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# Stock status of Atlantic salmon (*Salmo salar*) in the Miramichi River, 1995

by

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## ABSTRACT

Atlantic salmon (*Salmo salar*) in the Miramichi River, New Brunswick, were harvested by two user groups in 1995; First Nations and recreational fishers. The Aboriginal food fishery catches in 1995 represented an increase of 76% for small and a decrease of 50% for large salmon relative to previous years. Essentially all of the large salmon (98%) harvests and 80% of the small salmon harvests were taken prior to Sept. 1 in 1995. Recreational fishery catches for 1995 were not available at the time of the assessment but indications from a creel survey and from Crown Reserve waters were that angling catches were less than half of 1994 and the previous five years. For the Southwest Miramichi, 30500 small salmon and 17100 large salmon were estimated to have returned in 1995. After accounting for all removals, egg depositions in the Southwest Miramichi by both small and large salmon were 139% of target. For the Northwest Miramichi, 21700 small salmon and 15200 large salmon were estimated to have returned. Egg depositions by small and large salmon in the Northwest in 1994 were 265% of target. Egg depositions have exceeded the target in each branch during the last three years. The 1996 forecast for large salmon returning to the Miramichi is 30,507 with a probability of 81% meeting spawning 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 is for continued and increased abundance of salmon.



## 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 1995, les captures de grands saumons dans les pêches autochtones ont diminué de 50% par rapport à la moyenne des années antérieures tandis que les captures de madeleineaux (<63 cm longueur à la fourche) ont augmenté de 76%. Presque tous les grands saumons (98%) et 80% des madeleineaux récoltés par les autochtones provenaient de la remontée d'été (avant le 1er septembre). Les estimations de captures de madeleineaux et de grands saumons dans la pêche récréative n'étaient pas disponibles pour l'évaluation mais les captures observées dans les eaux de réserves de couronne et durant un recensemment sur le terrain indiquaient que les captures en 1995 étaient réduites d'au moins la moitié par rapport à 1994 et les cinq années antérieures. La montaison de saumon dans la rivière Miramichi sud-ouest s'est situé à 30 500 madeleineaux et 17 100 grands saumons. Les géniteurs auraient contribué à une ponte d'oeufs équivalente à 139% de la cible d'oeufs pour la rivière Miramichi sud-ouest. Dans la Miramichi nord-est, la montaison a été estimée à environ 21 700 madeleineaux et 15 200 grands saumons. Les géniteurs de cette montaison auraient contribué une ponte d'oeufs équivalente à 265% de la cible d'oeufs. Durant les trois dernières années, les pontes d'oeufs ont été supérieures aux cibles pour les deux affluents principales de la Miramichi, le sud-ouest et le nord-est. La prévision de la remontée de grands saumons pour 1996 est 30 507 poissons. Il est toutefois probable, à 81%, que la remontée soit égale ou supérieure au niveau de cible de géniteurs. 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 à celles observées très récemment.

**Stock:** Miramichi River, SFA 16
**Life Stage:** Small and large salmon
**Target:** 132 million eggs (23,600 large, 22,600 small salmon)

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | MIN[1] | MAX[1] | MEAN[7] |
|---|---|---|---|---|---|---|---|---|---|
| **Angling catch[2]** | | | | | | | | | |
| Large | 9258 | 6147 | 9476 | 8131 | 8451 | 8293 | 1792 | 14215 | 8293 |
| Small | 21372 | 11300 | 21482 | 16898 | 13415 | 16893 | 8310 | 30586 | 16893 |
| **Native harvest[3]** | | | | | | | | | |
| Large | 609 | 544 | 608 | 208 | 124 | 185 | 124[6] | 898[6] | 419 |
| Small | 2110 | 1111 | 1652 | 601 | 2977 | 3004 | 100[6] | 3004[6] | 1690 |
| **Other harvest[4]** | | | | | | | | | |
| Large | 99 | 131 | 142 | 166 | 119 | 125 | 99[7] | 166[7] | 131 |
| Small | 142 | 189 | 198 | 236 | 270 | 164 | 142[7] | 270[7] | 207 |
| **Spawning escapement** | | | | | | | | | |
| Large (x 1000) | 28 | 29 | 36 | 35 | 27 | 32 | 4 | 36 | 31 |
| Small (x 1000) | 60 | 48 | 135 | 76 | 40 | 34 | 13 | 135 | 72 |
| **Total returns** | | | | | | | | | |
| Large (x 1000) | 29 | 30 | 37 | 35 | 27 | 33 | 9 | 52 | 32 |
| Small (x 1000) | 83 | 61 | 153 | 92 | 57 | 54 | 24 | 153 | 89 |
| **% Egg target met** | 152 | 159 | 242 | 170 | 130 | 178 | 23 | 242 | 171 |

[1] MIN MAX over the period 1971-1995 unless stated otherwise.
[2] Angling catch includes hook and release estimates.
[3] Native harvest includes catch reported by Burnt Church, Red Bank, and Eel Ground Indian Bands.
[4] Other harvest includes broodstock removals, mortalities at all index traps, and all samples.
[6] For 1975 to 1994.
[7] For 1990 to 1994.

**Recreational catches:** Have ranged from 7686 to 14,215 large and 11,300 to 30,586 small salmon during the past 10 years. Effort in rod-days has increased in recent years. Angling catches for 1994 are revised final values. The 1995 catches are preliminary values based on the 1990-94 average because 1995 estimates are not yet available.

**Data and assessment:** For 1990-1991, returns were estimated from trap efficiency at a DFO trap operated in the estuary of the Miramichi River at Millbank. The efficiency of this trap was calibrated from tag recapture experiments in 1985 thru 1992. Index traps were operated in the estuaries of the Northwest and Southwest Miramichi Rivers in 1992 to 1995. Returns of small and large salmon were estimated separately from marks applied at these traps and recaptures upstream. Escapements were estimated as returns minus known removals.

**State of the stock:** Target egg deposition rates have been almost met or exceeded in each of the last ten years.

**Forecast for 1996:** The probability distribution model prediction for large salmon returns in 1996 is 30,507 with a probability of meeting the spawning target (23,600) of 81% (i.e., a 19% chance of returns being less than 23,600). No forecast available for small salmon.

**STOCK:** Northwest Miramichi River, SFA 16
**TARGET:** 41 million eggs (7316 large, 7006 small salmon)

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | MIN[1] | MAX[1] | MEAN[7] |
|---|---|---|---|---|---|---|---|---|---|
| **Angling catch[2]** | | | | | | | | | |
| Large | 2229 | 1533 | 1794 | 2186 | 2249 | 1998 | 419 | 3836 | 1998 |
| Small | 6825 | 3056 | 6960 | 6171 | 5166 | 5636 | 2232 | 9825 | 5636 |
| **Native harvest[3]** | | | | | | | | | |
| Large | 502 | 462 | 580 | 54 | 81 | 172 | 54[6] | 898[6] | 336 |
| Small | 2095 | 1109 | 1616 | 477 | 2921 | 1795 | 100[6] | 2921[6] | 1644 |
| **Other harvest[4]** | | | | | | | | | |
| Large | 39 | 44 | 56 | 100 | 51 | 31 | | | 58 |
| Small | 0 | 29 | 61 | 106 | 68 | 115 | | | 53 |
| **Spawning escapement** | | | | | | | | | |
| Large (x 1000) | n.a. | n.a. | 9 | 10 | 13 | 15 | | | |
| Small (x 1000) | n.a. | n.a. | 22 | 40 | 13 | 15 | | | |
| **Total returns** | | | | | | | | | |
| Large (x 1000) | n.a. | n.a. | 10 | 11 | 13 | 15 | | | |
| Small (x 1000) | n.a. | n.a. | 31 | 46 | 21 | 22 | | | |
| **% Egg target met** | n.a. | n.a. | 198 | 175 | 197 | 265 | | | |

[1] MIN MAX over the period 1972 to present unless stated otherwise.
[2] All angling catches are NB DNRE Fishsys values. Angling catch includes hook and release fish.
[3] Native harvest includes catch reported by Red Bank, and Eel Ground Indian Bands.
[4] Other harvest includes broodstock removals, mortalities at all index traps, and all samples.
[6] For 1972 to present.
[7] For 1990 to 1994.

**Recreational catches:** New Brunswick Department of Natural Resources and Energy FISHSYS estimates indicate that over the period 1987-1991, 27-34% (mean: 31%) of total angling in the Miramichi River has occurred in the Northwest Miramichi. Values for 1992 to 1994 are final revised estimates of catch. The 1995 values are not yet available and the previous 5-year catches are used as preliminary figures.

**Data and assessment:** Returns of small salmon and large salmon to the Northwest Miramichi River were estimated in 1992 to 1995 from a mark-recapture program, applying tags at Eel Ground Enclosure trap and recovering tags from traps at Redbank (NW), and from fences in the headwaters of the Northwest Miramichi and in Catamaran Brook. Spawners were estimated as returns minus known and estimated removals.

**State of the stock:** The spawning target for large salmon was exceeded in 1992 to 1995.

**Forecast for 1996:** Based on the forecast for the Miramichi River and proportion of total large salmon returning to the Northwest Miramichi (38%), returns in 1996 should exceed the spawning requirements. No forecast available for small salmon.

**STOCK:** Southwest Miramichi River, SFA 16
**TARGET:** 88 million eggs (15730 large, 15063 small salmon)

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | MIN[1] | MAX[1] | MEAN[7] |
|---|---|---|---|---|---|---|---|---|---|
| **Angling catch[2]** | | | | | | | | | |
| Large | 7029 | 4614 | 7682 | 5945 | 6202 | 6294 | 1373 | 10387 | 6294 |
| Small | 14547 | 8244 | 14522 | 10727 | 8249 | 11258 | 4570 | 22137 | 11258 |
| **Native harvest[3]** | | | | | | | | | |
| Large | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| Small | 0 | 0 | 0 | 0 | 0 | 1170 | | | |
| **Other harvest[4]** | | | | | | | | | |
| Large | 49 | 39 | 75 | 66 | 68 | 94 | | | 59 |
| Small | 0 | 39 | 26 | 130 | 202 | 49 | | | 79 |
| **Spawning escapement** | | | | | | | | | |
| Large (x 1000) | n.a. | n.a. | 27 | 22 | 14 | 17 | | | |
| Small (x 1000) | n.a. | n.a. | 106 | 33 | 26 | 19 | | | |
| **Total returns** | | | | | | | | | |
| Large (x 1000) | n.a. | n.a. | 27 | 22 | 14 | 17 | | | |
| Small (x 1000) | n.a. | n.a. | 121 | 43 | 34 | 32 | | | |
| **% Egg target met** | n.a. | n.a. | 259 | 150 | 108 | 139 | | | |

[1] MIN MAX over the period 1972 to present unless stated otherwise.
[2] All angling catches are NB DNRE Fishsys values. Angling catch includes hook and release fish.
[3] Eel Ground First Nations food fishery occurred in the Southwest branch using a trapnet.
[4] Other harvest includes broodstock removals, mortalities at all index traps, and all samples.
[6] For 1972 to present.
[7] For 1990 to 1994.

**Recreational catches:** New Brunswick Department of Natural Resources and Energy FISHSYS estimates indicate that over the period 1987-1991, 66--73% (mean: 69%) of total angling in the Miramichi River has occurred in the Southwest Miramichi. The 1995 values are preliminary and represent the average catches for the period 1990 to 1994 because the 1995 estimates are not yet available. Values for 1994 have been finalized.

**Data and assessment:** Returns of small salmon and large salmon to the Southwest Miramichi River were estimated in 1992 to 1995 from a mark-recapture program, applying tags at Enclosure trap and recovering tags from recapture trapnet upstream, from creel surveys, and from fences and barriers in the Southwest Miramichi. Spawners were estimated as returns minus known and estimated removals.

**State of the stock:** The egg deposition target was exceeded in 1992 to 1995.

**Forecast for 1996:** Based on the forecast for the Miramichi River and proportion of total large salmon returning to the Southwest Miramichi (62%), returns in 1996 should exceed the spawning requirements. No forecast available for small salmon.

## 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 . Until 1991, the assessments dealt exclusively with returns and escapement to the entire river (Randall and Chadwick MS1983a, b; Randall and Schofield MS1987, MS1988; Randall et al. MS1985, MS1986, MS1989, MS1990; Moore et al. MS1991, MS1992). Since 1992, separate assessments of the Northwest and Southwest branches have been prepared (Courtenay et al. MS1993; Chaput et al. MS1994b, MS1995).

There is considered to be two runs of Atlantic salmon in the Miramichi River. 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. Two size groups of salmon return to the river to spawn. The small salmon category consists of salmon of fork length less than 63 cm 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 previous spawners. The large salmon category consists of fish of fork length greater than or equal to 63 cm. This size group is generally referred to as multi-sea-winter or "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 until the spring of the year are referred to as kelts, or "black salmon" in contrast to "bright" salmon which are maturing 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). 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 escapement to the conservation target for the river. The status of the resource is determined by the proportion of the target achieved, 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 broken down into Northwest and Southwest Miramichi returns and further still into early and late run. We estimate egg depositions for each run in each branch by incorporating the variability in run composition, sex ratio, and size of fish. Juvenile surveys provide finer spatial scale assessments of spawning activity in the previous year. Finally, using time series data of returns, escapements, and juvenile surveys, we provide a prognosis for 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 (minutes in Appendix 1). Peer review notes are available under separate cover (Anon. 1996).

## 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 1995; 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 reduction and elimination of gillnetting effort in the Northwest Miramichi, compensated by food fishery trapnets operated by the bands. In 1995, Eel Ground First Nation fished two food fishery trapnets in the Northwest Miramichi and one food trapnet in the Southwest Miramichi. Two food trapnets were fished by Red Bank First Nation at identical 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 no significant changes in recreational fishery regulations in 1995 relative to previous years (Moore et al. MS1995) (Table 2). Individual recreational quotas remained in effect: daily limits of 2 small salmon kept (<63cm fork length) and a maximum of 8 kept for the year, hook and release only of all large salmon (>= 63 cm fork length). There were numerous river closures in 1995 resulting from low water levels (Table 2). The Northwest Miramichi (upstream of the confluence with the Little Southwest Miramichi) was closed to angling on August 10, pending a resolution of the Big Hole Tract conflict, and reopened on September 20. An extended hook and release angling fishery for the period Oct. 1 to 15 was approved for the stretch of the Southwest Miramichi River between Doaktown and Deersdale bridge (a length of about 75 km) contingent on sufficient water levels to promote the movement of fish into the headwater spawning areas. The fishery never opened because of insufficient water levels and lack of movement of fish, as monitored at the Southwest Miramichi protection barrier.

To prevent the excessive harvesting of salmon in the Big Hole Tract waters (Fig. 1), outside the food fishery agreement, a protection barrier (small mesh barrier net) was installed on July 5 to prevent the migration of salmon upstream. The barrier net was removed on September 13.

### Aboriginal Food Fisheries

The catches by size and week are summarized in Table 3. 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. Small salmon harvests were divided 60% from the Northwest Miramichi and 40% from the Southwest Miramichi River. Reported harvests from food fisheries in the Northwest Miramichi in 1995 were 172 large salmon and 1795 small salmon. A total of 1170 small salmon were harvested from the Southwest Miramichi. These harvests are exclusive of those taken as food outside areas specified in the Aboriginal Communal Fishing licenses. The extent of these unreported harvests is unknown.

Gillnets in the Northwest Miramichi accounted for 18% of the large salmon harvests and 4% of the small salmon harvest. The Eel Ground First Nation released all the large salmon from the food fishery trapnets (549 salmon) and 3% of the small salmon catch (47 of 1842 small salmon). The Red Bank First Nation released 84% of the large salmon catch (722 of 863 large salmon) and 23% of the small salmon catch (333 of 1433 small salmon). Food fishery harvests from the estuary by Burnt Church First Nation were low in 1995, 39 small and 13 large salmon; all were taken by gillnets (Table 3). The food fisheries mainly targeted the early run; 98% of the large salmon and 80% of the small salmon were harvested before September 1 (Table 3). The Aboriginal food fishery harvests in 1995 represented an increase of 76% for small salmon and a decrease of 50% for large salmon relative to the previous 5-year mean (Table 4).

**Recreational Fisheries**

Angling catch data have in the past been available from two sources: FISHSYS (mail-out survey after season closure of part of the angling license holders) 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 data for 1995 were not available at the time of preparation of this document (Table 5, Fig. 2).

Historical catches from the Miramichi River and for each branch are summarized in Figure 2. Large salmon catches (kept and released) in the Miramichi peaked in 1986 and have since declined to just over 5,000 salmon per year, similar to 1978 to 1984 levels (Fig. 2). Small salmon catches fluctuate annually, having peaked in 1988 at almost 31,000 fish and since declining to under 15,000. 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 peaked in 1986 and have steadily declined to under 5,000 fish per year.

The Crown Reserve waters of the Northwest Miramichi are regulated in terms of effort. Total effort in 1995 was the lowest since 1972 and was down 26% relative to the previous 5-year average (Fig. 3 and Table 5). Catches of small salmon were also the lowest ever and were down 58%. Large salmon catches were the third lowest since 1972 and were down 24%. The effort and catch of small salmon was down the most in the Sevogle and Northwest Miramichi crown reserve stretches; these stretches were affected by the barrier installed below Big Hole Tract on July 5 and the closure to angling on Aug. 10. The Little Southwest Miramichi effort would have been affected by the Aug. 10 closure as well but it reopened on Aug. 26. River closures in 1995 resulted in 540 fewer rod days available (-17%) for use by Crown reserve anglers. There was also a season extension to Sept. 15 (from the regular Aug. 31 closure) for the Little Southwest crown reserve stretches in 1995. The extension was already in place at the start of the season (June 10).

Quarryville Pool Creel Survey

A creel survey was conducted at Quarryville Pool during the period July 12 to Oct. 15. Quarryville Pool is the first pool on the Southwest Miramichi and is located at the confluence of the Renous River and the Southwest Miramichi (Fig. 1). The objectives of the survey were to quantify the variation in catches and effort over the season and to estimate the proportion of the angled catch which were adipose-clipped (fish of satellite rearing or semi-natural pond rearing origin). Angling activity for the entire pool could be easily monitored from a vantage point on the northeast bank. Monitoring occurred from 600 to 2200 hrs every day of the week. Angling effort (hours of fishing activity) was estimated by counting the active rods in the pool every fifteen minutes and these quarter hour estimates of effort were summed to give effort for the entire day in terms of hours fished. Total small salmon kept, small salmon released and large salmon released were obtained by direct observation of activity in the entire pool. Part of the small salmon catch (those small salmon landed on the same side of the river as the creel clerk) was sampled for the presence of a carlin tag and the presence of the adipose fin.

The total average daily fishing effort was lowest in August (53 hours) and highest in September (179 hours). There were large fluctuations in daily effort during the season (Fig. 4). The catch of small salmon was 202 kept and 10 released. Of the 155 small salmon sampled by the clerk, 10 had carlin tags and only one had an adipose clip. The number of large salmon released was 95 of which at least 4 had been tagged (tag reported to clerk by anglers).

The catch of small salmon in 1995 was only one-third of the catch estimated by creel survey for approximately the same time period in 1993: 644 small salmon kept, 30 released (Chaput et al. MS

1994b). Large salmon catch in 1995 was almost as high as in 1993 (116 large salmon released). Small salmon catches in 1995 compared with 1993 were especially low in August through October (Fig. 4). Large salmon catches in 1995 were very low in July and August but higher in October than observed in 1993 (Fig. 4). The distribution of effort in both years was more similar than the catches; about 50% of the effort for the year occurred after September 1 (Fig. 4). In both years, the survey began more than one month after the opening of the angling season (first week of June).

Timing of Harvests

Recreational fisheries exploit both the early and late runs. The small salmon catch from the Miramichi River has been historically comprised of 81% early and 19% late (after Aug. 31) run whereas 74% of the large salmon catch is taken in the summer (Moore et al. MS1995). These proportions differed for the two major branches. Catches in the Northwest tend to be high from the early run whereas Southwest catches are only slightly higher in the early season: 75% of large and 83% of small for the Northwest, 56% of large and 61% of small for the Southwest.

A smaller proportion of total tags released in 1995 were returned by anglers compared to previous years but the slightly higher return rate of July tags in 1995 is similar to that observed in 1992 and 1993. Exploitation has generally been heaviest on the early run fish and decreases progressively for September and October tag groups.

| Percent of tags returned from fish marked in each month | | | | | |
|---|---|---|---|---|---|
| Grilse | June | July | August | September | October |
| 1992 | 16% | 16% | 10% | 9% | 6% |
| 1993 | 11% | 14% | 13% | 8% | 5% |
| 1994 | 6% | 6% | 6% | 8% | 2% |
| 1995 | 3% | 5% | 4% | 3% | 2% |

The lower proportion of tags returned by anglers in 1994 and 1995 may in part be attributed to a change in tag return compensation. Prior to 1994, a $10 reward was paid for each tag returned. In 1994, angling badges rather than monetary rewards were given out and in 1995, a lottery with cash prizes ranging between $50 and $1000 was initiated. The changes in 1994 and 1995 were introduced in response to program reductions. Low tag returns in 1994 and 1995 may also correspond to reduced availability of fish to angling resulting from low water levels.

## TARGET

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. Since large salmon have a high proportion of females (greater than 80%) wherease the small salmon are mostly males (less than 20% female), a small salmon requirement is used to provide a minimum theoretical 1:1 sex ratio on the spawning grounds at the conservation level.

| | 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 |

## RESEARCH DATA

Data collected in 1995 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). The Southwest Enclosure trapnet and the Northwest Eel Ground Index trapnet were the main tagging trapnets. An upstream trapnet on the Southwest Miramichi (Millerton, Fig. 1) was used for tagging and recapture. Additional tagging in the Northwest and Southwest Miramichi was conducted at the food fishery trapnets operated by Eel Ground First Nation. The Red Bank trapnets were the main recapture gear for the Northwest Miramichi. 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 6.

The trapnets, with the exception of the Eel Ground food fishery trapnets, were constructed of 5.5 cm stretched mesh, knotless twine. The leaders were constructed of 12.5 cm knotted stretched mesh. The leaders at the Red Bank trapnets were constructed of 7.5 cm knotted stretched mesh twine. The Eel Ground food fishery trapnets and leaders were constructed of 5 cm knotted stretched mesh. The nets were identical to those used in 1994.

Salmon were marked with individually numbered blue Carlin tags (dimensions 9.5 mm X 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 6). The number of tags placed and the time and location of recaptures, by size group and month, at each of the tagging facilities in 1995 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, tag numbers of marked fish, and sex ratio of salmon.

Voluntary returns of tags from the angling fishery were used to describe the emigration of tagged fish outside the branch where they were originally marked (Appendix 2).

