	1	2		2			5
Broodstock Seining	0	0	0	0	0	0	**0**	0	0	0	0	0	0	**0**
Southwest Miramichi							0							0
Dungarvon							0							0
Little Southwest							0							0
Sevogle							0							0
Northwest							0							0

Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

Southwest Miramichi - Small Salmon

Tagging Area

		Southwest Food/Science Lower					Southwest Food/Science Upper						Millerton Trapnet - Southwest Miramichi							
		June	July	August	Sept.	Total	June	July	August	Sept.	Oct. 1-15	Total	May	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
	Tags Placed	52	229	101	.	**382**	2	0	46	250	110	**408**	0	21	451	111	207	106	3	**899**
Recapture Data																				
Percent reported																				
Angling	Total	3.8%	2.6%	4.0%	.	3.1%	0.0%	.	2.2%	2.8%	2.7%	2.7%	.	0.0%	3.5%	3.6%	3.9%	0.9%	0.0%	3.2%
Traps	NW	0.0%	5.7%	2.0%	.	3.9%	0.0%	.	2.2%	1.6%	0.0%	1.2%	.	4.8%	1.1%	0.0%	0.5%	0.0%	0.0%	0.8%
	SW	0.0%	8.3%	6.9%	.	6.8%	0.0%	.	6.5%	13.6%	12.7%	12.5%	.	14.3%	4.2%	1.8%	2.4%	10.4%	33.3%	4.6%
Angling Recaptures																				
In Southwest		2	4	4	0	**10**	0	0	1	6	3	**10**	0	0	16	4	6	0	0	**26**
	Unknown	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	June	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	1	1	.	.	2	.	.	.	.	.	0	.	.	6	.	.	.	.	6
	August	1	1	2	.	4	.	.	.	.	.	0	.	.	9	1	.	.	.	10
	Sept.	.	2	2	.	4	.	.	1	2	.	3	.	.	.	3	3	.	.	6
	Oct.	.	.	.	.	0	.	.	.	4	3	7	.	.	1	.	3	.	.	4
In Northwest		0	2	0	0	2	0	0	0	1	0	**1**	0	0	0	0	2	1	0	**3**
	Unknown	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	June	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	August	.	2	.	.	2	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	1	.	.	1
	Oct.	.	.	.	.	0	.	.	.	1	.	1	.	.	.	.	1	1	.	2
Miramichi	Unknown	.	.	.	.	**0**	.	.	.	.	.	**0**	.	.	.	.	.	.	.	**0**
Mortalities recovered upriver (in freshwater)																				
Northwest		.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Southwest		.	.	.	.	0	.	.	.	.	.	0	.	.	1	.	.	.	.	1
Unmarked fish recovered at facility above																				
		55	317	111	.	**483**	71	395	162	253	111	**992**	0	28	466	112	208	107	4	**925**
Mortalities at facility above																				
		.	1	.	.	**1**	.	.	.	1	.	**1**	.	3	2	.	1	.	.	**6**
Fish with tagging scars recovered at facility above																				
		.	.	1	.	**1**	.	.	.	.	.	**0**	.	.	.	.	.	.	.	**0**
Recaptured fish lost before reading tag number at facility above																				
		.	.	.	.	**0**	.	.	.	.	.	**0**	.	.	.	.	.	.	.	**0**

Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

Southwest Miramichi - Small Salmon

		Tagging Area																		
		Southwest Food/Science Lower					Southwest Food/Science Upper						Milleton Trapnet - Southwest Miramichi							
		June	July	August	Sept.	Total	June	July	August	Sept.	Oct. 1-15	Total	May	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
Tags Placed		52	239	181	.	**[illegible]**	2	0	48	258	118	**[illegible]**	0	21	451	111	207	186	3	**[illegible]**
Recoveries of tags placed at facility above																				
Southwest Food/Science Lower		0	9	1	0	**10**	0	0	0	0	0	**0**	0	1	3	0	0	0	0	**4**
	June	.	.	.	.	0	.	.	.	.	.	0	.	1	.	.	.	.	.	1
	July	.	9	.	.	9	.	.	.	.	.	0	.	.	3	.	.	.	.	3
	August	.	.	1	.	1	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Southwest Food/Science Upper		0	4	3	0	**7**	0	0	1	13	5	**19**	0	1	3	1	0	1	0	**6**
	June	.	.	.	.	0	.	.	.	.	.	0	.	1	.	.	.	.	.	1
	July	.	3	.	.	3	.	.	.	.	.	0	.	.	2	.	.	.	.	2
	August	.	1	3	.	4	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	1	8	.	9	.	.	1	1	.	.	.	2
	Oct. 1-15	.	.	.	.	0	.	.	.	5	5	10	.	.	.	.	.	1	.	1
Southwest Milleton Trapnet		0	6	3	0	**9**	0	0	2	21	9	**32**	0	1	13	1	5	10	1	**31**
	May	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	June	.	.	.	.	0	.	.	.	.	.	0	.	1	.	.	.	.	.	1
	July	.	6	.	.	6	.	.	.	.	.	0	.	.	11	.	.	.	.	11
	August	.	.	2	.	2	.	.	.	.	.	0	.	.	.	1	.	.	.	1
	Sept.	.	.	.	.	0	.	.	2	8	.	10	.	.	2	.	5	.	.	5
	Oct. 1-15	.	.	1	.	1	.	.	.	13	8	21	.	.	.	.	2	10	.	12
	>Oct. 15	.	.	.	.	0	.	.	.	.	1	1	.	.	.	.	.	.	1	1
Northwest Hackett's Trapnet		1	2	0	0	**3**	0	0	0	1	2	**3**	0	0	0	0	0	0	0	**0**
	June	1	.	.	.	1	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	.	1	.	.	1	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	August	.	1	.	.	1	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Oct. 1-15	.	.	.	.	0	.	.	.	1	2	3	.	.	.	.	.	.	.	0
	>Oct. 15	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Northwest Cassilis Trapnet		3	6	1	0	**10**	0	0	0	1	0	**1**	0	1	3	0	0	0	0	**4**
	June	1	.	.	.	1	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	2	5	.	.	7	.	.	.	.	.	0	.	1	1	.	.	.	.	2
	August	.	1	.	.	1	.	.	.	.	.	0	.	.	1	.	.	.	.	1
	Sept.	.	.	1	.	0	.	.	.	.	.	0	.	.	1	.	.	.	.	1
	Oct. 1-15	.	.	.	.	0	.	.	.	1	.	1	.	.	.	.	.	.	.	0
	>Oct. 15	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Red Bank Trapnets		0	13	2	0	**15**	0	0	1	2	0	**4**	0	0	2	0	1	0	0	**3**
	June	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	.	9	.	.	9	.	.	.	.	.	0	.	.	2	.	.	.	.	2
	August	.	3	.	.	3	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	1	2	.	3	.	.	1	1	.	2	.	.	.	.	1	.	.	1
	Oct. 1-15	.	.	.	.	0	.	.	.	2	.	2	.	.	.	.	.	.	.	0
Big Hole Partial Fence		0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
	June	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	August	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Oct. 1-15	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	>Oct. 15	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Barrier Fences		2	4	0	0	**6**	0	0	1	1	0	**2**	0	1	2	1	0	0	0	**4**
Dungarvon	June-Aug.	2	.	.	.	2	.	.	.	.	.	0	.	1	1	.	.	.	.	2
	Sept.-Oct.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
SW Miramichi	June-Aug.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.-Oct.	.	.	.	.	0	.	.	.	.	.	0	.	.	1	1	.	.	.	2
Clearwater Brook	June-Aug.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.-Nov.	.	1	.	.	1	.	.	1	1	.	2	.	.	.	.	.	.	.	0
NW Miramichi	June-Aug.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.-Oct.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Catamaran	June-Aug.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.-Nov.	.	3	.	.	3	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Broodstock Seining		0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	0	1	0	0	0	**1**
	Dungarvon	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Southwest	.	.	.	.	0	.	.	.	.	.	0	.	.	.	1	.	.	.	1
	Little Southwest	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sevogle	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Northwest	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0

Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

Northwest Miramichi - Large Salmon

Tagging Area		Hackett's Trapnet - Northwest Miramichi							Cassilis Trapnet - Northwest Miramichi						
		June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
	Tags Placed	13	12	5	23	16	6	**75**	11	138	61	50	14	.	**274**
Recapture Data															
Percent reported															
Angling	Total	.	8.3%	0.0%	0.0%	0.0%	0.0%	1.3%	9.1%	1.4%	3.3%	0.0%	0.0%	.	1.8%
Traps	NW	.	0.0%	0.0%	13.0%	0.0%	0.0%	5.3%	0.0%	20.3%	6.6%	8.0%	0.0%	.	13.1%
	SW	.	8.3%	0.0%	0.0%	12.5%	0.0%	4.0%	0.0%	2.2%	1.6%	2.0%	0.0%	.	1.8%
Angling Recaptures															
In Southwest		0	0	0	0	0	0	**0**	1	0	0	0	0	0	**1**
	Unknown	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	June	.	.	.	.	.	.	0	1	.	.	.	.	.	1
	July	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	August	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	Sept.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	Oct.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
In Northwest		0	1	0	0	0	0	**1**	0	2	2	0	0	0	**4**
	Unknown	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
	July	.	.	.	.	.	.	0	.	2	.	.	.	.	2
	August	.	1	.	.	.	.	1	.	.	1	.	.	.	1
	Sept.	.	.	.	.	.	.	0	.	.	1	.	.	.	1
	Oct.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Miramichi		.	.	.	.	.	.	0	.	.	.	.	.	.	0
Mortalities recovered upriver (in freshwater)															
Northwest		.	.	.	.	.	.	0	.	1	.	.	.	.	1
Southwest		1	.	.	.	.	.	1	1	1	.	.	.	.	2
Unmarked fish recovered at facility above		14	14	7	23	16	6	**80**	12	143	61	50	14	.	**280**
Mortalities at facility above		.	.	.	.	.	.	**0**	.	1	.	.	.	.	**1**
Fish with tagging scars recovered at facility above		.	.	.	.	.	.	**0**	.	.	.	.	.	.	**0**
Recaptured fish lost before reading tag number at facility above		.	.	.	.	.	.	**0**	.	.	.	.	.	.	**0**

Red Bank Trapnets - Northwest Miramichi	June	July	August	Sept.	Oct. 1-15	Total
Unmarked fish recovered at facility	27	284	122	102	10	**545**
Fish with tagging scars recovered at facility	.	.	.	.	.	**0**
Recaptured fish lost before reading tag number at facility above	.	.	.	.	.	**0**

Big Hole Partial Fence	June	July	August	Sept.	Oct. 1-15	Total
Unmarked fish recovered at facility	.	.	.	.	.	**0**
Fish with tagging scars recovered at facility	.	.	.	.	.	**0**
Recaptured fish lost before reading tag number at facility above	.	.	.	.	.	**0**

Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

Northwest Miramichi - Large Salmon

Tagging Area	Hackett's Trapnet - Northwest Miramichi							Cassilis Trapnet - Northwest Miramichi						
	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
Tags Placed	13	12	5	23	16	6	**75**	11	138	61	50	14	.	**274**
Recoveries of tags at facility above														
Northwest Hackett's Trapnet	0	0	0	0	0	0	**0**	0	1	0	1	0	0	**2**
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	.	.	.	.	.	.	0	.	.	.	.	.	.	0
August	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.	.	.	.	.	.	.	0	.	1	.	1	.	.	2
Oct. 1-15	.	.	.	.	.	.	0	.	.	.	.	.	.	0
> Oct. 15	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Northwest Cassilis Trapnet	0	0	0	0	0	0	**0**	0	5	2	2	0	0	**9**
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	.	.	.	.	.	.	0	.	4	.	.	.	.	4
August	.	.	.	.	.	.	0	.	.	2	.	.	.	2
Sept.	.	.	.	.	.	.	0	.	1	.	1	.	.	2
Oct. 1-15	.	.	.	.	.	.	0	.	.	.	1	.	.	1
> Oct. 15	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Red Bank Traps	1	0	0	3	0	0	**4**	0	23	2	2	0	0	**27**
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	1	.	.	.	.	.	1	.	23	.	.	.	.	23
August	.	.	.	.	.	.	0	.	.	1	.	.	.	1
Sept.	.	.	.	2	.	.	2	.	.	1	.	.	.	1
Oct. 1-15	.	.	.	1	.	.	1	.	.	.	2	.	.	2
Big Hole Partial Fence	0	0	0	0	0	0	**0**	0	0	0	0	0	0	**0**
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	.	.	.	.	.	.	0	.	.	.	.	.	.	0
August	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Oct. 1-15	.	.	.	.	.	.	0	.	.	.	.	.	.	0
> Oct. 15	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Southwest Food/Science Lower	0	0	0	0	0	0	**0**	0	0	1	0	0	0	**1**
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	.	.	.	.	.	.	0	.	.	.	.	.	.	0
August	.	.	.	.	.	.	0	.	.	1	.	.	.	1
Sept.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Southwest Food/Science Upper	0	1	0	0	1	0	**2**	0	1	0	1	0	0	**2**
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	.	.	.	.	.	.	0	.	1	.	.	.	.	1
August	.	1	.	.	.	.	1	.	.	.	.	.	.	0
Sept.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Oct. 1-15	.	.	.	.	1	.	1	.	.	.	1	.	.	1
Southwest Millerton Trapnet	0	0	0	0	1	0	**1**	0	2	0	0	0	0	**2**
May	.	.	.	.	.	.	0	.	.	.	.	.	.	0
June	.	.	.	.	.	.	0	.	.	.	.	.	.	0
July	.	.	.	.	.	.	0	.	.	.	.	.	.	0
August	.	.	.	.	.	.	0	.	1	.	.	.	.	1
Sept.	.	.	.	.	.	.	0	.	1	.	.	.	.	1
Oct. 1-15	.	.	.	.	1	.	1	.	.	.	.	.	.	0
> Oct. 15	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Barrier Fences	0	0	0	1	0	0	**1**	0	1	0	3	0	0	**4**
Dungarvon June-Aug.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.-Oct.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
SW Miramichi June-Aug.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.-Oct.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
NW Miramichi June-Aug.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.-Oct.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Catamaran June-Aug.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.-Nov.	.	.	.	.	.	.	0	.	.	.	2	.	.	2
Clearwater June-Aug.	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sept.-Nov.	.	.	.	1	.	.	1	.	1	.	1	.	.	2
Broodstock Seining	0	0	0	0	0	0	**0**	0	0	0	0	0	0	**0**
Southwest Miramichi	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Dungarvon	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Little Southwest	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Sevogle	.	.	.	.	.	.	0	.	.	.	.	.	.	0
Northwest	.	.	.	.	.	.	0	.	.	.	.	.	.	0

Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

Southwest Miramichi - Large Salmon		Southwest Food/Science Lower					Southwest Food/Science Upper						Millerton Trapnet - Southwest Miramichi							
Tagging Area		June	July	August	Sept.	Total	June	July	August	Sept.	Oct. 1-15	Total	May	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
	Tags Placed	6	69	43	.	**118**	9	108	67	168	67	**419**	1	2	135	68	88	98	4	**396**
Recapture Data																				
Percent reported																				
Angling	Total	0.0%	0.0%	2.3%	.	0.8%	0.0%	0.9%	0.0%	0.0%	0.0%	0.2%	.	0.0%	0.0%	0.0%	1.1%	2.0%	0.0%	0.8%
Traps	NW	0.0%	0.0%	2.3%	.	0.8%	0.0%	8.3%	3.0%	1.2%	0.0%	3.1%	.	0.0%	0.0%	1.5%	0.0%	0.0%	0.0%	0.3%
	SW	0.0%	4.3%	2.3%	.	3.4%	0.0%	3.7%	4.5%	7.7%	14.9%	7.2%	.	0.0%	3.7%	0.0%	9.1%	4.1%	0.0%	4.3%
Angling Recaptures																				
In Southwest		0	0	1	0	**1**	0	1	0	0	0	**1**	0	0	0	0	1	2	0	**3**
	Unknown	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	June	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	August	.	.	1	.	1	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	1	.	.	1
	Oct.	.	.	.	.	0	.	1	.	.	.	1	.	.	.	.	.	2	.	2
In Northwest		0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
	Unknown	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	June	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	July	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	August	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Sept.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
	Oct.	.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Miramichi	Unknown	.	.	.	.	**0**	.	.	.	.	.	**0**	.	.	.	.	.	.	.	**0**
Mortalities recovered upriver (in freshwater)																				
Northwest		.	.	.	.	0	.	.	.	.	.	0	.	.	.	.	.	.	.	0
Southwest		.	.	.	.	0	.	1	.	.	.	1	.	.	.	.	.	.	.	0
Unmarked fish recovered at facility above																				
		9	81	46	.	**136**	12	115	69	174	67	**437**	1	14	156	68	88	98	4	**429**
Mortalities at facility above																				
		.	2	.	.	**2**	2	1	2	.	.	**5**	.	10	11	.	.	.	.	**21**
Fish with tagging scars recovered at facility above																				
		.	1	.	.	**1**	.	.	.	.	1	**1**	.	.	.	.	.	.	.	**0**
Recaptured fish lost before reading tag number at facility above																				
		.	.	.	.	**0**	.	.	.	.	.	**0**	.	.	.	.	.	.	.	**0**

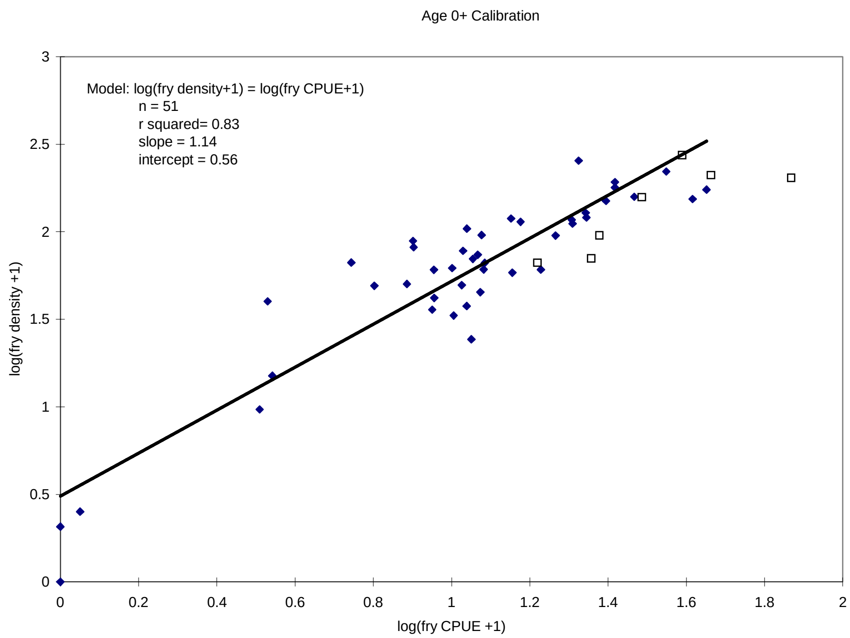
Appendix 2 (continued). Marking, recapture and fish sampling from Miramichi in 1999.