**Juvenile Surveys in the Miramichi River**

Electrofishing surveys were conducted at 36 sites (17 in the Northwest Miramichi and 19 in the Southwest Miramichi) between August 14 and September 26 1995, 13 of which have been sampled every year since 1970, except for 1991 (Fig. 5). A combination of open (26 in total) and closed (10 in total) sites was used. The density of salmon juveniles at closed sites was estimated using the successive removal method. Sites were closed using upstream and downstream fine-mesh barrier nets. Population estimates were obtained by the Zippin method (Zippin 1956). Open sites, fished in a manner similar to 1993 and 1994, provide an estimate of abundance based on catch per 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 one metre wide by 0.75 metre high lip seine, and a third person with the fish holding bucket and dipnet. The amount of fishing effort was recorded from the timer on the shocker unit and represents the total seconds of actual shocking time. Catch per effort was transformed to density (number of fish·100 $m^{-2}$) by calibrating the open site technique within the closed site (see Chaput et al. 1995). Percent habitat saturation (PHS) values were calculated for each site (Grant and Kramer 1990). The procedure is more fully described in Moore et al. (1996).

All fish were identified to species and measured for length (fork length except lamprey and American eel for which total length was recorded). At several sites, whole weights to the nearest 0.1 g were obtained using a portable electronic balance. Large eels were counted but not measured. Fish were anesthetized, using sodium bicarbonate salts, before measuring.

**Hatchery Stocking**

Various life stages are reared and stocked annually to the Miramichi River. Satellite rearing was initiated in 1984 and in 1995 a total of 80,000 young-of-the-year were distributed to satellite facilities and reared for release as fall fingerlings (Table 7). Smolt stocking is also an important component of the hatchery program. Over 27,000 2+ smolts were released to the Dungarvon River (Southwest Miramichi) in 1995 and 2,700 2+ smolts were released to Little River (Northwest Miramichi). Smolt releases to the Northwest Miramichi were negligible in 1995 because the approximately 30,000 smolts reared in the semi-natural ponds during 1994 tested positive for bacterial kidney disease and were destroyed. Unfed fry releases to the Northwest Miramichi consisted of 75,000 to the Sevogle River (Northwest Miramichi), 165,000 to the Little Southwest (Northwest Miramichi) and 40,000 to the Dungarvon River (Southwest Miramichi) (Table 7). Detailed descriptions of releases by date, location and life stage are available in

Appendix 3. All releases into the Miramichi, except for unfed fry and about 150 fall fingerlings stocked to the Renous River, were marked with an adipose fin clip before release (Table 7, Appendix 3).

Broodstock collections in 1995 consisted of 50 large salmon and 37 small salmon from the Southwest Miramichi, 16 large salmon and 79 small salmon from the Northwest Miramichi (Table 8).

## ESTIMATION OF STOCK PARAMETERS

### Estimation of Returns

The objectives of the assessment were to estimate the returns to each branch for early and late run periods. If seasonal stratification was not possible, then estimates to each branch for the whole year were obtained. Seasonal stratification was not possible for large salmon in the Northwest Miramichi because only one large salmon was recaptured at Red Bank during June to August. The returns to the Miramichi River were estimated from the sum of the returns to each branch.

There are two approaches to estimating returns to each branch:

1 - calculate returns to each branch separately by adjusting the tags available for recapture based on the emigration rate estimates described below, or

2 - use spatially-stratified estimators to estimate returns to each branch, and the total, simultaneously.

The tag and recapture matrices differ between the two methods (Table 9). In the first approach, fish tagged at Millerton in the Southwest Miramichi and recaptured at the Red Bank (Northwest Miramichi) trapnets can be used. These additional recoveries (21 small salmon and 10 large salmon, Appendix 2) represent 34% of the small salmon recaptures and 30% of the large salmon recaptures at Red Bank. These data would be ignored in method 2 because the Millerton trapnet would be treated exclusively as a recapture trapnet. Method 2 is attractive because it directly calculates the emigration rates. These emigration rates, based on trapnet recoveries, do not necessarily correspond to the rates obtained using angling recoveries.

There are two stratified estimators available: the Schaefer model (Ricker 1975) and the Darroch model (Arnason et al. 1995). Recent studies have indicated that the Schaefer model is unbiased if there is either constant capture rates or constant recovery rates (in temporal stratification, this would mean either constant tagging proportion or constant recapture probabilities in early and late runs) (Arnason et al. 1995). Under these conditions, the authors indicated that the pooled Petersen estimator is also unbiased and more precise (usually because it uses the aggregated recaptures). The Darroch model does not require the rigid assumptions of the pooled Petersen and Schaefer model. It will be less biased but also less precise than the pooled Petersen when the probability of capture or recapture varies but the reduced biasedness outweighs the loss of precision (Arnason et al. 1995). Unfortunately, the Darroch model does not always produce valid results (capture probabilities in some strata can be negative) especially under conditions of small sample sizes (recaptures in strata frequently 0 or less than 5). For comparative purposes and as an indicator of important assumption failures, we calculated the Schaefer and Darroch stratified estimates as well as the pooled Petersen estimates. As a confirmation of the estimated returns to each branch and to the Miramichi River, the Darroch and Schaefer models were fitted to the spatially-stratified matrix. The matrices used for both approaches are summarized in Table 9. The Darroch model could not provide valid parameter estimates for the combined temporal and spatial stratifications.

Only marks placed up to and including Oct. 15 are considered to be available for recapture. Tagging in the Southwest finished on Oct. 19 while in the Northwest, the last day of tagging was Oct. 15. The recapture trapnets in the Northwest Miramichi fished until Oct. 13, the upper trapnet on the Southwest Miramichi fished until Oct. 20. 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. .

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 - In 1995, salmon with tagging scars were recorded at recapture trapnets in the Northwest (3 small salmon, 1 large salmon at Red Bank) and Southwest (5 small salmon, 1 large salmon at Millerton). 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 does occur because in the fall of 1995, two salmon were caught at the trapnets with artificial flies embedded in the jaw. Since all fish at the trapnets are examined for tags and tagging scars, marked fish at the recapture facilities were considered as known without error.

2 - In the 1994 tag retention experiment, none of the tagged broodstock fish held for about 60 days had shed their tags in the hatchery tank. This result was similar to the 1992 experiment on small salmon (Courtenay et al. MS1993). Similar experiments conducted for the Margaree River assessment indicated that tag shedding for large salmon was in the order of 1% per day (Chaput et al. MS1994a). 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). Mortalities of tagged fish (2 large salmon and 1 small salmon) were recorded in the river in 1995 (Appendix 2). 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).

3 - Tagged fish frequently migrated out of the branch in which they were tagged (Appendix 2). The emigration rate of marked fish out of the branch where they were tagged was calculated using recaptures from angling (Chaput et al. MS1995). If we assume that the reporting rate of tags from the angling fisheries in the Northwest and Southwest branches are identical (but unknown), and that the return rate (RR) of tags through the mail is a function of the exploitation rate factored by the tag reporting rate, then we can estimate the rate of emigration using the following equations:

$$\frac{NW_{NW}}{RR_{NW}} + \frac{NW_{SW}}{RR_{SW}} = Total\ Tags_{NW}$$

$$\frac{SW_{NW}}{RR_{NW}} + \frac{SW_{SW}}{RR_{SW}} = Total\ Tags_{SW}$$

where $NW_{NW}$ = Northwest tags returned from Northwest Miramichi angling (known),
$NW_{SW}$ = Northwest tags returned from Southwest Miramichi angling (known),
$RR_{NW}$ = return rate of tags angled in the Northwest Miramichi (unknown),
$RR_{SW}$ = return rate of tags angled in the Southwest Miramichi (unknown),
$Total\ Tags_{NW}$ = total tagged fish released in the Northwest Miramichi (known),...

The solutions to these two linear equations are obtained by inverting the recapture matrix followed by multiplication of the tagged vector (Table 10).

Angling tag returns of both small and large salmon up to Oct. 15 were used to estimate the emigration rates (Table 10) because:

1 - we need to estimate emigration rates for both size groups,

2 - large salmon emigration rates could not be estimated because of insufficient returns of large salmon tags,

3 - sample sizes were insufficient in early and late periods to provide emigration rate estimates.

The point estimates and the resampling estimates for small and large salmon emigration in 1995 were:

| | Emigration rate to other branch | | |
|---|---|---|---|
| Origin | Point Estimate | Resampling median | 90% C.I. |
| Southwest | | | |
| Enclosure | 0.264 | 0.243 | 0.009 to 0.830 |
| Millerton | 0.081 | 0.081 | 0.009 to 0.273 |
| Northwest | 0.359 | 0.331 | 0.019 to 0.608 |

The uncertainty around the estimation of returns consists of two or three 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 of the emigration rate was estimated by resampling within the rows of the observed matrix of angling returns, the rows representing the tag returns from either the Northwest or Southwest Miramichi with tagging origin as the columns. Prior probabilities of tag origin were set at the observed proportions in the tag returns from angling.

3 - 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 total catches at the trapnets was set at the observed proportion for each tag release stratum. Recoveries were also assigned to one of the temporal strata at the recapture nets based on the observed distribution of recoveries.

For the spatially-stratified approach which did not use the emigration rate component, only tag loss and the stochastic variation in recaptures (1 & 3) were considered.

Returns by size, season and branch were obtained using a resampling technique as follows:

Step 1: select a tag loss/tag mortality factor, estimate emigration rate, 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 (2000 replications were performed).

Step 4: summarize distribution of returns from step 3.

Returns to the Southwest Miramichi in 1995

An estimated 30500 small salmon returned to the Southwest Miramichi in 1995 with a 95% probability that the returns were more than 10400 fish (Table 11, Fig. 6). By season, just under 18000 small salmon returned early and 12000 returned in the late run. Large salmon returns were estimated at 17100 fish with a 95% probability that the returns were at least 5661 fish (Table 11, Fig. 7). Just over 3100 large salmon returned early and 13900 returned in the late run. Estimates using the pooled Petersen and the Darroch models were generally close to the Schaefer estimated values (Table 11).

The large salmon returns to the Southwest Miramichi estimated with the spatially stratified matrix were not obtainable with the Darroch model (negative population values were obtained more than 10% of the time) whereas the Schaefer estimate for the Southwest was 20928 fish, 22% higher than the estimate using the emigration rate procedure (Table 11). Small salmon estimates from the Schaefer model were 23% lower than the corresponding estimates from the emigration rate procedure while the Darroch model

estimated returns which were 49% lower than the Darroch derived values from the emigration rate procedure. The coefficients of variation (CV) of the Schaefer derived estimates were about 10%.

The overall efficiency of the Millerton recapture trap was similar for small salmon but higher for large salmon than in 1994.

| | Catch | Return | Efficiency | 1994 efficiency |
|---|---|---|---|---|
| Small salmon | 2362 | 30500 | 7.7% | 7.9% |
| Large salmon | 1503 | 17100 | 8.8% | 6.9% |

Alternate estimates of the efficiency of the Southwest Miramichi recapture trapnet were obtained from sampling at the Renous partial fence. After adjusting for emigration and tag loss factors, the efficiency of the Millerton trapnet was estimated at 7.9% for small salmon and 8.6% for large salmon. These values are essentially identical to those calculated using tag recoveries at Millerton (see above).

Returns to the Northwest Miramichi in 1995

About 21700 small salmon returned to the Northwest Miramichi in 1995 with a 95% probability that the returns were more than 7100 fish (Table 11, Fig. 6). By season, just under 10600 small salmon returned early and 11000 returned in the late run. Large salmon returns were estimated at 15200 fish with a 95% probability that the returns were at least 7752 fish (Table 11, Fig. 7). Early and late returns of large salmon were estimated directly from the timing of the large salmon catches at the Red Bank trapnets, less than 20% early. Estimates using the pooled Petersen and the Darroch models were generally close to the Schaefer estimated values for small salmon (Table 11).

With the spatially-stratified matrix, the large salmon returns to the Northwest Miramichi were estimated at just under 13000 fish with the Schaefer model and 24329 fish with the Darroch model (Table 11). Compared to the emigration-rate-derived procedures, the Schaefer estimate was 16% lower and the Darroch estimate was 60% higher. For small salmon, the Darroch estimates from the spatially stratified matrix were identical to the emigration rate derived value but the Schaefer estimate was 26% lower (Table 11). The CVs of the Schaefer-derived estimates were also low, about 10%.

As with the Southwest Millerton trapnet, the overall efficiency of the Red Bank recapture trapnets (2) was similar for small salmon but higher for large salmon than in 1994.

| | Catch | Return | Efficiency | 1994 efficiency |
|---|---|---|---|---|
| Small salmon | 1402 | 21684 | 6.5% | 6.7% |
| Large salmon | 851 | 15196 | 5.6% | 3.9% |

Returns to the Miramichi River in 1995

In 1995, 32600 large salmon and 52200 small salmon returned to the Miramichi River (Table 11, Fig. 6, 7). With the spatially-stratified matrix, the large salmon returns to the Miramichi were estimated at just under 34000 fish with the Schaefer model and 38700 fish with the Darroch model (Table 11). The Darroch calculation for the Miramichi was not useful because of its extremely high CV. The Schaefer derived estimate was identical to the value obtained from the emigration rate procedure (4% higher). For small salmon, the Darroch and Schaefer model estimates were essentially identical, about 40000 fish but about 23% lower than the emigration-rate-derived values. The precision was much better (CV's between 9% and 12% compared to CV's of 28% to 39% from the emigration rate procedure) and there was only a 5% chance that returns of small salmon to the Miramichi were under 34000 fish. On the other hand, there was only a 5% chance that the returns were greater than 46000 or 49000 from the spatially stratified matrix approach.

We have chosen the emigration-rate-derived values for the estimation of returns in 1995 because the estimates obtained with the spatially-stratified approach assume that fish recovered at the recapture

trapnets are all destined to stay in that branch. From the 1994 tagging study (Chaput et al MS1995) and the recoveries of fish tagged at the Millerton trapnet in the Red Bank trapnets in 1995, we know that this is not true. There was no difference in the large salmon estimates but the small salmon estimate which we chose is about 30% higher than indicated by the spatially-stratified matrix. We do acknowledge that the estimation of the emigration rates using the angling recoveries is not perfect. Preliminary simulations indicate that when the emigration rates from the two branches are identical regardless of relative run size, the estimated emigration rates are unbiased. When the emigration rates are different, there is a tendency to underestimate the higher rate and overestimate the lower rate. Small sample size (low tag return rate) reduces the precision (G. Chaput, unpublished data). The less precise estimates derived from the emigration rate procedure result from the uncertainty introduced by the estimates of emigration rates which are not part of the spatially-stratified procedure.

**Estimation of Egg Depositions in 1995**

The estimated egg depositions in 1995 are obtained from the estimates of the escapement of small and large salmon and their respective observed biological characteristics in 1995.

Escapement in 1995

The escapement of salmon refers to fish which were not harvested in fisheries or otherwise removed from the river. Known losses are included; seizures in nets, reported mortalities in the river. Removals also include broodstock collections, scientific sampling, and incidental mortalities at the tagging trapnets (Table 12).

The total harvests and removals of salmon from the Miramichi River in 1995 were 20061 small salmon and 559 large salmon (Table 12). Total removals in the Northwest Branch were 7546 small salmon and 263 large salmon while Southwest Branch removals were 12477 small salmon and 283 large salmon.

The point estimates of escapements of small and large salmon in each branch by season are summarized below.

| | | Returns to recapture trapnets | Harvests below recapture trapnets | Total returns | Total removals | Escapement |
|---|---|---|---|---|---|---|
| **Northwest Miramichi** | | | | | | |
| Small | Early | 10,595 | 693 | 11,288 | 6,163 | 5,125 |
| | Late | 10,810 | 2 | 10,812 | 1,383 | 9,429 |
| | Total | 21,684 | 695 | 22,379 | 7,546 | 14,833 |
| Large[1] | Early | 2,735 | 31 | 2,766 | 249 | 2,517 |
| | Late | 12,460 | 0 | 12,460 | 14 | 12,446 |
| | Total | 15,196 | 31 | 15,227 | 263 | 14,964 |

| | | Returns to recapture trapnets | Harvests below recapture trapnets | Total returns | Total removals | Escapement |
|---|---|---|---|---|---|---|
| **Southwest Miramichi** | | | | | | |
| Small | Early | 17,895 | 1,148 | 19,043 | 8,435 | 10,608 |
| | Late | 12,045 | 22 | 12,067 | 4,042 | 8,025 |
| | Total | 30,505 | 1,170 | 31,675 | 12,477 | 19,198 |
| Large | Early | 3,170 | 0 | 3,170 | 207 | 2,963 |
| | Late | 13,866 | 0 | 13,866 | 76 | 13,790 |
| | Total | 17,097 | 0 | 17,097 | 283 | 16,814 |
| **Miramichi River** | | | | | | |
| Small | Total | 52,241 | 1,904 | 54,145 | 20,061 | 34,084 |
| Large | Total | 32,583 | 44 | 32,627 | 559 | 32,068 |

[1] returns of large salmon in the Northwest Miramichi early and late are based on the timing of the catches at the Red Bank recapture trapnets which were 18% of total up to Aug. 31 and 82% of total after.

Biological Characteristics of Salmon in 1995

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 whereas only external determinations of sex were obtained for the large salmon. Additional sex ratio information was obtained from the broodstock seining samples.

Sex ratios

The percent female in the small salmon component was significantly higher in the early run than in the late run for both Southwest and Northwest samples (Table 13). The sex ratios of small salmon were similar in the two branches for both the early and late runs: 32% female in the early run and 12% female in the late run. Large salmon were mostly female in both the Northwest and Southwest branches. The early run salmon had a higher percent female component (94%) than the late run (88%) (Table 14). The proportion female observed in 1995 is higher than the 80% female observed in 1994 (Chaput et al. MS1995). Broodstock seining samples generally supported the sex ratios observed at the trapnets (Table 15). There was an anomalously high female proportion observed in the small salmon samples from the Little Southwest Miramichi. Such high female proportions (60%), also observed in the Little Southwest in 1994 (Chaput et al. MS1995), may suggest that only June and July fish had managed to reach the upper stretches or that the upper Little Southwest is primarily a 1SW salmon stock (such stocks tend to have a high female proportion) (Porter et al. 1986).

Size and age

The early runs in both the Northwest and Southwest Miramichi were dominated by small salmon (Table 11, Fig. 8, 9). In the Northwest Miramichi, small salmon represented 79% of the returns compared to 85% of the returns to the Southwest. In the late run, large salmon were more abundant in both the Northwest and Southwest branches (54% of all fish). Small salmon in the fall run were slightly longer than in the early run but the average fork length of the large salmon decreased slightly (Table 16). Based on an age-length key, previous spawners made up just under 20% of the large salmon in both branches. In the 1994 return, a similar age-length analysis indicated that previous spawners comprised 28% to 30% of the returns. Age determinations of the 1994 samples indicated that previous spawners represented 25% of the large salmon returns in the Southwest Miramichi and 30% in the Northwest.

Egg depositions in 1995

In the Northwest Miramichi, almost four times as many eggs were contributed by the late run fish as compared to the early run (Table 17). The late run in the Southwest accounted for three times the eggs of the early run. Large salmon contribute the largest proportion of the eggs in both the early (66% to 78%) and late runs (over 95%) in each branch. Early run small salmon have the potential to be a more important contributor to the egg depositions (proportionally larger returns than in the fall, higher proportion of females) but because of the larger removals of small salmon in the early run, the resultant early run escapement was lower than the fall run. In the Miramichi River overall, large salmon contributed more than 88% of the total egg depositions (Fig. 10, Table 17).

## STATUS OF STOCK

Total egg depositions to the Miramichi by large salmon were 157% of target, with a greater than 99% probability of having met or exceeded the target. Egg depositions by both small and large salmon were 178% of target, with a greater than 99% probability of the target having been met or exceeded.

The average returns and escapements of small salmon to the Miramichi since 1986 are higher than the average of the previous years (Table 18, Fig. 11). The return in 1995 of 54,145 small salmon is 39% below and 16% below the previous 5-year and historical (1971 to 1994) average returns to the river, respectively. The escapement of small salmon was 41% below the 5-year average and 12% below the historical average. The large salmon returns were 7% below and 1% above the previous 5-year and historical averages respectively. The large salmon escapement was 5% below but 38% above the 5-year and historical averages, respectively (Fig. 11, Table 18). Since 1990, large salmon returns have averaged 32000 fish, a 52% increase from the average return between 1984 and 1989 (21000) (Fig. 11).

Egg depositions to the Miramichi River have been met or exceeded every year since 1985 (Fig. 12). Conservation requirements (2.4 eggs per $m^2$) have been met by large salmon alone every year since 1990. Large salmon egg depositions equalled or exceeded the conservation level in only four years between 1971 and 1989. The relative contribution of small salmon to the total egg depositions in the Miramichi in 1995 was 12%. 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. 12).

In the Southwest and Northwest branches, returns of small salmon have declined since 1992 but 1994 and 1995 returns are similar. Large salmon returns have declined since 1992 in the Southwest but have continued to increase in the Northwest Miramichi.

| | Small salmon | | Large salmon | |
|---|---|---|---|---|
| | Median | 5th to 95th Percentile | Median | 5th to 95th Percentile |
| **Southwest Miramichi** | | | | |
| 1992 | 120,701 | 85,263 to 157,794 | 25,028 | 17,657 to 32,744 |
| 1993 | 42,600 | 22,700 to 73,800 | 21,900 | 10,800 to 58,900 |
| 1994 | 33,775 | 23,450 to 54,150 | 14,000 | 9,100 to 22,850 |
| 1995 | 31,675 | 11,580 to 46,512 | 17,097 | 5,661 to 24,150 |
| **Northwest Miramichi** | | | | |
| 1992 | 30,321 | 23,040 to 40,864 | 10,000 | - |
| 1993 | 46,200 | 27,700 to 97,500 | 10,541 | 3,700 to 37,500 |
| 1994 | 20,600 | 11,750 to 38,525 | 12,600 | 6,450 to 31,300 |
| 1995 | 22,379 | 7,795 to 33,290 | 15,227 | 7,783 to 31,481 |

A total of 108.5 million eggs, 123% of target, were deposited by large salmon in the Southwest Miramichi in 1995. There was a 71% probability that the egg depositions by large salmon in the Southwest Miramichi exceeded the target (Fig. 13). Egg depositions by both small and large salmon were 139% of target, with a 81% probability of having met or exceeded the target.

In the Northwest Miramichi, 96.8 million eggs were contributed by large salmon (236% of target) (Table 18). There was a 95% probability that the target egg deposition was exceeded by large salmon alone (Fig. 13). Egg depositions by small and large salmon were 265% of target with a 99% probability of having met or exceeded the target.

Egg depositions in both the Northwest and Southwest branches have exceeded the conservation levels every year since 1992 (Fig. 12). Large salmon egg depositions exceeded the target in three of the four years. Small salmon have contributed slightly more to the total egg depositions in the Southwest Miramichi (mean = 18%) than in the Northwest Miramichi (mean = 14%).