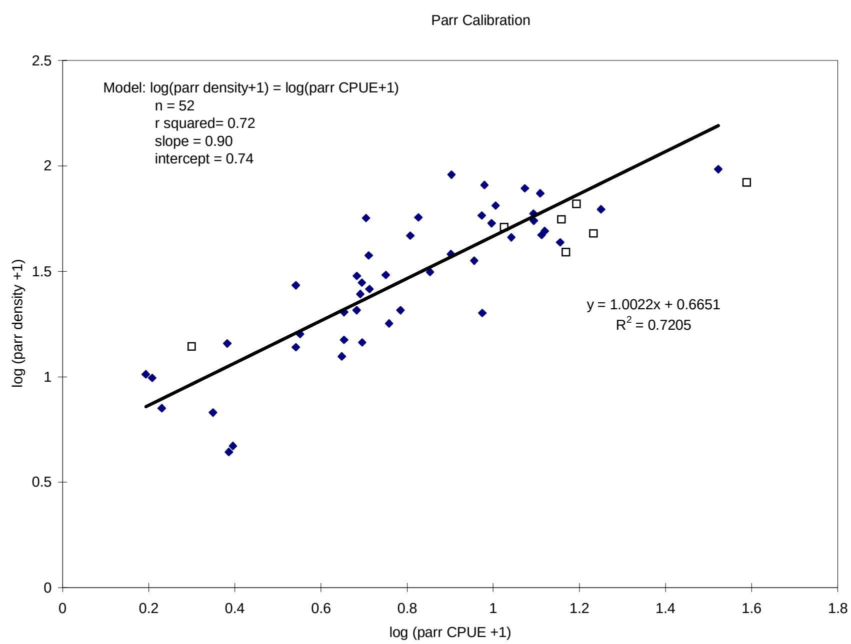
Southwest Miramichi - Large Salmon

Tagging Area

		Southwest Food/Science Lower					Southwest Food/Science Upper						Millerton Trapnet - Southwest Miramichi							
		June	July	August	Sept.	Total	June	July	August	Sept.	Oct. 1-15	Total	May	June	July	August	Sept.	Oct. 1-15	>Oct. 15	Total
Tags Placed		6	69	43		**119**	9	108	67	168	67	**419**	1	2	135	68	88	98	4	**396**
Recoveries of tags placed at facility above																				
Northwest Hackett's Trapnet		0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
	June					0						0								0
	July					0						0								0
	August					0						0								0
	Sept.					0						0								0
	Oct. 1-15					0						0								0
	> Oct. 15					0						0								0
Northwest Cassilis Trapnet		0	0	0	0	**0**	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
	June					0						0								0
	July					0		1				1								0
	August					0						0								0
	Sept.					0						0								0
	Oct. 1-15					0						0								0
	> Oct. 15					0						0								0
Red Bank Trapnets		0	0	1	0	**1**	0	8	2	2	0	**12**	0	0	0	1	0	0	0	**1**
	June					0						0								0
	July					0		5				5								0
	August			1		1		3	2			5				1				1
	Sept.					0				2		2								0
	Oct. 1-15					0						0								0
Big Hole Patial Fence		0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
	June					0						0								0
	July					0						0								0
	August					0						0								0
	Sept.					0						0								0
	Oct. 1-15					0						0								0
	> Oct. 15					0						0								0
Southwest Food/Science Lower		0	0	1	0	**1**	0	0	1	0	0	**1**	0	0	1	0	0	0	0	**1**
	June					0						0								0
	July					0						0			1					1
	August			1		1			1			1								0
	Sept.					0						0								0
Southwest Food/Science Upper		0	1	0	0	**1**	0	3	1	7	5	**16**	0	0	2	0	1	1	0	**4**
	June					0						0								0
	July					0		3				3			1					1
	August					0			1			1			1					1
	Sept.		1			1				4		4								0
	Oct. 1-15					0				3	5	8					1	1		2
Southwest Millerton Trapnet		0	2	0	0	**2**	0	1	1	6	5	**13**	0	0	2	0	7	3	0	**12**
	May					0						0								0
	June					0						0								0
	July		2			2		1				1			1					1
	August					0			1			1								0
	Sept.					0				3		3					4			4
	Oct. 1-15					0				3	5	8			1		3	3		7
	> Oct. 15					0						0								0
Barrier Fences		1	0	0	0	**1**	0	1	0	0	1	**2**	0	1	1	1	2	0	0	**5**
Dungarvon	June-Aug.	1				1						0		1						1
	Sept./Oct.					0						0								0
SW Miramichi	June-Aug.					0						0								0
	Sept./Oct.					0						0								0
Clearwater Brook	June-Aug.					0						0								0
	Sept./Nov.					0		1				1			1	1	1			3
NW Miramichi	June-Aug.					0						0								0
	Sept./Oct.					0						0								0
Catamaran	June-Aug.					0						0								0
	Sept./Nov.					0					1	1					1			1
Broodstock Seining		0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**
	Dungarvon					0						0								0
	Southwest					0						0			1					1
	Little Southwest					0						0								0
	Sevogle					0						0								0
	Northwest					0						0								0