**Headwater Barrier Fences**

Large and small salmon have been enumerated at headwater barrier fences on the Southwest branch (North Branch of SW Miramichi, Dungarvon River) since 1981 and on the Northwest branch (Northwest Miramichi River) since 1988 (Table 19). The fences are operated for varying periods each year but generally cover the entire migration period. The trend in the counts of large salmon in 1995 at the barrier fences of the Southwest Miramichi were contradictory; at the Southwest Miramichi fence, counts of large salmon were 12% higher than the previous 5-year mean but at the Dungarvon barrier, the large salmon counts were down by 58% (Table 19). Small salmon counts were down at both barriers.

Returns of large salmon at the Northwest Barrier were the highest observed since 1990 but relatively unchanged (+3%) from the previous 5-year average (Table 19). Small salmon counts were the lowest recorded since the beginning of operations in 1988, 45% below the previous 5-year average. Counts of small and large salmon at Catamaran Brook, a mainly fall-run tributary, were the highest for large salmon and the second highest for small salmon since 1990 (Table 20).

All the barrier and counting fences on the Miramichi, except for the Dungarvon Barrier, indicated that large salmon returns were similar to or above returns since 1992. Small salmon counts at all the headwater barriers were the lowest observed since 1991. Only Catamaran Brook received higher

numbers of small salmon. These trends are similar to the trends in returns estimated using mark and recapture experiments at the estuarine trapnets.

## ECOLOGICAL CONSIDERATIONS

### Seasonal and Environmental Conditions

The Southwest Miramichi River received relatively normal flow conditions between January and May 1995 but flows were deficient (in the lower quartile) for the months of June to October (Caissie MS1996). A record low monthly discharge was observed in July while in November an excessive (in the upper quartile) flow condition occurred (Caissie MS1996). The lowest daily discharge recorded on the Miramichi in 1995 occurred on August 23 and was equivalent to a 15-year low flow event.

Surface water temperatures in tidal waters at the index trapnets on occasion peaked above 25°C but the average temperatures never exceeded 25°C (Fig. 14). Bottom temperatures in the estuary were cooler than surface temperatures, especially during the last half of June and in late July, early August. Temperatures at the Southwest Miramichi headwater barriers were on average 4°C cooler than in the estuary but the Northwest barrier temperatures were on average more than 6°C cooler throughout the summer (Fig. 14).

### Timing and Movements of Salmon in 1995

Run timing of salmon at the recapture trapnets in the Northwest Miramichi (at Red Bank) and in the Southwest Miramichi (at Millerton) was nearly identical in 1995 (Fig. 15). The small salmon movements were earlier than the large salmon; by Aug. 31, about 40% of the small salmon for the year had been counted as compared to only 18% of the large salmon. Comparable values are available for the Millerton trapnet in 1994 when 16% of the count of large salmon and 36% of the small salmon had been sampled by Aug. 31 (Chaput et al. MS1995). Large salmon tagged in the early-run had a more delayed migration upriver than the small salmon (Table 9). For large salmon, 93% of the Red Bank recaptures of early-run tagged salmon and 63% of the Millerton recaptures of early-run tagged salmon were recovered after September 1. For small salmon, about 60% of the early-run tagged fish were recovered at the recapture trapnets prior to Sept. 1. With improved water conditions in the late fall, rapid upstream movements of salmon were observed. Both small and large salmon marked in the estuary in October were recaptured at the Southwest Miramichi barrier fence that same month with a large salmon covering the distance (more than 150 kms) in 12 days.

The low flow conditions encountered in June through October had a dramatic effect on the movements of salmon through the Southwest Miramichi barrier where more than 90% of the large salmon and 75% of the small salmon were counted after Oct. 9 (Fig. 16). At the Dungarvon River barrier, the movements of small and large salmon were relatively early compared to previous years, 95% of the large salmon and 90% of the small salmon had been counted through by the end of July with essentially no fish moving in August to the middle of October (Fig. 17). The Dungarvon Barrier was removed on Oct. 13 although in previous years, very few fish ascended into the barrier late in the season. Low water conditions also affected the movements of salmon through the Renous partial fence: for the period 16 June to 26 September, 69% of the small salmon and 51% of the large salmon were counted in the month of July, and only 7% of the small salmon and 14% of the large salmon were counted in September (Appendix 2). Relatively early movements of large salmon and small salmon were also observed at the Northwest Miramichi barrier followed by almost three months with relatively no movement of large salmon and a dribble of small salmon (Fig. 18). The movements of salmon through this barrier should have been impacted by the protection barrier net installed below Big Hole tract. This net held back all the salmon in the Northwest Miramichi from July 5 to Sept. 13. Considering the extremely low water levels observed in the Northwest Miramichi (although not monitored, levels were determined to have been as

low as those recorded in the Southwest Miramichi), upstream migrations of salmon after July would have been minimal.

**Spawner Distribution and Habitat Utilization**

In 1994, spawning occurred throughout the Northwest and Southwest Miramichi. At 71% of the sites in the Northwest, fry densities were greater than 50 fish per 100 $m^2$ (Fig. 19). No fry were observed at three sites in the Northwest Miramichi:

1 - salmon did not spawn at the Catamaran Brook site (number 46) in 1994 because a beaver dam blocked access to spawners (R. Cunjak, pers. comm.),

2 - Cave Brook, tributary of North Pole Stream, is inaccessible to anadromous salmon but non-feeding fry were stocked there in 1994,

3 - Tuadook River, in the headwaters of the Little Southwest Miramichi, had minimal spawning activity as evidenced by no fry and only one fry sampled at an adjacent site.

At those locations where fry were found, densities in the Northwest averaged 75 fry per 100 $m^2$ (Fig. 19). Parr densities were above 30 per 100 $m^2$ at 5 of 17 sites and averaged 36.8 fish per 100 $m^2$ (Fig. 19). Elson (1967) had indicated that parr densities of 38 fish per 100 $m^2$ (24 small parr and 14 large parr) were normal average values for New Brunswick rivers producing 3-year old smolts and normal average fry densities were in the order of 29 per 100 $m^2$ (Elson 1967). Percent Habitat Saturation (PHS) values ranged between 16 and 54.5 (mean = 28.8) for the whole Northwest Miramichi. A PHS value of 28 is used as a reference point for acceptable habitat use; it represents the value at which density dependent effects have a 50% probability of being expressed at the site (Grant and Kramer 1990). PHS values at the Little Southwest Miramichi sites averaged 24.9, slightly less than the 32.2 value for the remaining Northwest Miramichi sites.

Spawning had occurred in the vicinity of all the sites in Southwest in 1994; fry densities were greater than 50 per 100 $m^2$ at all 19 sites sampled (Fig. 20) and averaged 145 per 100 $m^2$. Parr densities were also high, greater than 30 per 100 $m^2$ at 11 of 19 sites (58%) and averaged 42 parr per 100 $m^2$. PHS values were above 30 at 10 of the 19 sites, averaging 36.6 (range 8.3 to 92.1).

Spawning had also occurred throughout the Miramichi River in 1991 to 1993 (Chaput et al. MS1994b, MS1995).

PHS values have increased at the index sites since 1970 (Fig. 21) corresponding to an increase in juvenile production resulting from higher egg deposition and/or higher survival in the river.

## FORECAST/PROSPECTS

### Short Term

A non-parametric model (probability density function) has been used to forecast the large salmon returns based on the small salmon returns in the preceding year (Claytor et al. MS1991, Claytor et al. 1992) (Fig. 22). Based on this relationship and a 1995 return of small salmon to the Miramichi of 54000 fish, the 1996 forecast for large salmon returning to the Miramichi is 30,507 with a 81% probability of meeting spawning requirements (23,600 large salmon). This model, used since 1992, has tended to underestimate the observed returns:

| Forecast year | Forecast value | Actual return | %(Predicted-Actual)/Actual |
|---|---|---|---|
| 1992 | 29,000 | 37,000 | -22% |
| 1993 | 18,315 | 35,200 | -48% |
| 1994 | 28,200 | 27,500 | +3% |
| 1995 | 30,040 | 32,583 | -8% |
| 1996 | 30,507 | | |

Since 1992, the large salmon returns to the Miramichi have been divided about 62% Southwest and 38% Northwest Miramichi. This would indicate that the returns to the Northwest Miramichi would be about 11,700 large salmon whereas returns to the Southwest would be about 18,800 large salmon.

There is no forecast model for small salmon but based on the smolt counts at Catamaran Brook in 1995 and the observed temporal trend in smolt counts in year i, small salmon returns to the Northwest in year i+1, we would expect the small salmon returns in 1996 to be in the order of those observed in 1995 and 1994, about 20,000 fish to the Northwest.

### Long Term

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 is for continued and increased abundance of salmon (Fig. 23 and 24). At least in the freshwater portion of the life cycle, the abundance of the cohorts is increasing in both the Northwest and Southwest Miramichi.

In terms of the Miramichi system, large salmon returns have averaged 32000 fish between 1990 and 1995, a 52% increase from the average return during 1984 to 1989 (21000) (Fig. 11). Given an average life cycle of 5 to 6 years (migration to migration) for large salmon, the returns to the Miramichi in 1996 to 2001 will be the progeny of the 1990 to 1995 escapements. Between 1971 and 1989, large salmon escapements equalled or exceeded 30,000 spawners 3 times and the returns of large salmon 6 years later from these escapements ranged from 28000 to 37000 fish (Table 18, Fig. 11). While the trends in abundance of some stocks of Atlantic salmon in Canada correlate with an index of winter marine habitat (Anon. 1995), the Miramichi River large salmon returns do not. This is not to say that the sea survival of Atlantic salmon from the Miramichi in recent years has not been affected by colder marine conditions. If the Miramichi stock has been affected, then smolt output from the Miramichi must be at a level which masks declining sea survival and produces fairly constant returns of large salmon.

## MANAGEMENT CONSIDERATIONS

### Was conservation met in 1995?

The conservation (egg deposition) targets for the Southwest Miramichi, Northwest Miramichi and Miramichi River system were exceeded in 1995. The conservation targets are for the entire run to the river. There is a higher exploitation rate on the early run small and large salmon but the exploitation rates on large salmon remain low; 9% of the early-run large salmon in the Northwest and 6% of the early-run large salmon in the Southwest were removed prior to spawning. Small salmon are more heavily utilized; 36% of the total returns in the Northwest and 40% of total returns to the Southwest Miramichi were removed.

### Will the returns in 1996 exceed the conservation targets for the river?

There is a very good chance (81% probability) that the returns of large salmon in 1996 will at least meet the conservation target for the Miramichi River. Based on the relative returns to each branch since 1992, the returns to each branch should also exceed the target. Relative to the conservation target, the returns to the Northwest have been relatively better than those to the Southwest. The exploitation rates of small and large salmon which occurred in the last 4 years, if continued into 1996, should not threaten the resource. Since the 1996 forecast is for returns during the whole year, the exploitation of both small and large salmon would be most wisely distributed across the entire migration. In the Northwest and Southwest Miramichi rivers, this would represent about 20% of potential harvests of large salmon taking place prior to Sept. 1 and 80% of harvests after Aug. 31. For small salmon, more fish return early, 40% up to and including Aug. 31 and 60% after Aug. 31.

### Are assessments required at a finer spatial resolution?

Since 1992, assessments of the returns of salmon to the Northwest and Southwest Miramichi rivers have been prepared. The separate branch assessments were initiated to address the concerns regarding the differences in stock characteristics and exploitation levels. The assessments indicate that returns and escapements have exceeded the conservation targets in each branch. There are concerns that in the Northwest Miramichi, one of the two major tributaries (Little Southwest Miramichi) may not be receiving adequate spawning escapement. In spite of concerns regarding the status of the Little Southwest Miramichi stock, the crown reserve angling season was extended by two weeks in 1995. The crown reserve stretches are in the upper sections of the river and early-run salmon would be the main target of angling activity. Returns to the lower sections of the Little Southwest, as monitored at Catamaran Brook, have not declined and were the highest ever in 1995.

The concerns for the Little Southwest Miramichi are based on the declines in angling catches and the lower juvenile densities compared to the Northwest Miramichi. The Little Southwest Miramichi may also be subject to pH depressions in the spring and to very high water temperatures in the summer (maximum water temperature of 30°C on August 11, 1995 reported by Caissie MS1996). Separate targets for the Little Southwest Miramichi and the Northwest Miramichi could be calculated because the two rivers join together at the head of tide and freshwater production below the confluence would be minimal.

Enhancement activities on the Renous/Dungarvon River were initiated to increase the early returns of small and large salmon. A division of the Renous/Dungarvon River from the Southwest Miramichi would also be possible since the Renous enters the Southwest at the head of tide. Assessing the returns to each of these rivers requires additional monitoring such as the partial fence operated on the Renous River in 1995. Although a separate estimate of returns to the Renous River was not part of this assessment, such a calculation could be done using the recaptures at the Dungarvon barrier of fish tagged at the fence (Appendix 2). The calculation for 1995 indicates that about 9000 small salmon returned to the Renous River in 1995 (June to October), one-third of the total Southwest Miramichi returns. Similar initiatives could be undertaken by user groups for the Little Southwest Miramichi. Additionally, more extensive

juvenile surveys of these rivers could assist in determining if there are low production areas within the rivers. Low production could be the result of inadequate habitat and/or low escapement.

**What is the contribution of hatchery origin salmon to the Miramichi?**

The broodstock collections in 1995 amounted to about 0.2 million eggs from the Northwest and 0.3 million eggs from the Southwest. These represent less than 0.1% of the in-river egg depositions in both the Northwest and Southwest.

Overall, returns of adipose clipped fish (exclusive of non-feeding fry stocking which are not marked) represent a minute proportion of the total returns to each branch (Table 21). In 1995, small salmon sampled at the Enclosure and Millerton trapnets in the Southwest were predominantly (>99.5%) wild in both the early and late runs. Large salmon returns were essentially all wild origin (>99.5%) in the Southwest Miramichi. In the Northwest Miramichi, both small salmon and large salmon were predominantly of wild origin (>99%) (Table 21).

In the tributaries which received most of the adipose-clipped stocking in recent years, returns of adipose-clipped fish comprised a higher percentage of the returns. The Renous River received 33000 smolts in 1994 and the headwaters of the Northwest Miramichi were stocked with more than 41000 smolts (Chaput et al. MS1995). At the partial counting fence on the Renous River, adipose-clipped small salmon made up 3% of the returns during June to August, the highest proportions were in June and July (Table 21). At Rocky Brook, 70% of the small salmon were wild; this tributary has received about 15000 fall fingerlings from satellite rearing in recent years. No adipose-clipped large salmon were recovered in any of the tributaries sampled.

A counting trap was operated on Little River between Oct. 15 and 25. Little River had been stocked with about 1500 2+ smolts reared in lake cages near Heath Steele mines. The counts at the Little River trap are not considered to be complete because salmon had probably ascended the river before installation of the trap. On numerous occasions, holes in the trapnet and leaders (due to rodents) were discovered and repaired. During that time, 44 small salmon were counted, 2 of which had adipose clips (4.5% of total small) (Table 21). Two small salmon and one large salmon had been previously tagged at the estuary trapnets.

The contribution of adipose-clipped fish to the returns and subsequent egg depositions in the Miramichi is negligible. Adipose-clipped fish were relatively abundant in only the Rocky Brook sampling. The contributions of adipose-clipped fish to the 1996 returns are expected to be less than in 1995. Smolts in 1995 were stocked almost exclusively to the Renous/Dungarvon River because the Northwest Miramichi semi-natural pond stock (about 27000 fish) was destroyed after testing positive for bacterial kidney disease (BKD). Smolt stocking in 1996 is expected to be in the order of 30000 fish in each of the Renous/Dungarvon River and Northwest Miramichi River. For 1997, Little Southwest Miramichi stocking will be undertaken instead of the Northwest Miramichi.

**Did the Big Hole Tract protection barrier in 1995 have a negative impact on the Atlantic salmon resource?**

The protection barrier was installed on July 5 and removed on Sept. 13, 1995. During that time, the highest water levels were observed during the week following installation and then dropped continually up to the time the barrier was removed. Activity at the barrier (fish jumping just below the net) was highest in the first two weeks. Water temperatures became warm in late July and peaked at 28°C on Aug. 1 (Fig. 25). There were large daily fluctuations in temperatures. On Aug. 11 when the water temperature in the Little Southwest Miramichi peaked at 30°C, the maximum temperature at Big Hole Tract was 27°C (Fig. 25). There were unconfirmed reports of salmon mortalities resulting from the barrier but these

reported mortalities were no greater in number than the mortalities observed in the Southwest Miramichi during late July and August, at the peak of water temperatures. Low water levels in the Northwest Miramichi limited the movement of salmon into the river. Even if the barrier had not been in place, it is unlikely that many fish would have moved upstream as shown by the movements of salmon through the Dungarvon and Southwest Miramichi barriers. Once the barrier was removed and water levels improved in October, salmon were abundant in the Northwest Miramichi (comments from user groups at the Science workshop). There was no apparent negative impact on salmon of the Northwest Miramichi in 1995.

## RESEARCH RECOMMENDATIONS

1 - Emigration of tagged fish between the branches continues to be a complicating factor in the assessment of returns to the individual branches. The use of tags recaptured by angling to assess the emigration rate should be explored further through simulation to determine the sensitivity of the estimation process to the sample size, temporal and spatial heterogeneity and other factors. Alternate ways of estimating emigration should be explored, especially if the estimates are sensitive to small sample size.

2 - Biological characteristics of salmon spawned at the fish culture station should be examined and used to update, if warranted, the fecundity data currently used for the Miramichi. Similarly, the type of fecundity data (green eggs versus stripped eggs as in the hatchery) used in the derivation of 240 eggs per 100 $m^2$ needs to be described. If green eggs were used, then potential egg depositions should also use green egg derived fecundity values.

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**Table 1.** Food fishery agreements on the Miramichi River for 1995.

| Location | Allocation Small | Allocation Large | Gear | Time Period |
|---|---|---|---|---|
| **Eel Ground First Nation** | | | | |
| Northwest | 1980 | 100 | trapnets[1], gill nets[2] and recreational[3] | May 1 to Aug. 31 |
| | 800 | - | trapnets[1], gill nets[2] and recreational[3] | Sept. 1 to Oct. 31 |
| Southwest | 1420 | - | trapnet[4] and recreational[3] | May 1 to Aug. 31 |
| | 800 | - | trapnet[4] and recreational[3] | Sept. 1 to Oct. 31 |
| **Red Bank First Nation** | | | | |
| Little Southwest | 1320 | 60 | trapnet[4] and recreational[3] | June 1 to Aug. 31 |
| | 680 | 10 | trapnet[4] and recreational[3] | Sept. 1 to Oct. 31 |
| Northwest | 1320 | 60 | trapnet[4] and recreational[3] | June 1 to Aug. 31 |
| | 680 | 11 | trapnet[4] and recreational[3] | Sept. 1 to Oct. 31 |
| **Burnt Church First Nation[6]** | | | | |
| Miramichi Bay | 1300 | 80 | gill nets[5] and angling | May 1 to July 31 |
| | 700 | 120 | gill nets[5] and angling | Aug. 1 to Oct. 15 |

[1]Maximum of 2 trapnets
[2]Maximum of 10 gill nets of maximum length 125 feet each, and to be removed after capture of the 100 salmon
[3]Native recreational fishing gear
[4]Maximum of 1 trapnet
[5]Maximum of 25 gill nets; 15 nets of maximum length 300 feet each and 10 nets of maximum 150 feet each
[6]Communal fishing licence only

**Table 2. Bright salmon angling seasons for 1995.**

**General Season:** **June 8 to October 15**

**Exceptions to the General Season:**

Opens June 8, closes August 31
- NW Miramichi River upstream from Little River
- Rocky Brook, tributary of SW Miramichi River

Opens June 8, closes September 15
- All tributaries of SW Miramichi River above Cains River except Rocky Brook
- Big Sevogle River above Square Forks
- Dungarvon River above the Furlong Bridge
- LSW Miramichi River above Catamaran Brook
- North and South branches of the SW Miramichi River
- North and South branches of the Renous River
- SW Miramichi River upstream from McKiel Brook, not including tributaries

Opens June 8, closes September 30
- Big Sevogle River downstream from Square Forks
- Dungarvon River downstream from the Furlong Bridge
- LSW Miramichi River below Catamaran Brook
- SW Miramichi River upstream of the mouth of Burnt Land Brook to McKiel Brook
- NW Miramichi River downstream from Little River
- Renous River downstream from the confluence of the North and South branches

Opens June 10, closes August 31
- Crown Reserve waters on the NW Miramichi and Sevogle rivers

Opens June 10, closes September 15
- Crown Reserve waters on the LSW Miramichi River

**Variation Orders altering the above seasons during 1995:**

**1995-092** - The Northwest Miramichi upstream from the Johnson Bridge to Wildcat Brook was closed to all fishing from July 5 to December 31, 1995. This closure was not revoked when the rest of the river opened on September 20, 1995

**1995-122** - Closed to angling from July 31 to December 31, 1995, the Southwest Miramichi River 100 meters upstream and downstream of the Quarryville bridge.

**1995-123** - Closed to angling the Renous River above the mouth of Crown Pt. Brook from July 31 to December 31, 1995.

**1995-127** - Closed to angling the entire Renous and Dungarvon rivers as well as their tributaries from August 9 to December 31, 1995.

**1995-128** - Closed all waters of the NW Miramichi, Big Sevogle, and LSW Miramichi rivers to angling from August 10 to December 31, 1995.

**1995-139** - Revoked 1995-128 and opened the LSW Miramichi River to angling August 26, 1995. NW Miramichi and Big Sevogle rivers remained closed to angling.

**1995-142** - Revoked 1995-139 and repeats the closure of the NW Miramichi and Big evogle rivers from September 2 to December 31, 1995. Closed all lakes tributary to these rivers to angling from September 16 to December 31, 1995.

**1995-143** - Revoked 1995-127 and repeats closure of the Renous and Dungarvon rivers from September 5 to December 31, 1995. Closed all lakes tributary to these rivers to angling from September 16 to December 31, 1995.

**1995-155** - On September 20, 1995, this revoked 1995-139 and opened the NW Miramichi and Big Sevogle rivers to angling.