Appendix 3. Juvenile survey CPUE to density calibration for the Miramichi River for 1993 to 1999. The 1999 sites are shown as open squares. CPUE is expressed as fish per 180 seconds of fishing effort, density expressed as fish per 100 m^2.





Appendix 4. Detailed distribution records of Atlantic salmon from the Miramichi Fish Hatchery, South Est, NB, 1999.

LOCATION	dd	mm	yr	Mark	SPC.	STOCK	RIVER	Program	Stage	#FISH
Little River - Outlet of North Little R. Lake	25	5	99	AC	J	Little River	NW	Hatchery	1+ Parr	3,665
Little River - Electro site @ bridge off Rt. 430	25	5	99	AC	J	Little River	NW	Hatchery	1+ Parr	3,665
Little River - Electro site @ bridge off Rt. 430	26	5	99	AC	A	NW Mir.	NW	Heath Steele	2+ Smolts	4,723
Dungarvon River, Crooked Bridge Brook	11	6	99	NM	J	Dungarvon	SW	Hatchery	0+ Parr	8,000
LSW, Smyth Forks	11	6	99	NM	J	LSW Mir.	NW	Hatchery	0+ Parr	4,750
LSW, Libies Brook	11	6	99	NM	J	LSW Mir.	NW	Hatchery	0+ Parr	4,750
Sisters Brook	14	8	99	NM	J	Rocky Brook	SW	Satellite	0+ Parr	500
Main Southwest Miramichi - Harris Brook	29	8	99	NM	J	SW Miramichi	SW	Satellite	0+ Parr	3,530
Cains R. - Admiral Camp	13	9	99	AC	J	Cains	SW	Satellite	0+ Parr	4,257
Duffy Brook		9	99	NM	J	Dungarvon	SW	Satellite	0+ Parr	4,000
Gillman Brook	1	10	99	AC	J	SW Miramichi	SW	Satellite	0+ Parr	3,000
Main Southwest Miramichi	1	10	99	AC	J	SW Miramichi	SW	Satellite	0+ Parr	3,791
NW Miramichi - Camp Adam	4	10	99	AC	J	NW Mir.	NW	Satellite	0+ Parr	4,700
Black Brook	11	10	99	AC	J	Cains	SW	Satellite	0+ Parr	2,500
East Br. - Six Mile	11	10	99	AC	J	Cains	SW	Satellite	0+ Parr	2,500
Southwest Miramichi at Deadman Camp	11	10	99	AC	J	SW Miramichi	SW	Satellite	0+ Parr	4,537
Mouth of Salmon Brook	12	10	99	AC	J	SW Miramichi	SW	Satellite	0+ Parr	2,000
Southwest Miramichi at Salmon Brook Club	12	10	99	AC	J	SW Miramichi	SW	Satellite	0+ Parr	2,000
Mt. Channell Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	1,000
White Rapids Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	1,000
MacKenzie Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	800
Morse Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	1,000
Main Southwest Miramichi	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	587
Salmon Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	1,100
Six Mile Brook - middle	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	823
Becket's Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	200
Astles Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	500
Buttermilk Brook	14	10	99	AC	J	Cains	SW	Satellite	0+ Parr	400
Slate Island Brook	17	10	99	AC	J	SW Miramichi	SW	Satellite	0+ Parr	4,934
Sevogle R. - Barrack's Brook	21	10	99	AC	J	Sevogle	NW	Satellite	0+ Parr	4,300
Sevogle R. - Travis Brook	21	10	99	AC	J	Sevogle	NW	Satellite	0+ Parr	2,411
Sevogle R. - Johnstone Brook	21	10	99	AC	J	Sevogle	NW	Satellite	0+ Parr	2,412
Clearwater Brook	26	10	99	AC	J	Clearwater	SW	Satellite	0+ Parr	4,200
Big Hole Tract	28	10	99	AC	J	NW Mir.	NW	Hatchery	0+ Parr	2,959