**1995-158** - On September 28, 1995, this revoked 1995-143 and opened the Renous and Dungarvon rivers to angling.

**Table 3. Harvest and effort (net days) for native food fisheries on the Miramichi in 1995 for early and late runs by week, as reported by band councils. ***

| Week | Burnt Church | | Eel Ground | | | | | Red Bank | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gillnets | | Gillnets * * | | | Trapnet (SW) | Trapnets (NW) | Trapnet (NW) | | Trapnet (LSW) | |
| | Small | Large | Effort | Small | Large | Small | Small | Small | Large | Small | Large |
| Early run | | | | | | | | | | | |
| May 21-27 | - | - | 5 | 0 | 0 | - | - | - | - | - | - |
| May 28-June 3 | - | - | 5 | 0 | 1 | - | 0 | - | - | - | - |
| June 4-10 | - | - | 34 | 2 | 7 | - | 0 | 1 | 3 | - | - |
| June 11-17 | - | - | 20 | 2 | 1 | - | 5 | 3 | 1 | 0 | 0 |
| June 18-24 | 1 | 2 | 29 | 12 | 0 | 2 | 3 | 1 | 0 | 7 | 1 |
| June 25-July 1 | 4 | 3 | 28 | 14 | 8 | 37 | 28 | 4 | 3 | 4 | 2 |
| July 2-8 | - | - | 30 | 20 | 8 | 211 | 125 | 55 | 6 | 12 | 2 |
| July 9-15 | 12 | 2 | 25 | 12 | 6 | 158 | 112 | 42 | 14 | 18 | 5 |
| July 16-22 | 7 | 1 | 11 | 4 | 0 | 275 | 174 | 120 | 22 | 1 | 0 |
| July 23-29 | 15 | 5 | 9 | 0 | 0 | 157 | 33 | 128 | 37 | 7 | 1 |
| July 30-Aug. 5 | - | - | 4 | 4 | 0 | 83 | 73 | 35 | 14 | 7 | 1 |
| Aug. 6-12 | - | - | - | - | - | 70 | 9 | 8 | 3 | 39 | 15 |
| Aug. 13-19 | - | - | 0 | 0 | 0 | 35 | 12 | 6 | 3 | 9 | 1 |
| Aug. 20-26 | - | - | 0 | 0 | 0 | 50 | 36 | 10 | 1 | 0 | 3 |
| Aug. 27-Sept. 2 | - | - | 0 | 0 | 0 | 70 | 13 | 0 | 0 | 2 | 0 |
| Subtotal | 39 | 13 | 200 | 70 | 31 | 1148 | 623 | 413 | 107 | 106 | 31 |
| Late run | | | | | | | | | | | |
| Sept. 3-9 | - | - | 0 | 0 | 0 | 22 | 2 | 21 | 2 | 18 | 1 |
| Sept. 10-16 | - | - | 0 | 0 | 0 | - | - | 67 | - | 2 | - |
| Sept. 17-23 | - | - | 0 | 0 | 0 | - | - | 50 | - | 30 | - |
| Sept. 24-30 | - | - | - | - | - | - | - | 15 | - | 9 | - |
| Oct. 1-7 | - | - | - | - | - | - | - | 168 | - | 48 | - |
| Oct. 8-14 | - | - | - | - | - | - | - | 101 | - | 52 | - |
| Subtotal | 0 | 0 | 0 | 0 | 0 | 22 | 2 | 422 | 2 | 159 | 1 |
| Total Season | 39 | 13 | 200 | 70 | 31 | 1170 | 625 | 835 | 109 | 265 | 32 |
| % Early run | 100% | 100% | 100% | 100% | 100% | 98.3% | 99.7% | 49.5% | 98% | 40% | 97% |

* These figures do not include harvest and effort data for native fishing off reserve

** Data obtained from 'Eel Ground First Nation, Native Fisheries Officers Program, 1995 Final Report prepared by Romeo Francis (Supervisor). Effort units are net-days

**Table 4.** Recorded harvests of salmon in all fisheries, Miramichi River and Bay, 1951-95 (includes commercial, by-catch, recreational, and native). Kelts angled in year i are added to landings in year i-1. 1995 data are preliminary. All data are numbers X 1000.

| | | | | Angling Fisheries | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Commercial Fishery | | | Kelts (yr i+1) | | | Brights (yr i) | | | | Native Fishery | | | All |
| Year | Small | Large | Total | Small | Large | Total | Small | Large | Total | All | Small | Large | Total | Fisheries |
| 1951 | | 27.6 | 27.6 | | | 12.0 | | | 9.6 | 21.6 | | | | 49.2 |
| 1952 | | 27.3 | 27.3 | | | 11.3 | | | 15.9 | 27.2 | | | | 54.5 |
| 1953 | | 24.4 | 24.4 | | | 10.1 | | | 18.2 | 28.3 | | | | 52.7 |
| 1954 | | 50.6 | 50.6 | | | 11.2 | | | 23.5 | 34.7 | | | | 85.3 |
| 1955 | | 15.3 | 15.3 | | | 8.9 | | | 14.7 | 23.6 | | | | 38.9 |
| 1956 | | 24.7 | 24.7 | | | 9.3 | | | 28.9 | 38.2 | | | | 62.9 |
| 1957 | | 29.9 | 29.9 | | | 8.4 | | | 19.5 | 27.9 | | | | 57.8 |
| 1958 | | 25.2 | 25.2 | | | 10.2 | | | 36.7 | 46.9 | | | | 72.1 |
| 1959 | | 37.3 | 37.3 | | | 9.5 | | | 10.3 | 19.8 | | | | 57.1 |
| 1960 | | 30.8 | 30.8 | | | 5.6 | | | 4.5 | 10.1 | | | | 40.9 |
| 1961 | | 30.0 | 30.0 | | | 9.5 | | | 11.0 | 20.5 | | | | 50.5 |
| 1962 | | 41.6 | 41.6 | | | 7.3 | | | 10.3 | 17.6 | | | | 59.2 |
| 1963 | | 40.7 | 40.7 | | | 5.2 | | | 50.9 | 56.1 | | | | 96.8 |
| 1964 | | 69.8 | 69.8 | | | 9.0 | | | 35.1 | 44.1 | | | | 113.9 |
| 1965 | | 69.5 | 69.5 | | | 16.0 | 38.7 | 3.9 | 42.6 | 58.6 | | | | 128.1 |
| 1966 | | 72.9 | 72.9 | | | 20.0 | 51.7 | 5.9 | 57.6 | 77.6 | | | | 150.5 |
| 1967 | | 102.2 | 102.2 | | | 14.1 | 41.8 | 4.1 | 45.9 | 60.0 | | | | 162.2 |
| 1968 | | 48.5 | 48.5 | | | 6.9 | 7.0 | 1.5 | 8.5 | 15.4 | | | | 63.9 |
| 1969 | | 41.3 | 41.3 | 3.7 | 1.6 | 5.3 | 24.3 | 3.8 | 28.1 | 33.4 | | | | 74.7 |
| 1970 | | 39.7 | 39.7 | 2.4 | 1.4 | 3.8 | 19.6 | 3.3 | 22.9 | 26.7 | | | | 66.4 |
| 1971 | | 18.3 | 18.3 | 1.5 | 0.5 | 2.0 | 13.7 | 1.8 | 15.5 | 17.5 | | | | 35.8 |
| 1972 | | 2.5 | 2.5 | 1.5 | 3.0 | 4.5 | 19.1 | 8.9 | 28.0 | 32.5 | | | | 35.0 |
| 1973 | | 0.9 | 0.9 | 1.5 | 3.0 | 4.5 | 13.9 | 6.0 | 19.9 | 24.4 | | | | 25.3 |
| 1974 | | 1.0 | 1.0 | 1.8 | 3.1 | 4.9 | 18.2 | 7.2 | 25.4 | 30.3 | | | | 31.3 |
| 1975 | 0.4 | 0.7 | 1.1 | 2.3 | 1.4 | 3.7 | 15.6 | 6.3 | 21.9 | 25.6 | 0.4 | 0.2 | 0.6 | 27.3 |
| 1976 | 1.8 | 0.9 | 2.7 | 2.4 | 2.2 | 4.6 | 27.2 | 7.4 | 34.6 | 39.2 | 0.2 | 0.2 | 0.4 | 42.3 |
| 1977 | 0.4 | 6.9 | 7.3 | 1.4 | 2.1 | 3.5 | 13.6 | 11.6 | 25.2 | 28.7 | 0.5 | 0.4 | 0.9 | 36.9 |
| 1978 | 1.2 | 8.4 | 9.6 | 1.5 | 1.7 | 3.2 | 8.3 | 4.9 | 13.2 | 16.4 | 0.4 | 0.4 | 0.8 | 26.8 |
| 1979 | 5.5 | 1.7 | 7.2 | 2.2 | 1.5 | 3.7 | 14.5 | 2.7 | 17.2 | 20.9 | 0.1 | 0.2 | 0.3 | 28.4 |
| 1980 | 2.7 | 10.9 | 13.6 | 1.7 | 2.1 | 3.8 | 12.0 | 6.5 | 18.5 | 22.3 | | | | 35.9 |
| 1981 | 1.6 | 7.8 | 9.4 | 2.7 | 1.4 | 4.1 | 22.7 | 3.2 | 25.9 | 30.0 | 1.0 | 0.5 | 1.5 | 40.9 |
| 1982 | 2.3 | 12.5 | 14.8 | 2.1 | 1.0 | 3.1 | 21.4 | 4.6 | 26.0 | 29.1 | 0.7 | 0.4 | 1.1 | 45.0 |
| 1983 | 1.6 | 17.1 | 18.7 | 0.9 | 0.7 | 1.6 | 8.4 | 2.2 | 10.6 | 12.2 | 0.4 | 0.2 | 0.6 | 32.5 |
| 1984 | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 | 2.4 | 18.8 | 0.0 | 18.8 | 21.2 | 0.4 | 0.3 | 0.7 | 21.9 |
| 1985 | 0.0 | 0.0 | 0.0 | 2.5 | 0.0 | 2.5 | 18.4 | 0.0 | 18.4 | 20.9 | 0.5 | 0.3 | 0.8 | 21.7 |
| 1986 | 0.0 | 0.0 | 0.0 | 2.7 | 0.0 | 2.7 | 26.2 | 0.0 | 26.2 | 28.9 | 2.0 | 0.6 | 2.6 | 31.5 |
| 1987 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 4.2 | 20.8 | 0.0 | 20.8 | 25.0 | 1.3 | 0.9 | 2.2 | 27.2 |
| 1988 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 5.4 | 30.6 | 0.0 | 30.6 | 36.0 | 0.9 | 0.3 | 1.2 | 37.2 |
| 1989 | 0.0 | 0.0 | 0.0 | 3.9 | 0.0 | 3.9 | 24.4 | 0.0 | 24.4 | 28.3 | 1.1 | 0.5 | 1.6 | 29.9 |
| 1990 | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 | 2.4 | 21.7 | 0.0 | 21.7 | 24.1 | 2.1 | 0.6 | 2.7 | 26.8 |
| 1991 | 0.0 | 0.0 | 0.0 | 2.3 | 0.0 | 2.3 | 11.3 | 0.0 | 11.3 | 13.6 | 1.1 | 0.5 | 1.6 | 15.2 |
| 1992 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 1.8 | 21.5 | 0.0 | 21.5 | 23.3 | 1.7 | 0.6 | 2.3 | 25.6 |
| 1993 | 0.0 | 0.0 | 0.0 | 0.9 | 0.0 | 0.9 | 15.3 | 0.0 | 15.3 | 16.2 | 0.6 | 0.2 | 0.8 | 17.0 |
| 1994 | 0.0 | 0.0 | 0.0 | | | | 11.2 | 0.0 | 11.2 | | 3.0 | 0.1 | 3.1 | |
| 1995 | 0.0 | 0.0 | 0.0 | - | - | - | | | | | 3.0 | 0.2 | 3.2 | |
| 1990-94 Mean | | | | | | 18.8 | 0.0 | 18.8 | | 1.4 | 0.5 | 1.9 | | |
| change = (95-mean)/mean | | | | | | | | | | | +76% | -50% | +52% | |

Note: Angling catches from 1951-68 are from DFO while catches from 1969-94 are from DNRE FISHSYS

**Table 5.** Recreational Atlantic salmon fishery statistics from the Miramichi River, 1995. Mean is for the years 1990 to 1994. % change represents 1995 minus mean divided by mean. Detailed catches are in Moore et al. (MS1995) of which 1994 data have been finalized. 1995 data are preliminary. Crown reserve data for 1995 are from: B. Dubee and S. Tulle. Salmon catch and effort on crown reserve waters of the Miramichi River system NewBrunswick 1995. N.B. Department of Natural Resources and Energy, Newcastle, New Brunswick. Manuscript, 7p.

| | | Miramichi River | Northwest | Southwest |
|---|---|---|---|---|
| **Black salmon fishery** | | | | |
| Effort (rod days) | 1995 | | | |
| | Mean | 11374 | 2330 | 9044 |
| | % change | % | % | % |
| Small salmon | 1995 | | | |
| | Mean | 2600 | 443 | 2157 |
| | % change | % | % | % |
| Large salmon | 1995 | | | |
| | Mean | 4216 | 706 | 3511 |
| | % change | % | % | % |
| **Bright salmon fishery** | | | | |
| Effort (rod days) | 1995 | | | |
| | Mean | 115561 | 36790 | 78771 |
| | % change | % | % | % |
| Small salmon | 1995 | | | |
| | Mean | 16893 | 5636 | 11258 |
| | % change | % | % | % |
| Large salmon | 1995 | | | |
| | Mean | 8293 | 1998 | 6294 |
| | % change | % | % | % |

| **Northwest Miramichi crown reserve angling** | | | Individual stretches | | |
|---|---|---|---|---|---|
| | | | Little Southwest | | Northwest Miramichi |
| | | Total | | Sevogle | |
| Effort (rod days) | 1995 | 1773 | 490 | 466 | 817 |
| | Mean | 2407 | 524 | 773 | 1109 |
| | % change | -26% | -7% | -40% | -26% |
| Small salmon | 1995 | 523 | 136 | 122 | 265 |
| | Mean | 1256 | 165 | 332 | 760 |
| | % change | -58% | -17% | -63% | -65% |
| Large salmon | 1995 | 88 | 22 | 19 | 47 |
| | Mean | 116 | 30 | 34 | 53 |
| | % change | -24% | -26% | -44% | -11% |

Table 6. Summary of trapnet operation dates, catch, and tags applied in the Miramichi River, 1995. Catch represents all fish sampled, including recaptures.

| Trapnets | Time Period | Catch | | Tagged | |
|---|---|---|---|---|---|
| | | Small | Large | Small | Large |
| **NW Miramichi** | | | | | |
| Eel Ground Index | June 2 to Oct. 15 | 457 | 252 | 393 | 228 |
| Eel Ground FFT#1 | May 31 to Aug. 31 | 474 | 114 | 0 | 101 |
| (food trapnet) | Sept. 1 to Sept. 5 | 5 | 4 | 0 | 4 |
| | Total | 479 | 118 | 0 | 105 |
| Eel Ground | May 28 to Aug. 31 | 165 | 32 | 0 | 29 |
| Hatchery | Sept. 1 | 0 | 0 | 0 | 0 |
| (food trapnet) | Total | 165 | 32 | 0 | 29 |
| Red Bank NW (food trapnet) | June 6 to Oct. 13 | 1029 | 588 | 0 | 0 |
| Red Bank LSW (food trapnet) | June 15 to Oct. 13 | 404 | 275 | 0 | 0 |
| **SW Miramichi** | | | | | |
| Eel Ground | June 21 to Aug. 31 | 1162 | 359 | 0 | 318 |
| SWFFT | Sept. 1 to Sept. 4 | 36 | 40 | 0 | 38 |
| (food trapnet) | Total | 1198 | 399 | 0 | 356 |
| Enclosure | May 25 to Oct. 15 | 1296 | 836 | 1155 | 744 |
| | Oct. 16 to Oct. 19 | 19 | 56 | 17 | 50 |
| | Total | 1315 | 892 | 1172 | 794 |
| Millerton | May 23 to Oct. 15 | 2531 | 1598 | 2143 | 1384 |
| | Oct. 16 to Oct. 20 | 97 | 136 | 66 | 92 |
| | Total | 2628 | 1734 | 2209 | 1476 |

**Table 7.** Distribution of salmon juveniles in the Miramichi River in 1995. Under Mark, AC = adipose-clip, NM = unmarked.

| River | Life Stage | Mark | Number of Fish Stocked |
|---|---|---|---|
| **Northwest** | $2^+$ smolts | AC | 2,734 |
| | $2^+$ parr | AC | 137 |
| | $0^+$ parr | - | 0 |
| | Non-feeding fry | NM | 240,000 |
| | Satellite distribution | AC | 21,143 |
| **Southwest** | $2^+$ smolts | AC | 27,123 |
| | $2^+$ parr | AC | 5,893 |
| | $0^+$ parr | AC | 15,575 |
| | Non-feeding fry | NM | 40,000 |
| | Satellite distribution | AC | 65,018 |
| | | NM | 150 |
| **Miramichi** (total) | $2^+$ smolts | AC | 29,857 |
| | $2^+$ parr | AC | 6,030 |
| | $0^+$ parr | AC | 15,575 |
| | Non-feeding fry | NM | 280,000 |
| | Satellite distribution | AC | 86,311 |
| | | NM | 150 |

**Table 8.** Summary of broodstock collection in 1995.

| Stock Collected | Date Collected | Female Salmon | Female Grilse | Male Salmon | Male Grilse | Collection Site |
|---|---|---|---|---|---|---|
| **Northwest** | | | | | | |
| L. S. W. | 09/11/95 | 4 | 0 | 0 | 11 | Smith Fork & Moose Landing |
| | 10/04/95 | 3 | 38 | 1 | 24 | Smith Fork & Moose Landing |
| N. W. | 09/20/95 | 4 | 0 | 1 | 3 | Barrier Pool |
| Sevogle | 10/12/95 | 3 | 0 | 0 | 3 | Trash Heap Pool |
| **Subtotal** | | 14 | 38 | 2 | 41 | |
| **Southwest** | | | | | | |
| Clearwater | 09/08/95 | 11 | 0 | 1 | 9 | Bridge at Clearwater |
| Cains | 10/13/95 | 1 | 0 | 0 | 1 | Black Brook Salmon Club |
| | 10/14/95 | 3 | 0 | 0 | 0 | George Holmes, Island Pool |
| | 10/16/95 | 0 | 0 | 1 | 1 | Black Brook Salmon Club |
| Dungarvon | 09/12/95 | 25 | 0 | 2 | 23 | Barrier Pool |
| Rocky Brook | 09/09/95 | 5 | 0 | 1 | 3 | McGrath Pool |
| **Subtotal** | | 45 | 0 | 5 | 37 | |
| **Total** | | 59 | 38 | 7 | 78 | |

Table 9. Raw data matrices used in the estimation of returns of small salmon and large salmon to the Miramichi River in 1995.

**Using method based on prior estimation of emigration rates using angling recaptures.**

*Matrices for Estimating Large Salmon Returns to the Northwest Miramichi in 1995*

| | Recaptured at Red Bank | | Tags placed in 1995 | | |
|---|---|---|---|---|---|
| Tagged | Early | Late | NW | SWEncl | SWMill |
| Early | 1 | 13 | 155 | 414 | 294 |
| Late | 0 | 19 | 208 | 689 | 1095 |
| Total recoveries | 155 | 673 | | | |

*Matrices for Estimating Large Salmon Returns to the Southwest Miramichi in 1995*

| | Recaptured at Millerton | | Tags placed in 1995 | |
|---|---|---|---|---|
| Tagged | Early | Late | NW | SWEncl |
| Early | 12 | 20 | 155 | 414 |
| Late | 0 | 38 | 208 | 689 |
| Total recoveries | 315 | 1118 | | |

*Matrices for Estimating Small Salmon Returns to the Northwest Miramichi in 1995*

| | Recaptured at Red Bank | | Tags placed in 1995 | | |
|---|---|---|---|---|---|
| Tagged | Early | Late | NW | SWEncl | SWMill |
| Early | 10 | 7 | 103 | 446 | 1024 |
| Late | 0 | 45 | 289 | 708 | 1114 |
| Total recoveries | 548 | 813 | | | |

*Matrices for Estimating Small Salmon Returns to the Southwest Miramichi in 1995*

| | Recaptured at Millerton | | Tags placed in 1995 | |
|---|---|---|---|---|
| Tagged | Early | Late | NW | SWEncl |
| Early | 12 | 8 | 103 | 446 |
| Late | 0 | 59 | 289 | 708 |
| Total recoveries | 1107 | 1176 | | |

**Using spatial stratification without prior estimation of emigration rates**

*Large Salmon in 1995*

| | Recaptures in | | |
|---|---|---|---|
| Tagged in | NW | SW | Tags placed |
| NW | 8 | 10 | 363 |
| SW | 15 | 60 | 1103 |
| Total recoveries | 851 | 1503 | |

*Small Salmon in 1995*

| | Recaptures in | | |
|---|---|---|---|
| Tagged in | NW | SW | Tags placed |
| NW | 17 | 6 | 353 |
| SW | 24 | 73 | 1037 |
| Total recoveries | 1402 | 2362 | |

Table 10. Tagging and recapture matrices used to estimate the emigration rate of tagged fish outside the branch where they were marked. Recaptures are exclusively returns from angling.

**Small and Large Salmon Recoveries in Angling Fishery Combined**

| Enclosure vs NW Index | | | Tags Placed | Emigration Rate |
|---|---|---|---|---|
| | *To* | | | |
| *From* | NW | SW | | |
| NW | 5 | 10 | 755 | 34.4% |
| SW | 6 | 64 | 2255 | 26.4% |

| Millerton vs NW Index | | | Tags Placed | Emigration Rate |
|---|---|---|---|---|
| | *To* | | | |
| *From* | NW | SW | | |
| NW | 5 | 10 | 755 | 36.7% |
| SW | 3 | 117 | 3527 | 8.1% |

| Enclosure and Millerton vs NW Index | | | Tags Placed | Emigration Rate |
|---|---|---|---|---|
| | *To* | | | |
| *From* | NW | SW | | |
| NW | 5 | 10 | 755 | 35.9% |
| SW | 9 | 181 | 5782 | 15.1% |

**Example calculation for Enclosure vs NW Index**

1 - invert recapture matrix:

| | | | | |
|---|---|---|---|---|
| 5 | 10 | Inverted--: | 0.2462 | -0.0385 |
| 6 | 64 | | -0.0231 | 0.0192 |

2 - multiply by tag vector

| | | | |
|---|---|---|---|
| 755 | -->> | 99.12 | = NW weighting for tag recoveries |
| 2255 | | 25.94 | = SW weighting for tag recoveries |

3 - estimate tag distribution in each branch by multiplying recapture matrix by respective weightings from step 2

| | | | | |
|---|---|---|---|---|
| (5 X 99.12) | (10 X 25.94) | -->> | 496 | 259 |
| (6 X 99.12) | (64 X 25.94) | | 595 | 1660 |

4 - estimate emigration rate by dividing tags from branch A estimated to have moved to branch B relative to tags placed in branch A.

| | | |
|---|---|---|
| NW tags to SW branch = | (259 / 755) = | 34.3% |
| SW tags to NW branch = | (595 / 2255) = | 26.4% |

Table 11. Estimates of returns of small salmon and large salmon by season for the Northwest Miramichi, Southwest Miramichi, and Miramichi River in 1995. Estimates were obtained by resampling technique. Values in bold are the estimates used for returns in 1995.

| | | | Southwest | | | | Northwest | | | | Miramichi River | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | Season | Estimator | Median | 5th perc. | 95th perc. | CV | Median | 5th perc. | 95th perc. | CV | Median | 5th perc. | 95th perc. | CV |
| **Using method based on prior estimation of emigration rates using angling recaptures** | | | | | | | | | | | | | | |
| Large | Early | Petersen | . | . | . | . | . | . | . | . | . | . | . | . |
| | | Schaefer | 3170 | 1063 | 4814 | 35.4% | . | . | . | . | . | . | . | . |
| | | Darroch | 1692 | 217 | 5449 | 88.5% | . | . | . | . | . | . | . | . |
| | Late | Petersen | . | . | . | . | . | . | . | . | . | . | . | . |
| | | Schaefer | 13866 | 4597 | 19612 | 32.3% | . | . | . | . | . | . | . | . |
| | | Darroch | 14578 | 4735 | 21192 | 33.7% | . | . | . | . | . | . | . | . |
| | Total | Petersen | 17235 | 5653 | 24155 | 32.2% | **15196** | **7752** | **31450** | 44.5% | **32583** | **19703** | **50304** | 27.4% |
| | | Schaefer | **17097** | **5661** | **24150** | 32.2% | . | . | . | . | . | . | . | . |
| | | Darroch | 16601 | 5401 | 23750 | 33.5% | . | . | . | . | . | . | . | . |
| Small | Early | Petersen | . | . | . | . | . | . | . | . | . | . | . | . |
| | | Schaefer | 17895 | 5910 | 29707 | 39.6% | 10595 | 3243 | 18375 | 42.3% | 28542 | 9165 | 47911 | 38.9% |
| | | Darroch | 22541 | 7410 | 45645 | 55.6% | 12925 | 3664 | 27043 | 52.1% | 35456 | 11073 | 72602 | 50.7% |
| | Late | Petersen | . | . | . | . | . | . | . | . | . | . | . | . |
| | | Schaefer | 12045 | 4391 | 17053 | 29.5% | 10810 | 3771 | 15418 | 32.2% | 23275 | 8481 | 30147 | 27.2% |
| | | Darroch | 11095 | 4082 | 15716 | 29.8% | 10082 | 3573 | 14718 | 32.8% | 21580 | 8006 | 27922 | 26.6% |
| | Total | Petersen | 25656 | 9050 | 35234 | 29.2% | 19440 | 6598 | 27288 | 32.3% | 45636 | 16049 | 59796 | 28.0% |
| | | Schaefer | **30505** | **10410** | **45342** | 32.7% | **21684** | **7100** | **32595** | 34.7% | **52241** | **17795** | **75562** | 32.2% |
| | | Darroch | 34521 | 11672 | 58230 | 41.7% | 23584 | 7538 | 38804 | 38.7% | 58006 | 19181 | 97320 | 38.9% |
| **Using spatial stratification without prior estimation of emigration rates** | | | | | | | | | | | | | | |
| Large | Total | Schaefer | 20928 | 18020 | 24969 | 10.2% | 12736 | 10806 | 15547 | 11.4% | 33728 | 29126 | 40036 | 10.0% |
| | | Darroch | 14179 | -15736 | 27532 | 334.1% | 24329 | 5702 | 79795 | 408.4% | 38691 | 28822 | 69450 | 134.1% |
| Small | Total | Schaefer | 23460 | 20342 | 27344 | 9.4% | 15938 | 13542 | 19167 | 10.8% | 39461 | 34365 | 45998 | 9.0% |
| | | Darroch | 17661 | 6316 | 25078 | 37.9% | 22734 | 14686 | 39527 | 36.2% | 40610 | 34755 | 49268 | 11.9% |

**Table 12.** Removals of Atlantic salmon by size and season from the Northwest Miramichi, Southwest Miramichi and Miramichi River system in 1995.

| | Northwest Miramichi | | | Southwest Miramichi | | | Estuary | Miramichi River | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Early | Late | Total | Early | Late | Total | Early | Early | Late | Total |
| **Small Salmon** | | | | | | | | | | |
| Food Fisheries | 1212 | 583 | 1795 | 1148 | 22 | 1170 | 39 | 2399 | 605 | 3004 |
| Angling[1] | 4836 | 800 | 5636 | 7239 | 4019 | 11258 | - | 12124 | 4769 | 16893 |
| Seizures[2] | 30 | - | 30 | - | - | - | - | 30 | - | 30 |
| Broodstock | 79 | - | 79 | 37 | - | 37 | - | 116 | - | 116 |
| Incidental Mortalities[3] | 6 | 0 | 6 | 11 | 1 | 12 | - | 17 | 1 | 18 |
| **Total** | 6163 | 1383 | 7546 | 8435 | 4042 | 12477 | 39 | 14686 | 5375 | 20061 |
| **Large Salmon** | | | | | | | | | | |
| Food Fisheries | 169 | 3 | 172 | 0 | 0 | 0 | 13 | 182 | 3 | 185 |
| Angling[4] | 49 | 11 | 60 | 115 | 74 | 189 | - | 164 | 85 | 249 |
| Seizures[2] | 15 | - | 15 | 22 | - | 22 | - | 37 | - | 37 |
| Broodstock | 16 | - | 16 | 50 | - | 50 | - | 66 | - | 66 |
| Incidental Mortalities[3] | 0 | 0 | 0 | 20 | 2 | 22 | - | 20 | 2 | 22 |
| **Total** | 249 | 14 | 263 | 207 | 76 | 283 | 13 | 469 | 90 | 559 |

1: Average harvest of small salmon (1990-1994) from DNRE Fishsys.
2: Reported by DFO Conservation and Protection staff.
3: Include trapnet mortalities, meshed fish mortalities and other 'seen' mortalities.
4: Based on 3% of average catch of large salmon (1990-1994) from DNRE Fishsys.

**Table 13.** Sex ratio (% female) of small salmon by trap, season, and river system for 1995.

| | Early Run | Late Run | $X^2$ | P. value | DF |
|---|---|---|---|---|---|
| NW Eel Ground | 33.06% | 12.83% | 29.974 | 0.000 | 1 |
| NW Red Bank | 33.72% | 12.27% | 73.696 | 0.000 | 1 |
| $X^2$ | 0.032 | 0.053 | average | | |
| P. value | 0.858 | 0.818 | early: | 33.51% | |
| DF | 1 | 1 | late: | 12.44% | |

| | Early Run | Late Run | $X^2$ | P. value | DF |
|---|---|---|---|---|---|
| SW Enclosure | 30.75% | 9.86% | 86.785 | 0.000 | 1 |
| SW Millerton | N/A | 13.38% | - | - | - |
| $X^2$ | - | 5.223 | average | | |
| P. value | - | 0.022 | early: | 30.75% | |
| DF | - | 1 | late: | 12.05% | |

| | Early Run | Late Run | $X^2$ | P. value | DF |
|---|---|---|---|---|---|
| NW Miramichi | 33.51% | 12.44% | 103.589 | 0.000 | 1 |
| SW Miramichi | 30.75% | 12.05% | 105.599 | 0.000 | 1 |
| $X^2$ | 1.069 | 0.087 | average | | |
| P. value | 0.301 | 0.768 | early: | 32.40% | |
| DF | 1 | 1 | late: | 12.17% | |

**Table 14.** Sex ratio (% female) of large salmon by trap, season, and river system for 1995.

| | Early Run | Late Run | $X^2$ | P. value | DF |
|---|---|---|---|---|---|
| NW Eel Ground | N/A | 85.56% | - | - | - |
| NW Red Bank | 93.84% | 87.63% | 4.547 | 0.033 | 1 |
| $X^2$ | - | 0.539 | average | | |
| P. value | - | 0.463 | early: | 93.84% | |
| DF | - | 1 | late: | 87.13% | |

| | Early Run | Late Run | $X^2$ | P. value | DF |
|---|---|---|---|---|---|
| SW Enclosure | N/A | 88.41% | - | - | - |
| SW Millerton | N/A | 88.85% | - | - | - |
| $X^2$ | - | 0.085 | average | | |
| P. value | - | 0.770 | early: | N/A | |
| DF | - | 1 | late: | 88.69% | |

| | Early Run | Late Run | $X^2$ | P. value | DF |
|---|---|---|---|---|---|
| NW Miramichi | 93.84% | 87.13% | 5.306 | 0.021 | 1 |
| SW Miramichi | N/A | 88.69% | - | - | - |
| $X^2$ | - | 1.291 | average | | |
| P. value | - | 0.256 | early: | 93.84% | |
| DF | - | 1 | late: | 88.24% | |

**Table 15.** Sex ratios (% female) of small and large salmon observed during broodstock collections and at the Renous River partial counting fence. All determinations are based on external characteristics.

| | Small salmon | | | Large salmon | | |
|---|---|---|---|---|---|---|
| | females | males | % females | females | males | % females |
| **Broodstock Collection** | | | | | | |
| **Southwest Miramichi** | | | | | | |
| Clearwater Brook (Aug. 9, 1995) | 9 | 45 | 17% | 11 | 1 | 92% |
| Renous, Furlong Bridge (Sept. 12, 1995) | 16 | 34 | 32% | 3 | 0 | 100% |
| Dungarvon Barrier (Sept. 19, 1995) | 73 | 120 | 38% | 56 | 6 | 90% |
| **Northwest Miramichi** | | | | | | |
| Sevogle, Trash Heap Pool (Oct. 12, 1995) | 24 | 32 | 43% | 3 | 0 | 100% |
| **Little Southwest Miramichi** | | | | | | |
| Moose Landing | | | | | | |
| (Sept. 11, 1995) | 11 | 12 | 48% | 4 | 0 | 100% |
| (Sept. 21, 1995) | 17 | 17 | 50% | 0 | 0 | - |
| (Oct. 4, 1995) | 16 | 12 | 57% | 0 | 0 | - |
| Smith Forks | | | | | | |
| (Sept. 11, 1995) | 10 | 7 | 59% | 1 | 0 | 100% |
| (Sept. 21, 1995) | 36 | 22 | 60% | 0 | 0 | - |
| (Oct. 4, 1995) | 23 | 14 | 62% | 2 | 0 | 100% |
| **Counting Fence** | | | | | | |
| **Southwest Miramichi** | | | | | | |
| Renous River | | | | | | |
| (June 17 to Aug. 31) | 91 | 325 | 22% | 17 | 18 | 49% |
| (Sept. 1 to Sept. 26) | 1 | 29 | 3% | 3 | 2 | 60% |
| Total | 92 | 354 | 21% | 20 | 20 | 50% |

**Table 16.** Biological characteristics (fork length, sex ratio, fecundity and previous spawner composition) of small and large salmon for the Southwest and Northwest Miramichi and Miramichi River system for 1995.

| | Small Salmon | | Large Salmon | |
|---|---|---|---|---|
| | Estimate | Std. Dev. | Estimate | Std. Dev. |
| **Northwest Miramichi** | | | | |
| **% Female** | | | | |
| early: | 33.5 | | 93.8 | |
| late: | 12.4 | | 87.1 | |
| total: | 22.9 | | 88.3 | |
| **Fork length** | | | | |
| early: | 52.4 | 2.80 | 77.5 | 7.60 |
| late: | 55.5 | 2.68 | 76.8 | 5.88 |
| total: | 54.0 | 3.13 | 76.9 | 6.59 |
| **Fecundity*** | | | | |
| early: | 992 | | 6907 | |
| late: | 442 | | 6331 | |
| total: | 714 | | 6434 | |
| **% Previous spawners** | | | | |
| early: | | | 25.1 | |
| late: | | | 18.1 | |
| total: | | | 19.4 | |
| **Southwest Miramichi** | | | | |
| **% Female** | | | | |
| early: | 30.8 | | - | |
| late: | 12.1 | | 88.7 | |
| total: | 23.2 | | 88.7 | |
| **Fork length** | | | | |
| early: | 52.8 | 2.47 | 78.3 | 8.62 |
| late: | 55.7 | 2.72 | 77.0 | 6.08 |
| total: | 54.0 | 2.97 | 77.2 | 6.61 |
| **Fecundity*** | | | | |
| early: | 933 | | 6623 | |
| late: | 433 | | 6468 | |
| total: | 732 | | 6497 | |
| **% Previous spawners** | | | | |
| early: | | | 24.7 | |
| late: | | | 17.2 | |
| total: | | | 18.6 | |
| **Miramichi System** | | | | |
| **% Female** | | | | |
| early: | | | | |
| late: | | | | |
| total: | 23.1 | | 88.5 | |
| **Fork length** | | | | |
| early: | | | | |
| late: | | | | |
| total: | 54.0 | | 77.1 | |
| **Fecundity*** | | | | |
| early: | | | | |
| late: | | | | |
| total: | 725 | | 6467 | |
| **% Previous spawners** | | | | |
| early: | | | | |
| late: | | | | |
| total: | | | 19.0 | |

* Note: Eggs per fish (fecundity) calculations are based on fecundity length relationship and sex ratios (Randall 1989). Eggs per spawner (small) = $\%Female * e^{[3.1718*Ln(FL)-4.5636]}$ Eggs per spawner (large) = $\%Female * e^{[1.4132*Ln(FL)+2.7560]}$

**Table 17.** Egg deposition (millions of eggs) and % of conservation target met for early, late and total spawners for the NW Miramichi, SW Miramichi and Miramichi system in 1995.

| | | | Small | Large | Total | Contribution by Large | % Egg target met |
|---|---|---|---|---|---|---|---|
| Northwest | Early | | 5.1 | 17.6 | 22.7 | 77.5 % | |
| | Late | | 4.5 | 78.6 | 83.1 | 94.6 % | |
| | Total | | 11.8 | 96.7 | 108.5 | 89.1 % | |
| | | Target | | | 41.0 | 235.9 % | 264.6 % |
| Southwest | Early | | 10.4 | 19.9 | 30.3 | 65.7 % | |
| | Late | | 3.8 | 88.5 | 92.3 | 95.9 % | |
| | Total | | 14.1 | 108.5 | 122.6 | 88.5 % | |
| | | Target | | | 88.0 | 123.3 % | 139.3 % |
| Miramichi | Early | | | | | | |
| | Late | | | | | | |
| | Total | | 28.0 | 207.1 | 235.1 | 88.1% | |
| | | Target | | | 132.0 | 156.9 % | 178.1 % |

**Table 18.** Estimated returns and escapement to the Miramichi River (to Millbank 1971 to 1991; to enclosure area 1992 to 1995) of small and large salmon. % change is 1995 minus mean relative to the mean.

| Year | Returns to the Estuary | | Escapement | |
|---|---|---|---|---|
| | Small Salmon | Large Salmon | Small Salmon | Large Salmon |
| 1971 | 35,673 | 24,407 | 21,946 | 4,347 |
| 1972 | 46,275 | 29,049 | 27,135 | 17,671 |
| 1973 | 44,545 | 27,192 | 30,688 | 20,349 |
| 1974 | 73,418 | 42,592 | 55,186 | 34,445 |
| 1975 | 64,902 | 28,817 | 48,469 | 21,448 |
| 1976 | 91,580 | 22,801 | 62,380 | 14,332 |
| 1977 | 27,743 | 51,842 | 13,247 | 32,917 |
| 1978 | 24,287 | 24,493 | 14,353 | 10,829 |
| 1979 | 50,965 | 9,054 | 30,848 | 4,541 |
| 1980 | 41,588 | 36,318 | 26,894 | 18,873 |
| 1981 | 65,273 | 16,182 | 39,929 | 4,608 |
| 1982 | 80,379 | 30,758 | 56,000 | 13,258 |
| 1983 | 25,184 | 27,924 | 14,849 | 8,458 |
| 1984 | 29,707 | 15,137 | 18,929 | 14,687 |
| 1985 | 60,800 | 20,738 | 41,815 | 20,122 |
| 1986 | 117,549 | 31,285 | 89,398 | 30,216 |
| 1987 | 84,816 | 19,421 | 62,777 | 18,056 |
| 1988 | 121,919 | 21,745 | 90,278 | 20,980 |
| 1989 | 73,231 | 17,211 | 48,385 | 15,540 |
| 1990 | 83,148 | 28,574 | 59,524 | 27,588 |
| 1991 | 60,869 | 29,949 | 48,269 | 29,089 |
| 1992 | 152,647 | 37,000 | 129,288 | 35,927 |
| 1993 | 92,400 | 35,200 | 76,416 | 34,702 |
| 1994 | 56,929 | 27,544 | 42,479 | 27,147 |
| 1995 | 54,145 | 32,627 | 33,347 | 32,093 |
| % change 5-year | -39% | -7% | -41% | -5% |
| historical | -16% | +1% | -12% | +38% |

**Table 19.** Numbers of large and small salmon counted at barriers in three tributaries of the Miramichi River, 1981 to 1995.

| 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 |
| 1990-94 | Mean | 908 | 1219 | 2127 | | |
| | Change (95-mean)/mean | 12% | -34% | -14% | | |
| *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 |
| 1990-94 | Mean | 226 | 540 | 766 | | |
| | Change (95-mean)/mean | -58% | -39% | -45% | | |
| *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 |
| 1990-94 | Mean | 244 | 991 | 1235 | | |
| | Change (95-mean)/mean | 3% | -45% | -35% | | |

**Table 20.** Counts of migrant parr, smolts, small salmon and large salmon at Catamaran Brook, Northwest Miramichi 1990 to 1995. Data courtesy of R. Cúnjak (DFO Science, Moncton, NB). Migrant parr (ages ≥ 1) counts are for May to November. Survivals back to the fence as small and large salmon are based on smolt counts only.

| | Downstream | | Upstream | | Survival to | |
|---|---|---|---|---|---|---|
| Year | Migrant parr | Smolts | Small salmon | Large salmon | Small salmon | Large salmon |
| 1990 | 851[1] | 760 | 83[1] | 28[1] | 0.103 | 0.086 |
| 1991 | 1684 | 1165 | 78 | 49 | 0.109 | 0.037 |
| 1992 | 1229 | 2135 | 127 | 65 | 0.050 | 0.012 |
| 1993 | 1371 | 426 | 106 | 43 | 0.134 | 0.169 |
| 1994 | 1779 | 887 | 57 | 25 | 0.133 | |
| 1995 | 1620 | 935 | 118 | 72 | | |

[1] incomplete count because of damage to counting fence

Table 21. Relative contribution of wild (non-adipose clipped) salmon to the returns in 1995.

| | Counts of fish by origin | | | | | |
|---|---|---|---|---|---|---|
| | Small salmon | | | Large salmon | | |
| | Wild | Adipose-clipped | % Wild | Wild | Adipose-clipped | % Wild |
| **Southwest Miramichi** | | | | | | |
| Sampling at Enlcosure and Millerton trapnets | | | | | | |
| June to August | 1629 | 5 | 99.7% | 434 | 2 | 99.5% |
| Sept. to October | 2305 | 3 | 99.9% | 2185 | 5 | 99.8% |
| Total | 3934 | 8 | 99.8% | 2619 | 7 | 99.7% |
| Creel survey at Quarryville Pool | | | | | | |
| July | 50 | 1 | 98.0% | . | . | . |
| August | 37 | 0 | 100.0% | . | . | . |
| September | 91 | 0 | 100.0% | . | . | . |
| October | 33 | 0 | 100.0% | . | . | . |
| Total | 211 | 1 | 99.5% | . | . | . |
| Renous River | | | | | | |
| Partial counting fence | | | | | | |
| June | 34 | 4 | 89.5% | 4 | 0 | 100.0% |
| July | 294 | 10 | 96.7% | 22 | 0 | 100.0% |
| August | 74 | 0 | 100.0% | 11 | 0 | 100.0% |
| September | 30 | 0 | 100.0% | 6 | 0 | 100.0% |
| Total | 432 | 14 | 96.9% | 43 | 0 | 100.0% |
| Seining at Furlong Bridge of Dungarvon River | | | | | | |
| Sept. 12 | 34 | 0 | 100.0% | 3 | 0 | 100.0% |
| Clearwater Brook (received satellite reared fall fingerlings) | | | | | | |
| Sening at Bridge Pool | | | | | | |
| Sept. 8 | 42 | 2 | 95.5% | 12 | 0 | 100.0% |
| Rocky Brook (received satellite reared fall fingerlings) | | | | | | |
| Seining at McGrath Pool | | | | | | |
| Sept. 9 | 39 | 17 | 69.6% | 23 | 0 | 100.0% |
| **Northwest Miramichi** | | | | | | |
| Sampling at Red Bank trapnets | | | | | | |
| June to August | 558 | 6 | 98.9% | 153 | 1 | 99.4% |
| September to October | 867 | 2 | 99.8% | 709 | 0 | 100.0% |
| Total | 1425 | 8 | 99.4% | 862 | 1 | 99.9% |
| Little Southwest Miramichi (no marked fish stocked here prior to 1995) | | | | | | |
| Seining at Moose Landing and Smiths Forks | | | | | | |
| Sept. 11 to Oct. 4 | 87 | 1 | 98.9% | 6 | 0 | 100.0% |
| Northwest Miramichi (at DNRE barrier) | | | | | | |
| Sept. 20 | 55 | 0 | 100.0% | 29 | 0 | 100.0% |
| Sevogle River (Trash heap Pool) | | | | | | |
| Oct. 12 | 56 | 0 | 100.0% | 3 | 0 | 100.0% |
| Little River (counting trap) | | | | | | |
| Oct. 15 to Oct. 25 | 42 | 2 | 95.5% | 17 | 0 | 100.0% |