Wayerton Bridge	28	10	99	AC	J	NW Mir.	NW	Hatchery	0+ Parr	2,959
Bridge Pool, Depot	28	10	99	AC	J	NW Mir.	NW	Hatchery	0+ Parr	2,959
Sisters Brook, Fullerton branch	29	10	99	AC	J	Rocky Brook	SW	Hatchery	0+ Parr	4,637
Sisters Brook	29	10	99	AC	J	Rocky Brook	SW	Hatchery	0+ Parr	4,637
Rocky Brook LL Road	29	10	99	AC	J	Rocky Brook	SW	Satellite	0+ Parr	7,323
Rocky Brook LL Road	29	10	99	AC	J	Rocky Brook	SW	Satellite	0+ Parr	4,092
S. Br. SW Mir., above Juniper Lumber Mill	2	11	99	AC	J	Juniper	SW	Hatchery	0+ Parr	2,500
S. Br. SW Mir., below Juniper Lumber Mill	2	11	99	AC	J	Juniper	SW	Hatchery	0+ Parr	2,500
N. Br. SW Mir., Irving Gate house	2	11	99	AC	J	Juniper	SW	Hatchery	0+ Parr	1,600
Salmon Brook	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	650
Salmon Brook	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	650
Bloomfield Bdg - Southwest Miramichi	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	700
Bloomfield - Standish Bridge	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	300
E. Br.Burntland Brook on Bantalor Road	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	500
Southwest Miramichi @ Tuckaway Lodge	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	1,100
Mamies Brook - Boiestown	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	200
Harris Brook - Ludlow	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	200
N. Br. Bett's Mill Brook - Bettsburg Road	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	300
S. Br. Bett's Mill Brook - Bettsburg Road	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	300
Southwest Miramichi @ Ledges Inn	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	400
Southwest Miramichi @ Atlantic Salmon Msm	4	11	99	AC	J	Clearwater	SW	Riverstock	0+ Parr	2,200
Sutter Lodge	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	5,000
Old Squaw Rock	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	1,300
Whites Rapids Brook, Route # 8	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	400
White Rapids Brook, Below Smith Lake	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	300
White Rapids Brook, North Branch	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	62
Hudson Brook, Route # 8	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	500
Big Hole Brook - Crooked Bridge Brook	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	500
Big Hole Brook - Crooked Bridge Road	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	1,000
Old River Lodge - Blissfield	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	600
Moores Brook	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	300
Gray Rapids Brook	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	300
Kelly Brook	10	11	99	AC	J	Black Brook	SW	Hatchery	0+ Parr	200
Clearwater Brook		11	99	AC	J	Clearwater	SW	Satellite	0+ Parr	45,000
Total										191,663

Mark
AC = adipose clip
NM = not marked

SPC
A = Smolts
J = Non-smolts