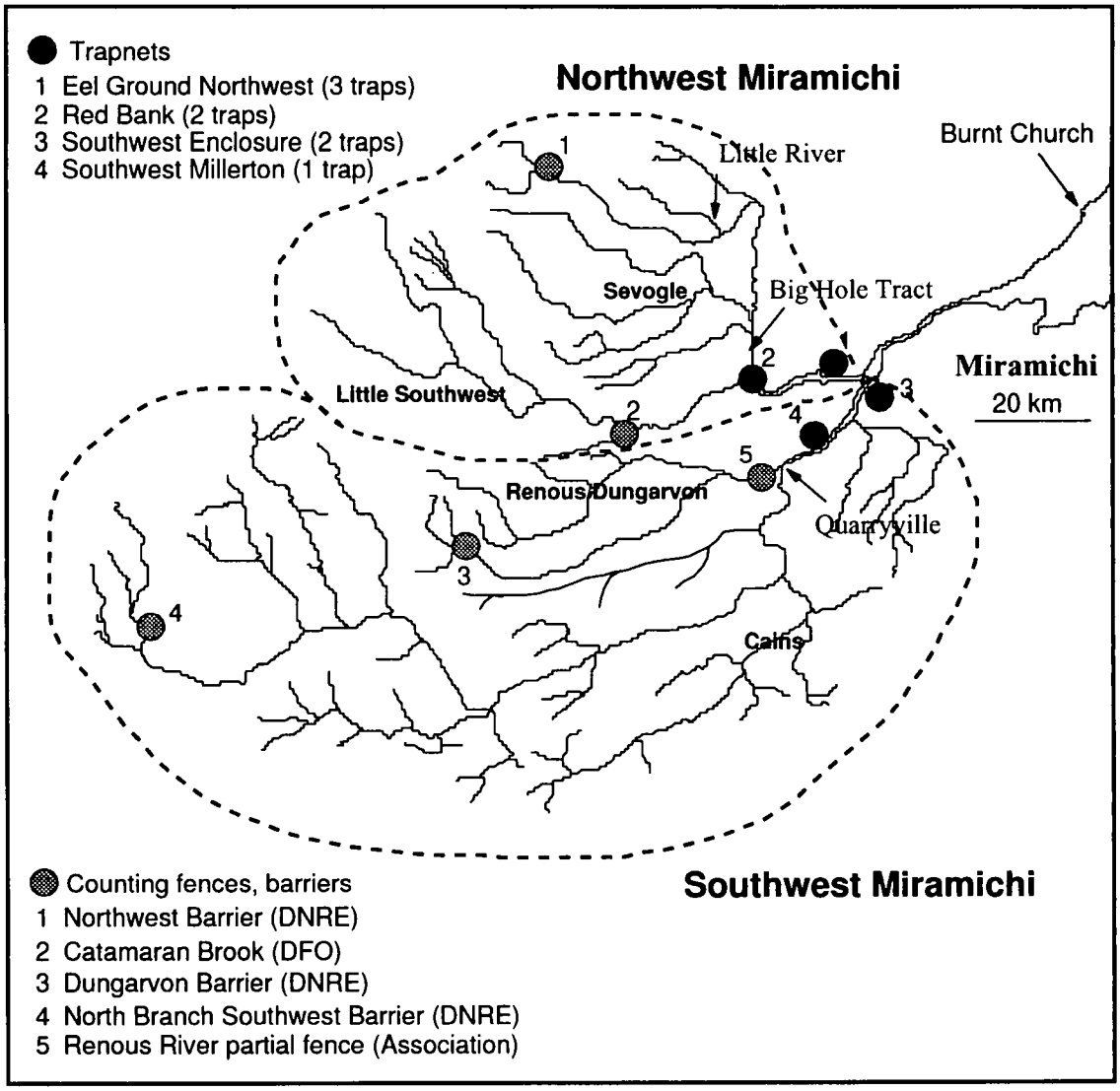
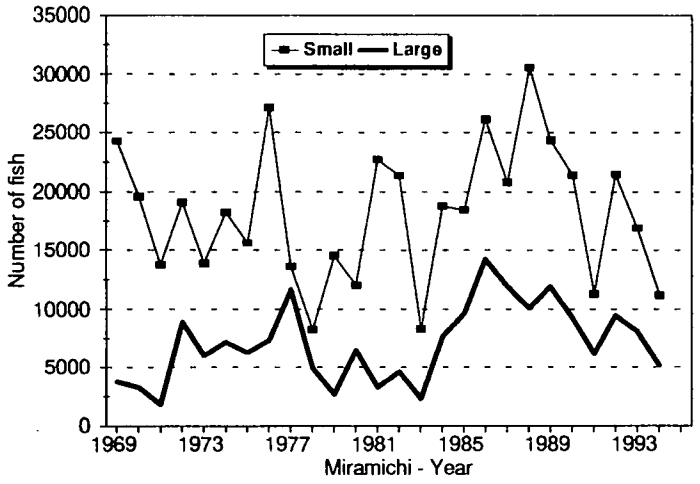
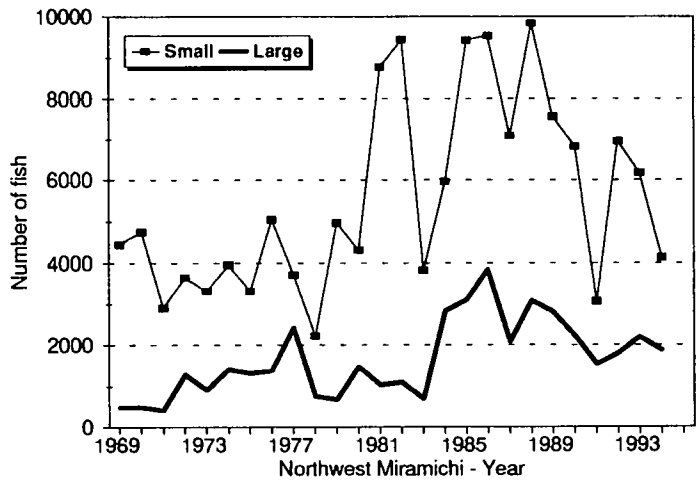



Figure 1. The Miramichi River indicating major branches, major tributaries and location of trapnets and counting fences operated in 1995.



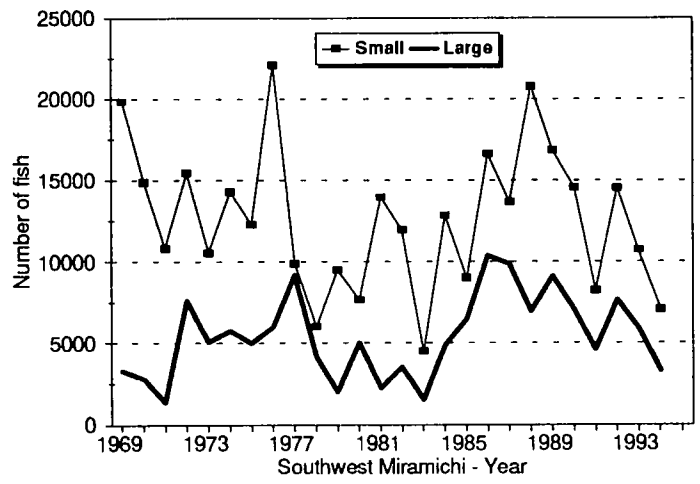




Figure 2. Trends in angling catches of small and large salmon from the Miramichi River (top), Northwest Miramichi (middle) and Southwest Miramichi (bottom), 1969 to 1994.

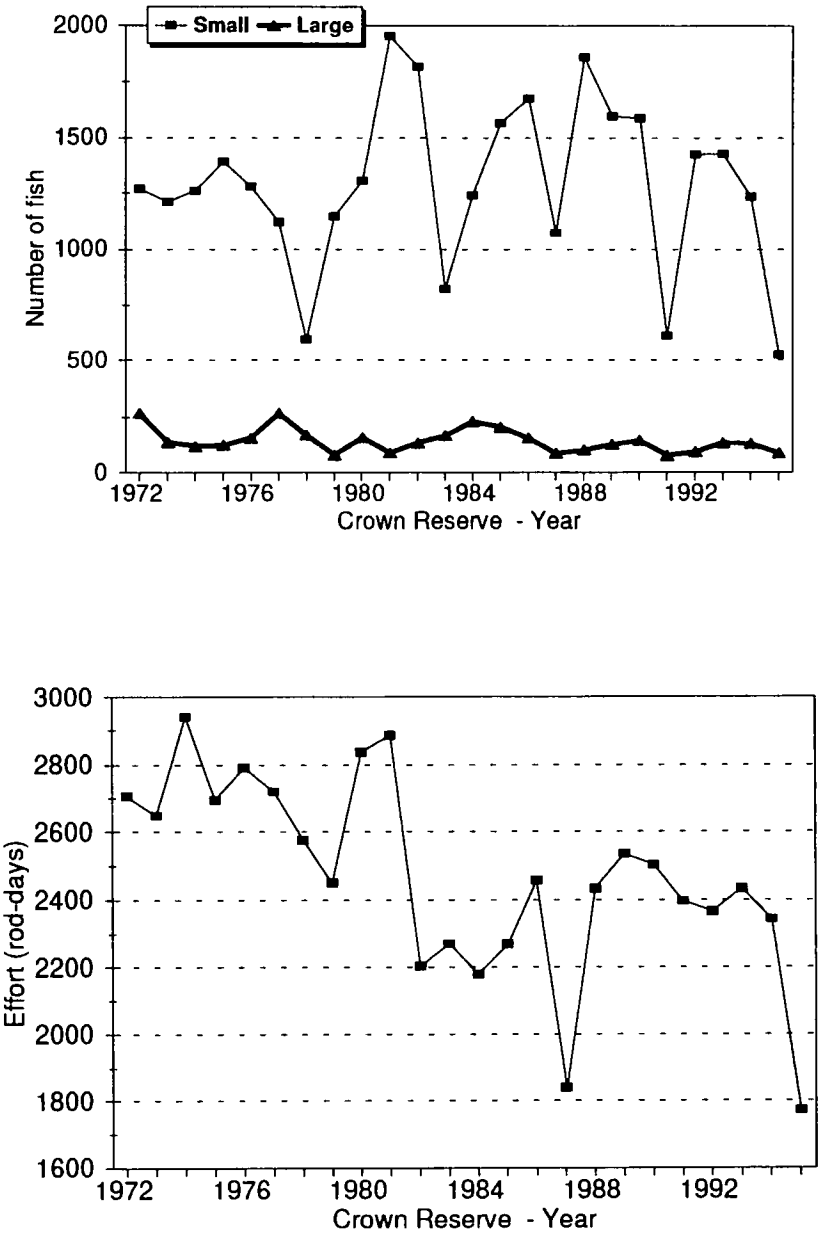
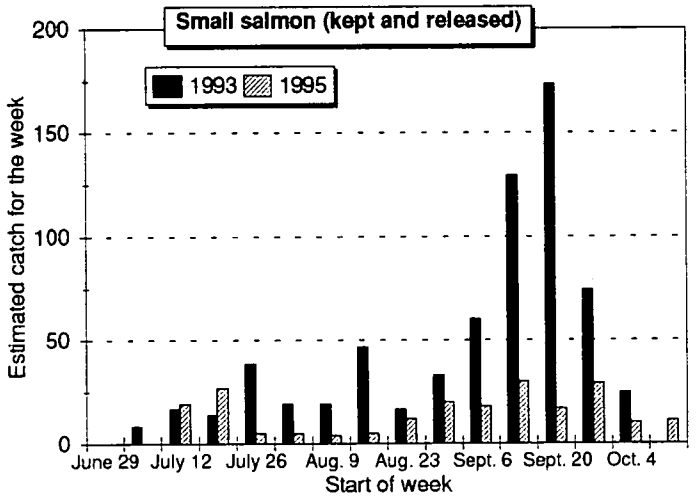
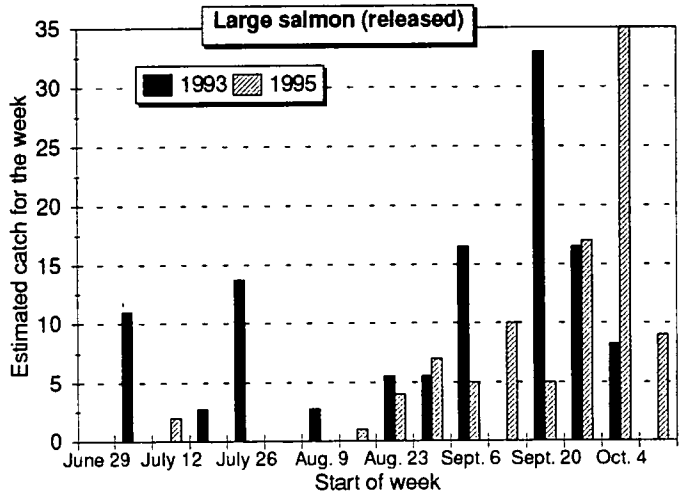
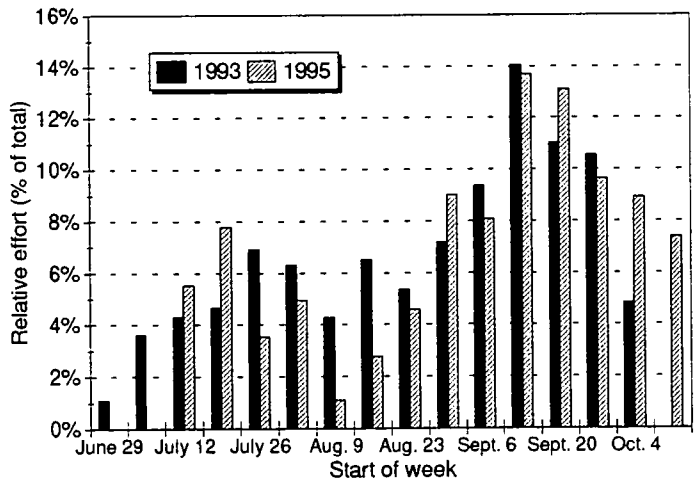



Figure 3. Trends in effort and catch of small and large salmon from the Crown Reserve waters of the Northwest Miramichi, 1972 to 1995.



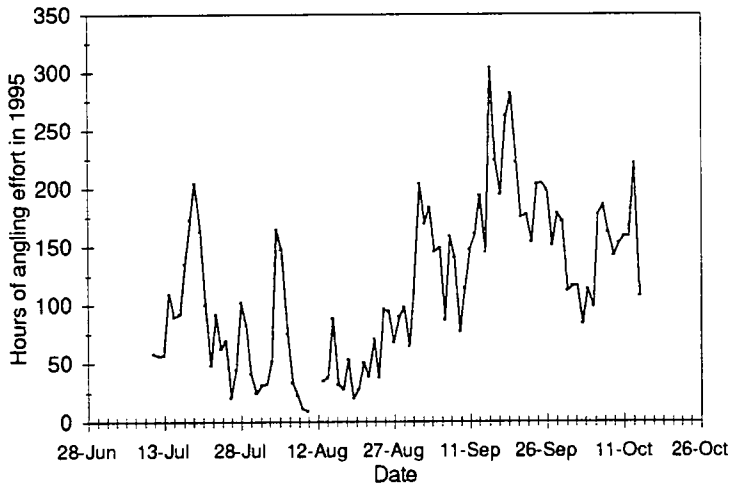




Figure 4. Catches of small and large salmon as well as daily (1995) and weekly distribution of effort at Quarryville pool determined by creel survey in 1993 and 1995.

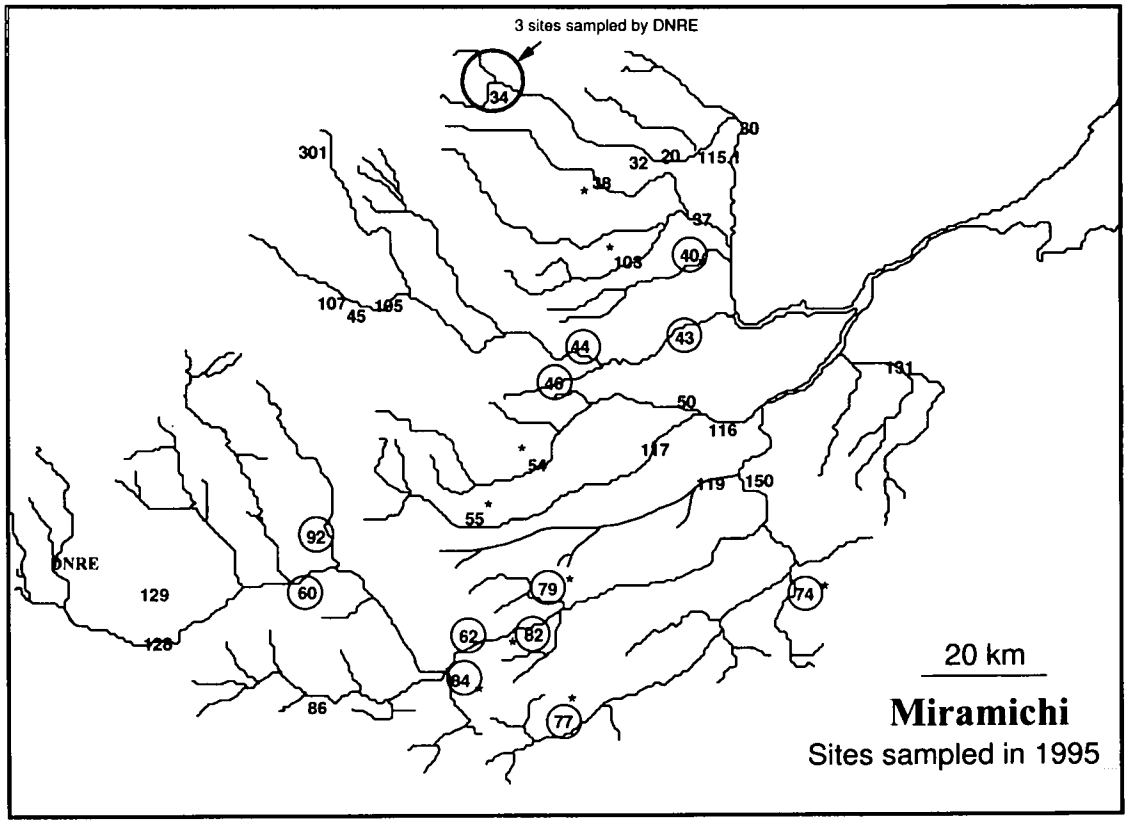



Figure 5. Juvenile salmon electrofishing sites, identified by sequential site number, sampled in 1995. Circled sites are index sites. Asterisk indicates closed sites.

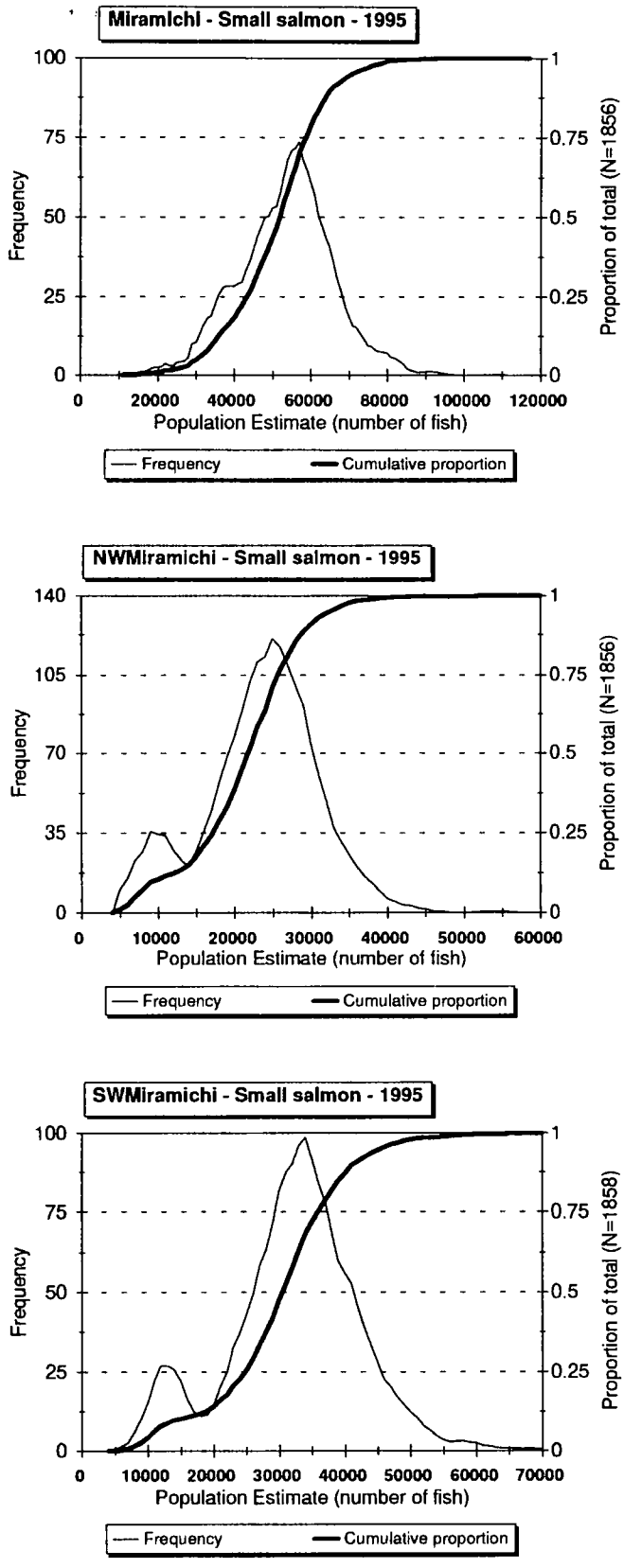



Figure 6. Estimated returns of small salmon to the Miramichi River (upper), Northwest Miramichi (middle) and Southwest Miramichi (lower) in 1995.

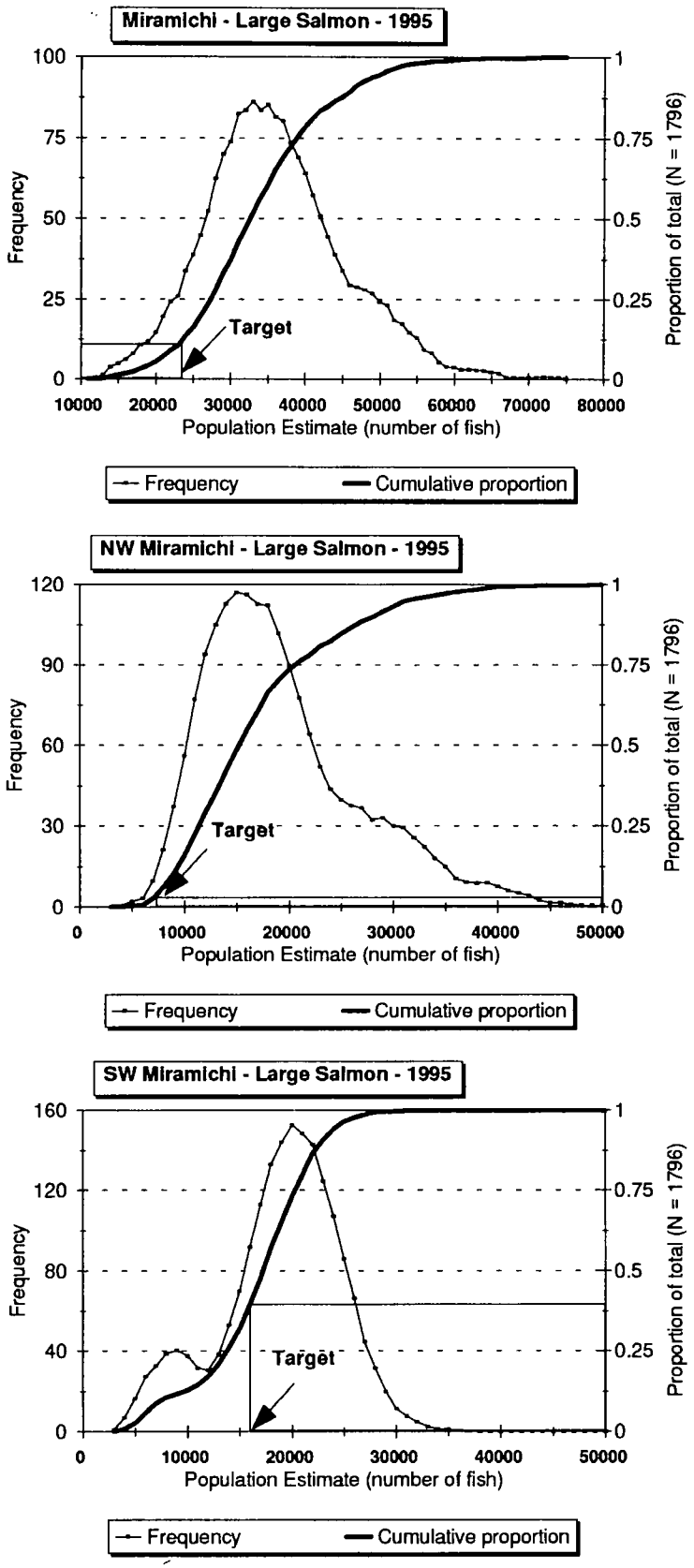



Figure 7. Estimated returns of large salmon to the Miramichi River (upper), Northwest Miramichi (middle) and Southwest Miramichi (lower) in 1995.

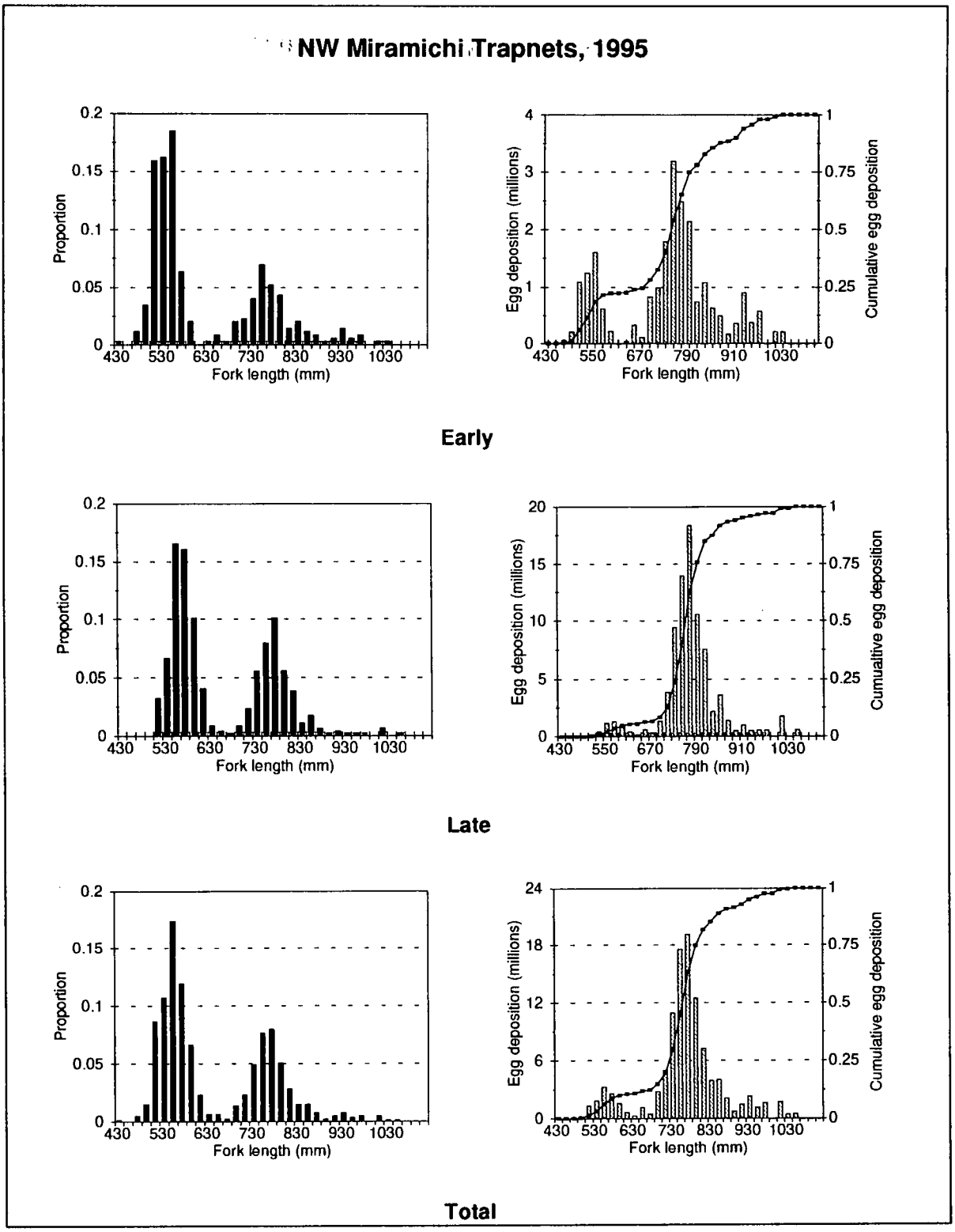



Figure 8. Proportion at length, egg deposition at length and cumulative egg deposition at length for early, late and total spawners in the Northwest Miramichi during 1995.

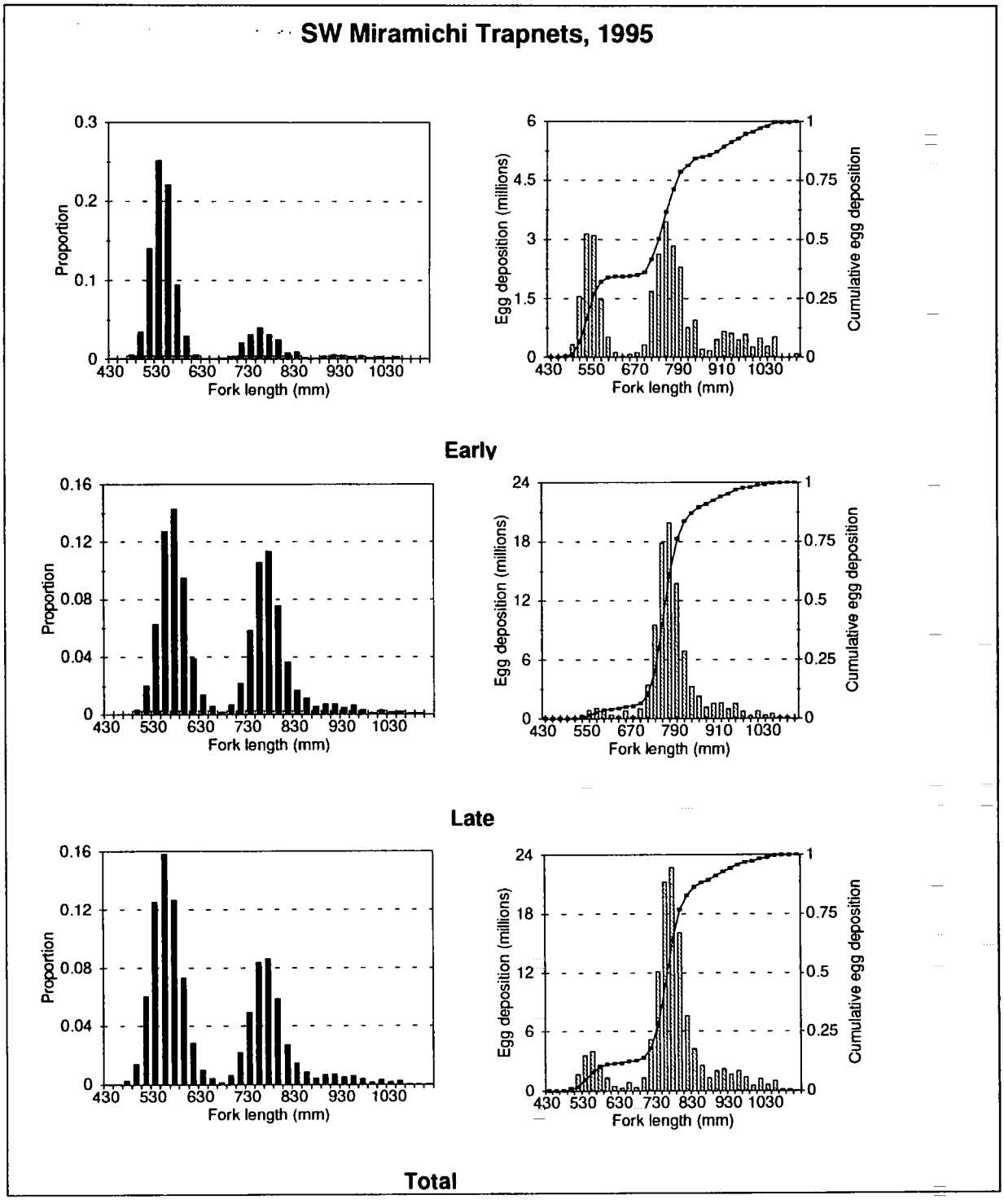



Figure 9. Proportion at length, egg deposition at length and cumulative egg deposition at length for early, late and total spawners in the Southwest Miramichi during 1995

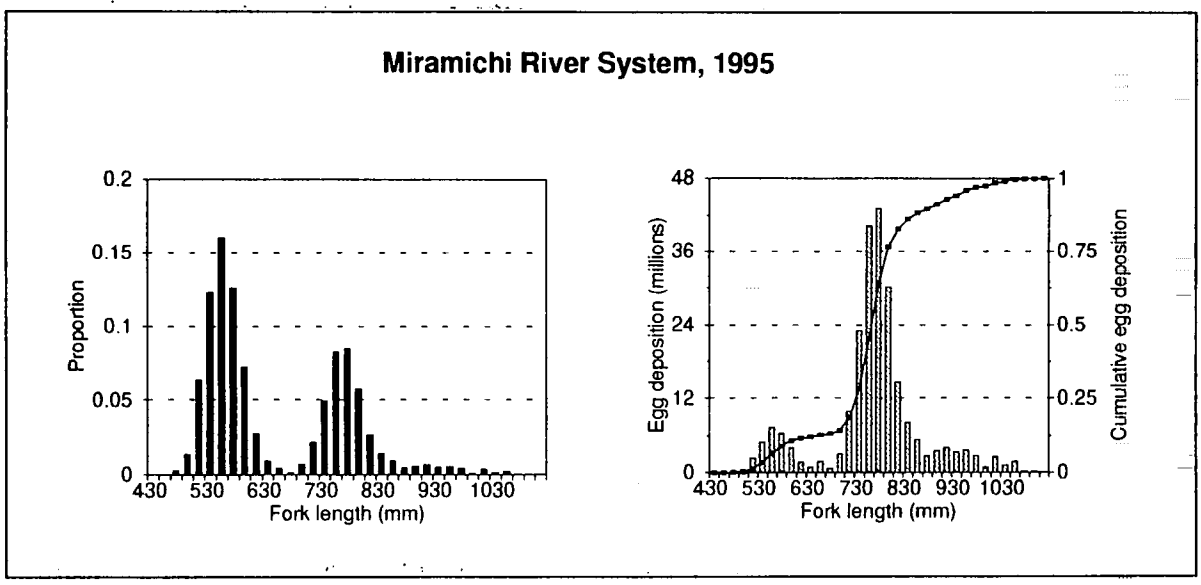



Figure 10. Proportion at length, egg deposition at length and cumulative egg deposition at length for the total spawners of the Miramichi system during 1995.

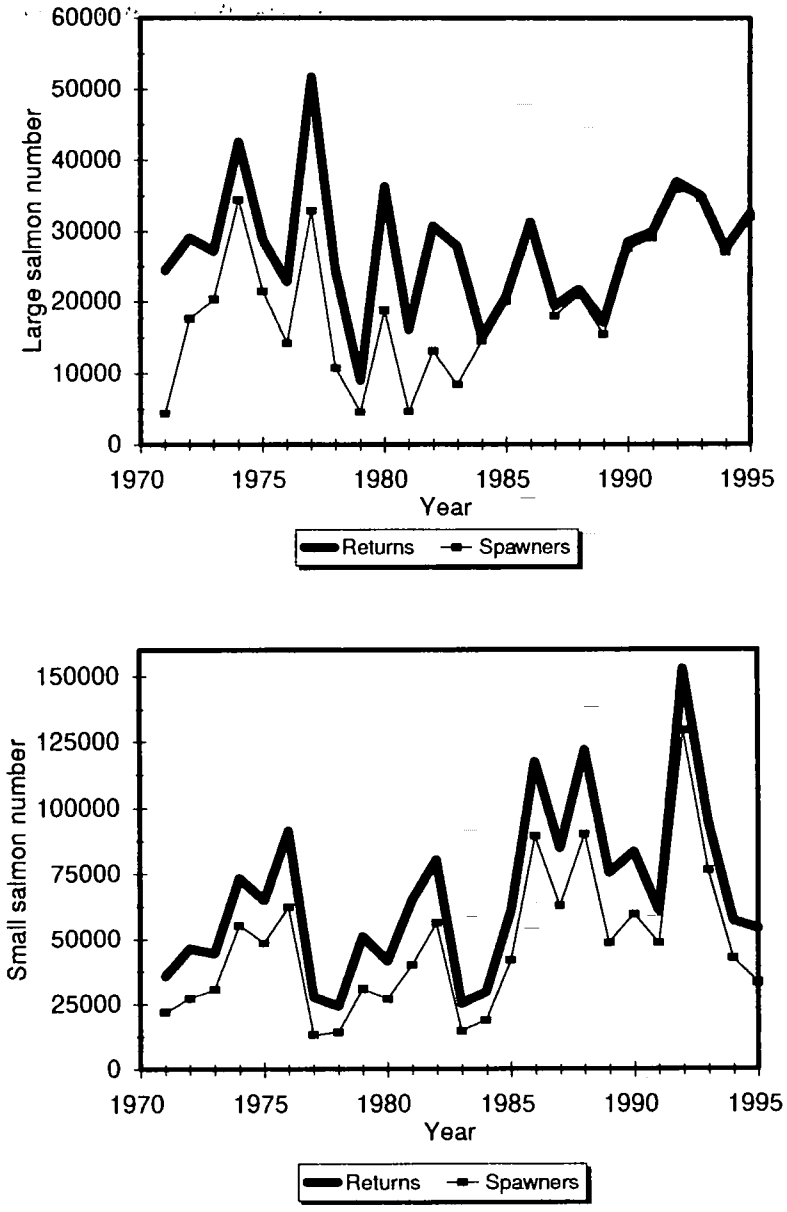



Figure 11. Total returns to the Miramichi River estuary and number of spawners of large (upper) and small (lower) salmon, 1971 to 1995.

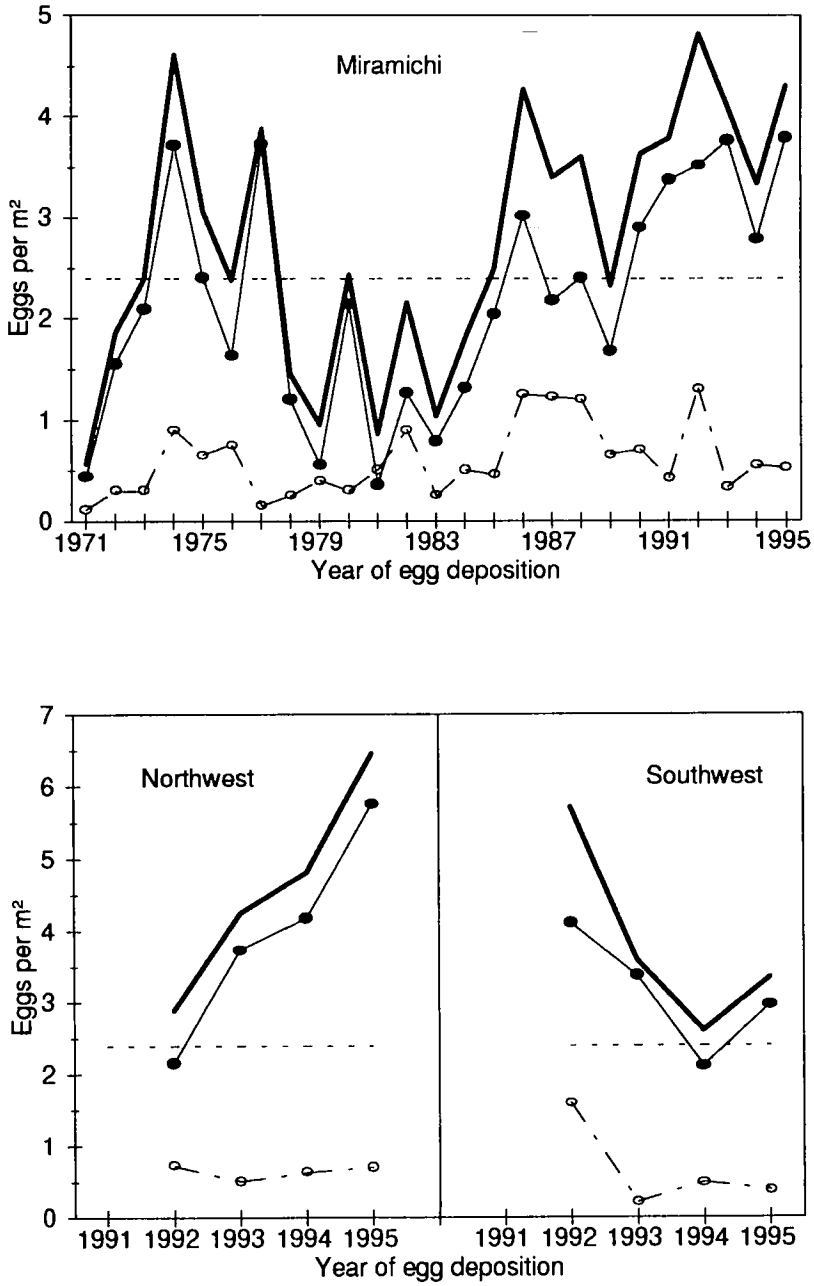



Figure 12. Annual egg depositions (eggs per m²) by small (circle stipled line), large (dots and narrow line) and combined (thick line) for the Miramichi River, 1971 to 1995 (upper) and for the Northwest and Southwest branches, 1992 to 1995 (lower). Dashed line is the target egg deposition level of 2.4 eggs per m².

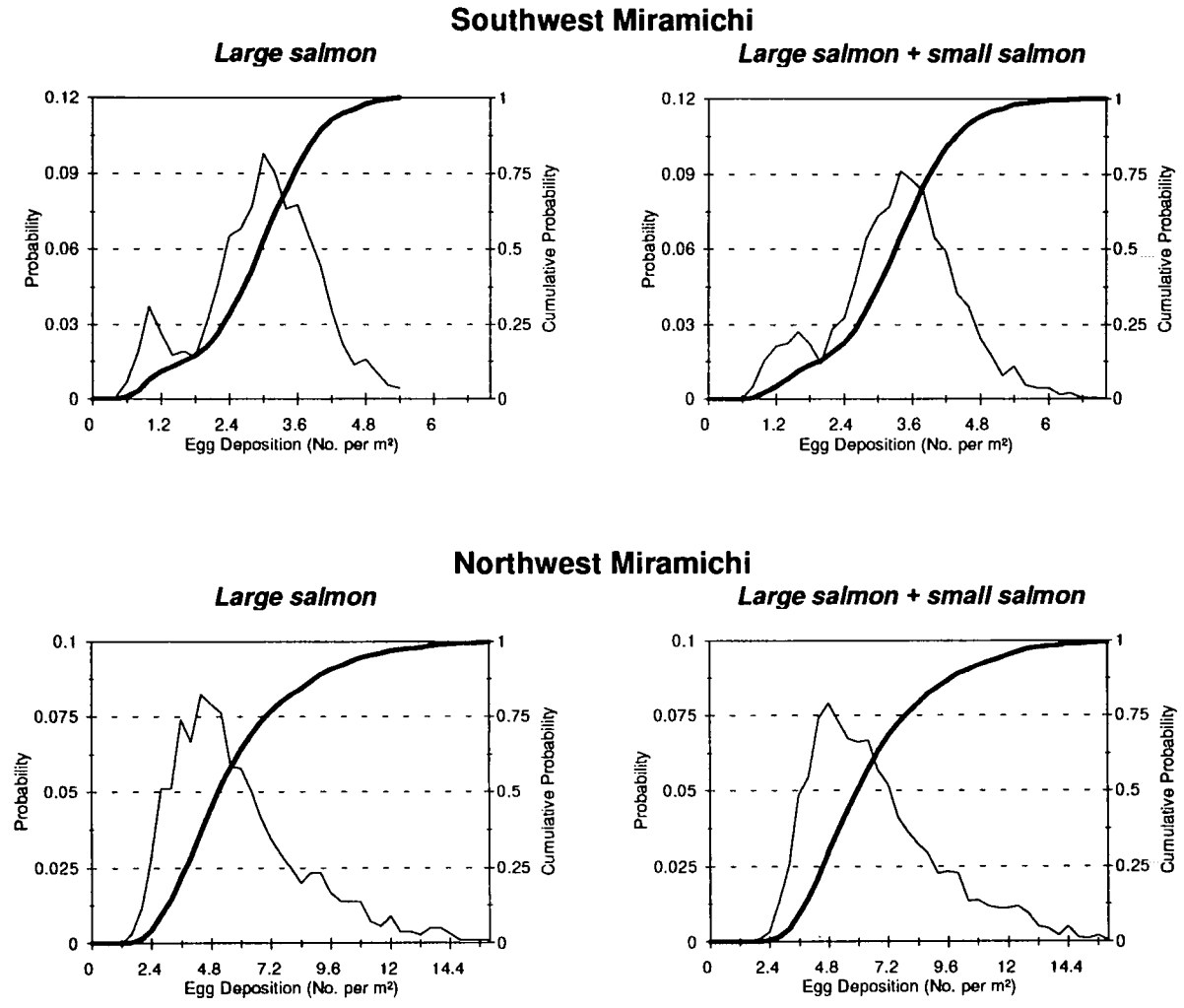



Figure 13. Probability plots of the estimated egg depositions to the Southwest Miramichi (upper) and the Northwest Miramichi (lower) in 1995. Target egg deposition for both branches is 2.4 eggs per $m^2$.

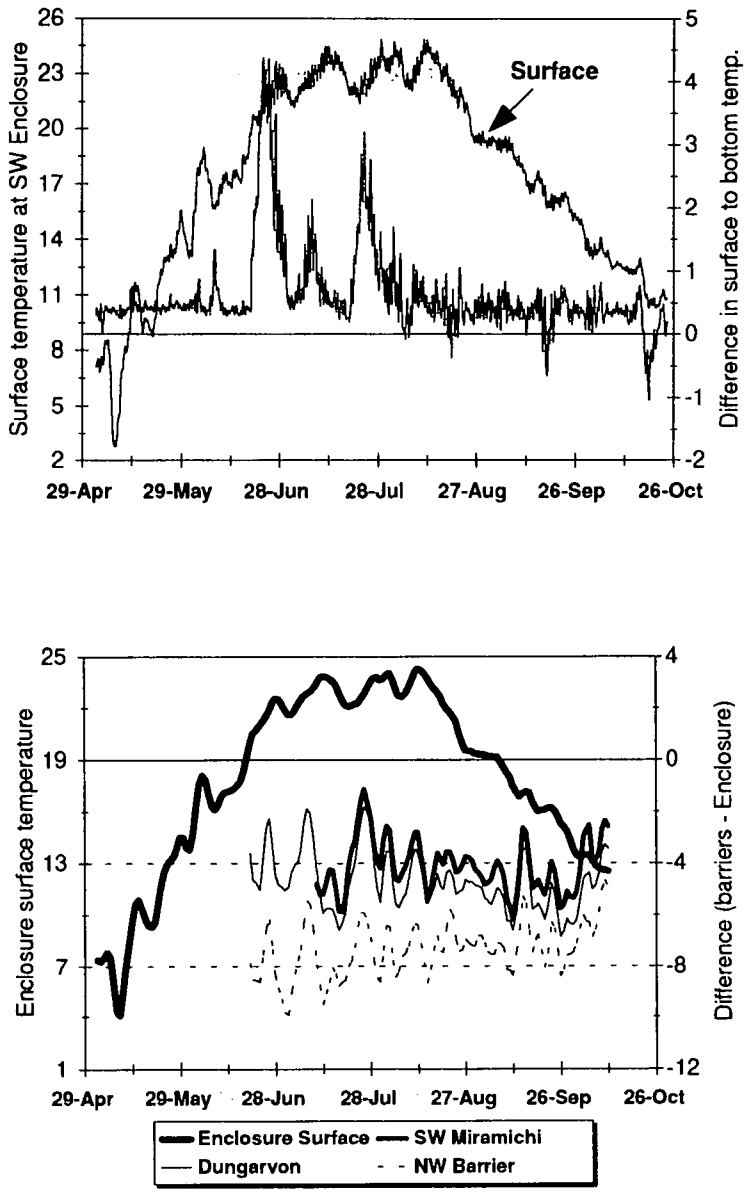



Figure 14. Water temperature profiles from the Soutwest Enclosure trapnet site and at the three DNRE protection barriers in the Southwest and Northwest branches in 1995.

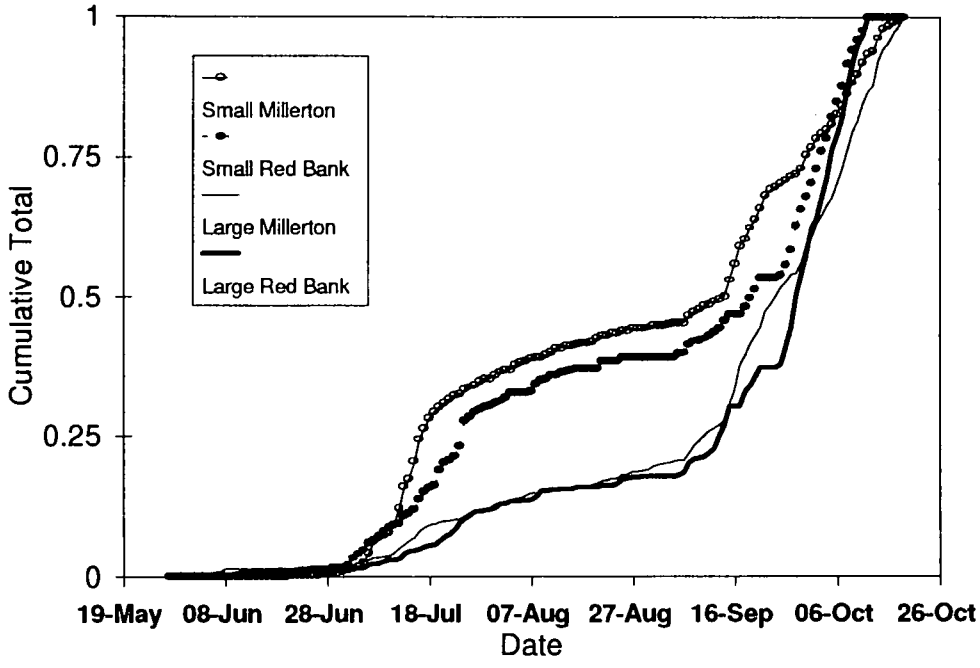
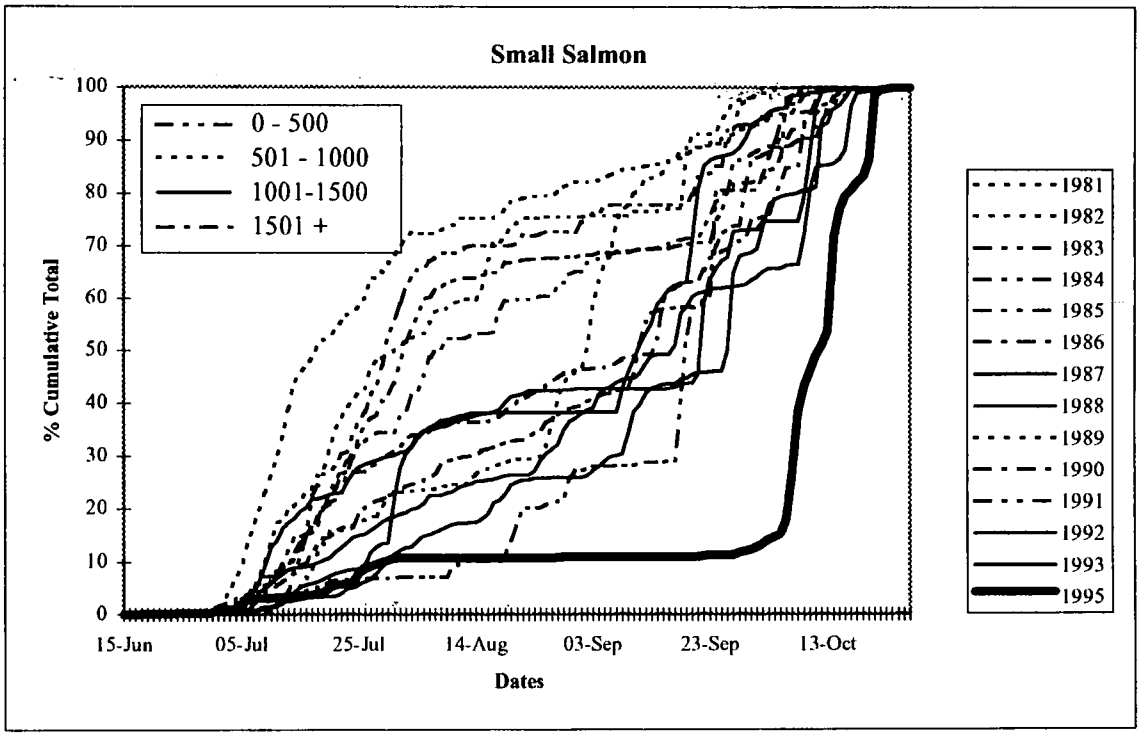



Figure 15. Distribution and timing of small and large salmon at the Millerton trapnet (Southwest Miramichi) and the Red Bank trapnets (Northwest Miramichi) in 1995.



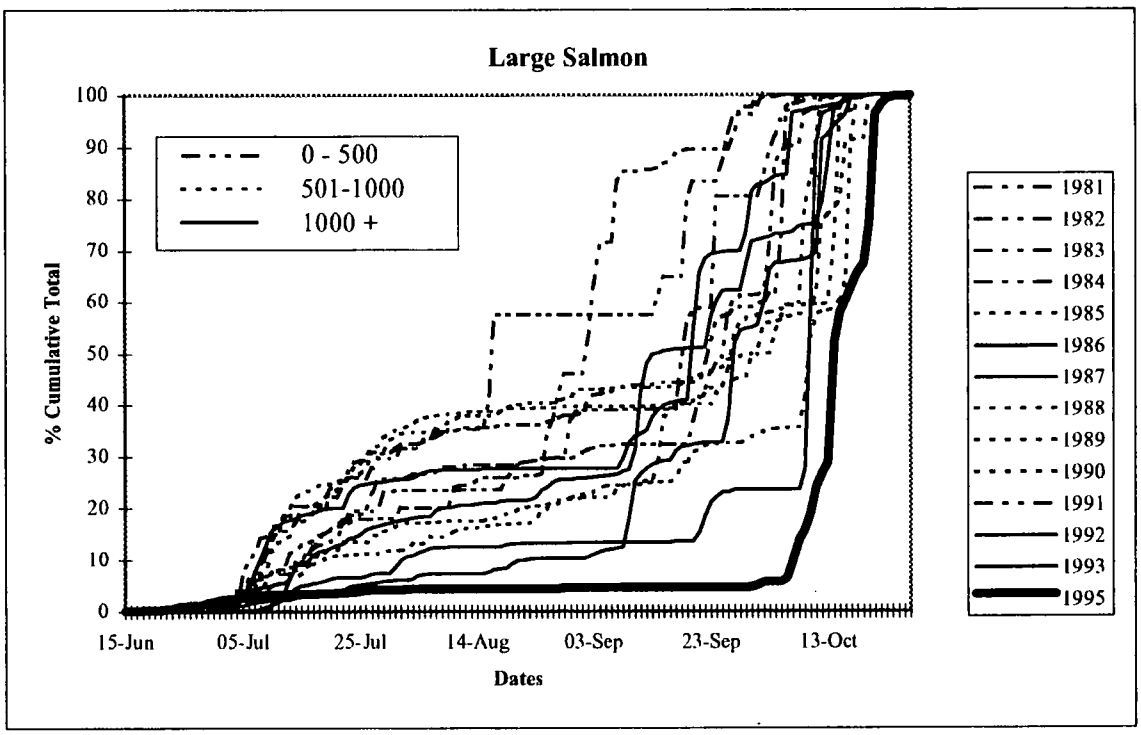
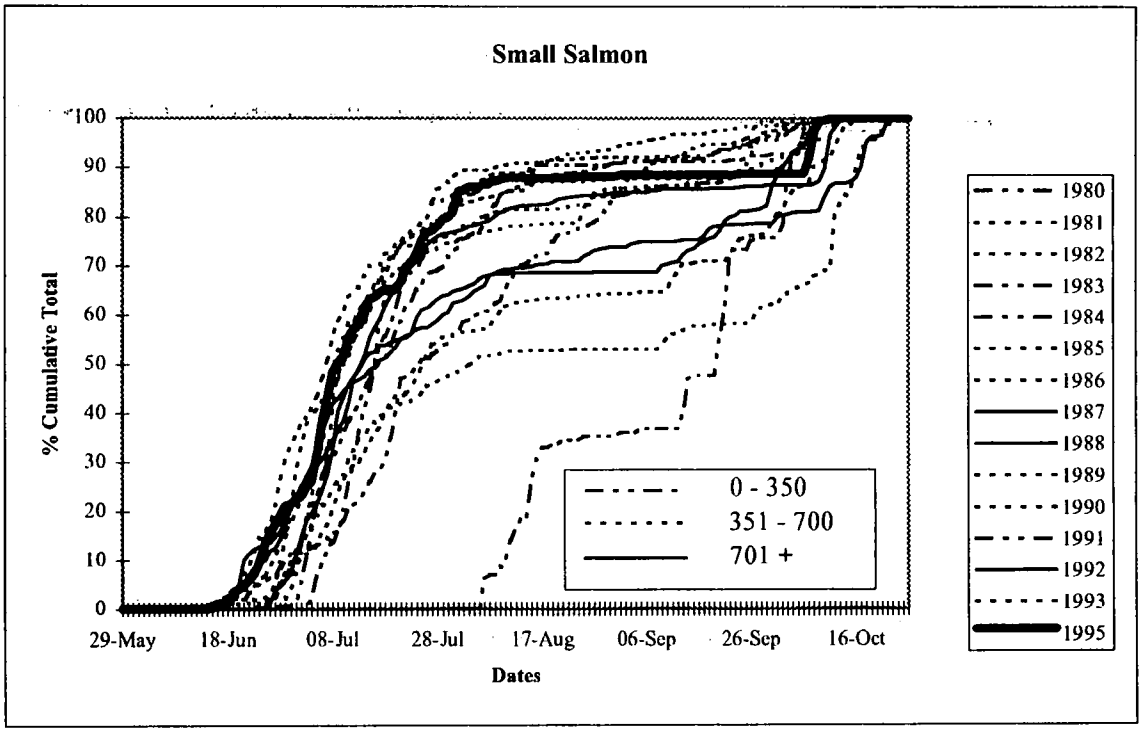




**Figure 16.** Distribution and timing of small and large salmon runs for the Bridge Pool (Juniper) Barrier (Southwest Miramichi) from 1981 to 1993 and 1995. 1994 data were not available.



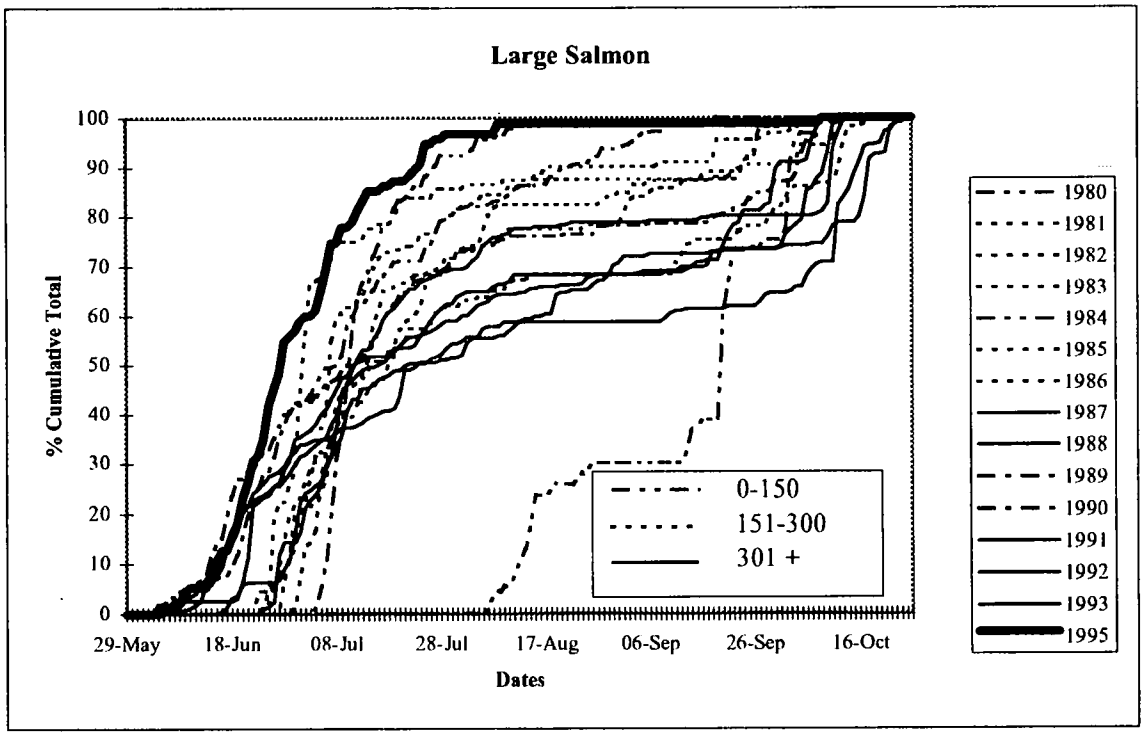




**Figure 17.** Distribution and timing of small and large salmon runs for the Dungarvon Barrier (Southwest Miramichi) from 1980 to 1993, 1995. Data for 1994 were not available.

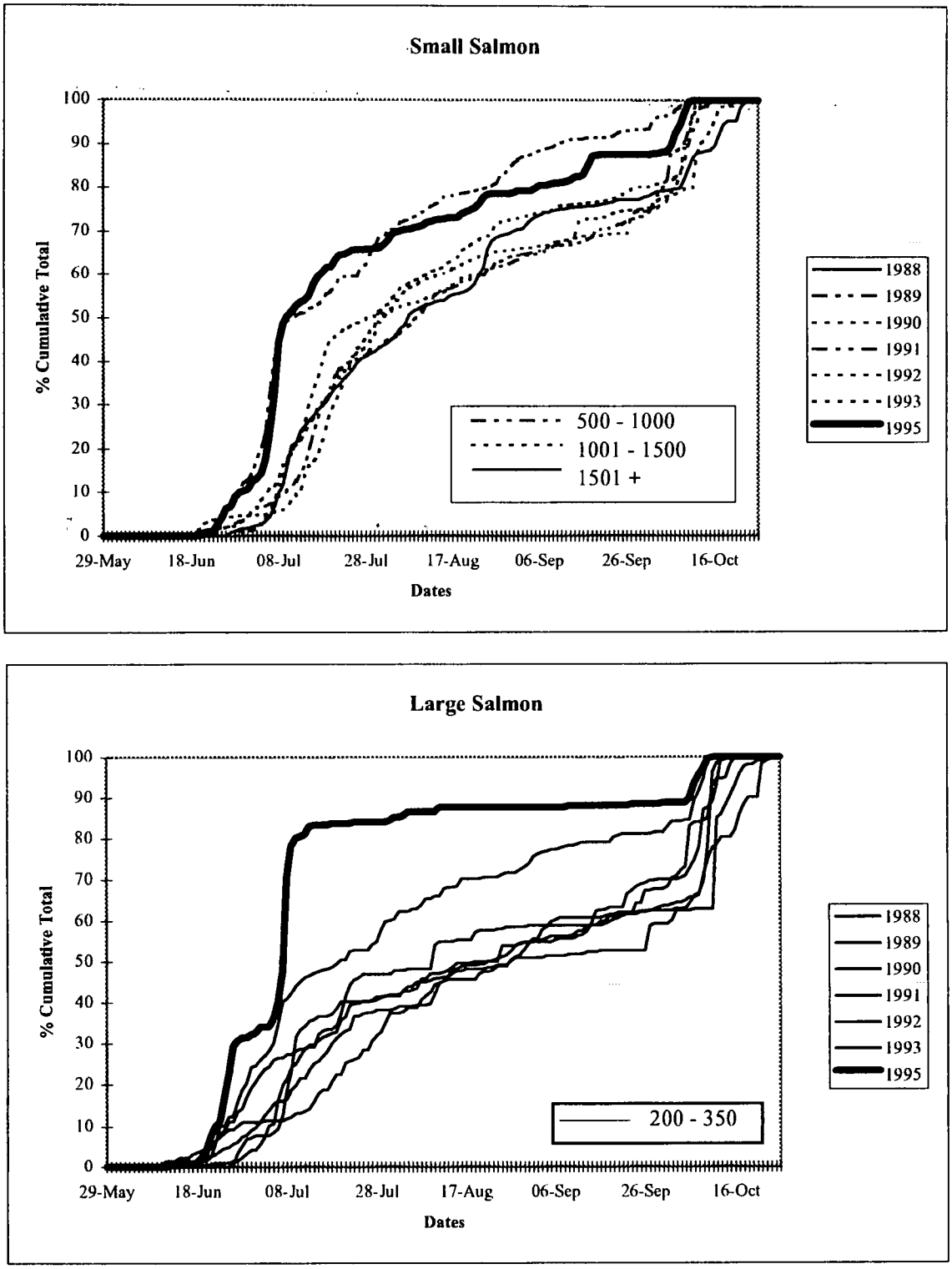



**Figure 18.** Distribution and timing of small and large salmon runs for the NW Miramichi Barrier (Northwest Miramichi) from 1988 to 1993 and 1995. Data for 1994 were not available.

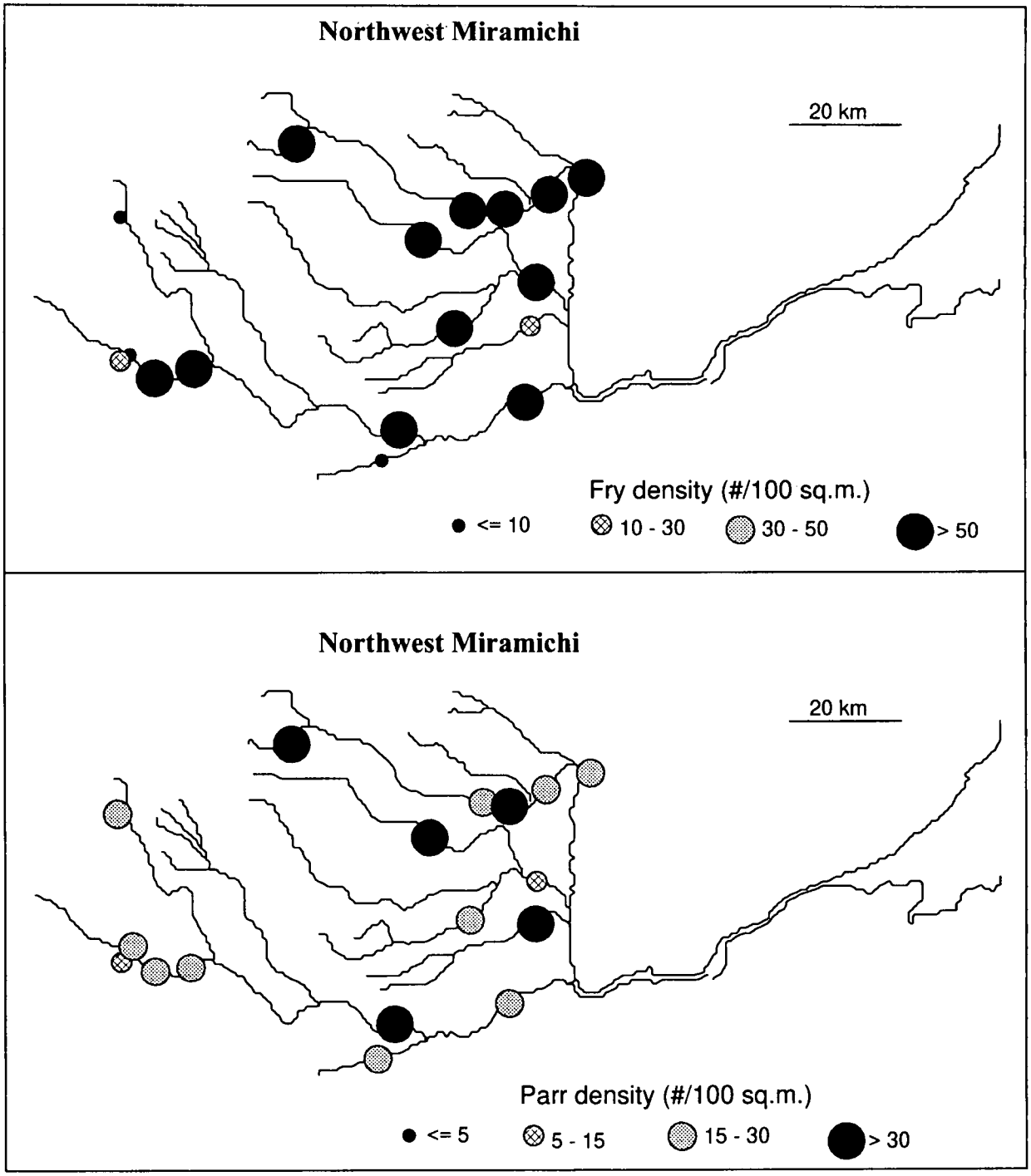



Figure 19. Observed fry (upper) and parr (lower) densities in the Northwest Miramichi in 1995.

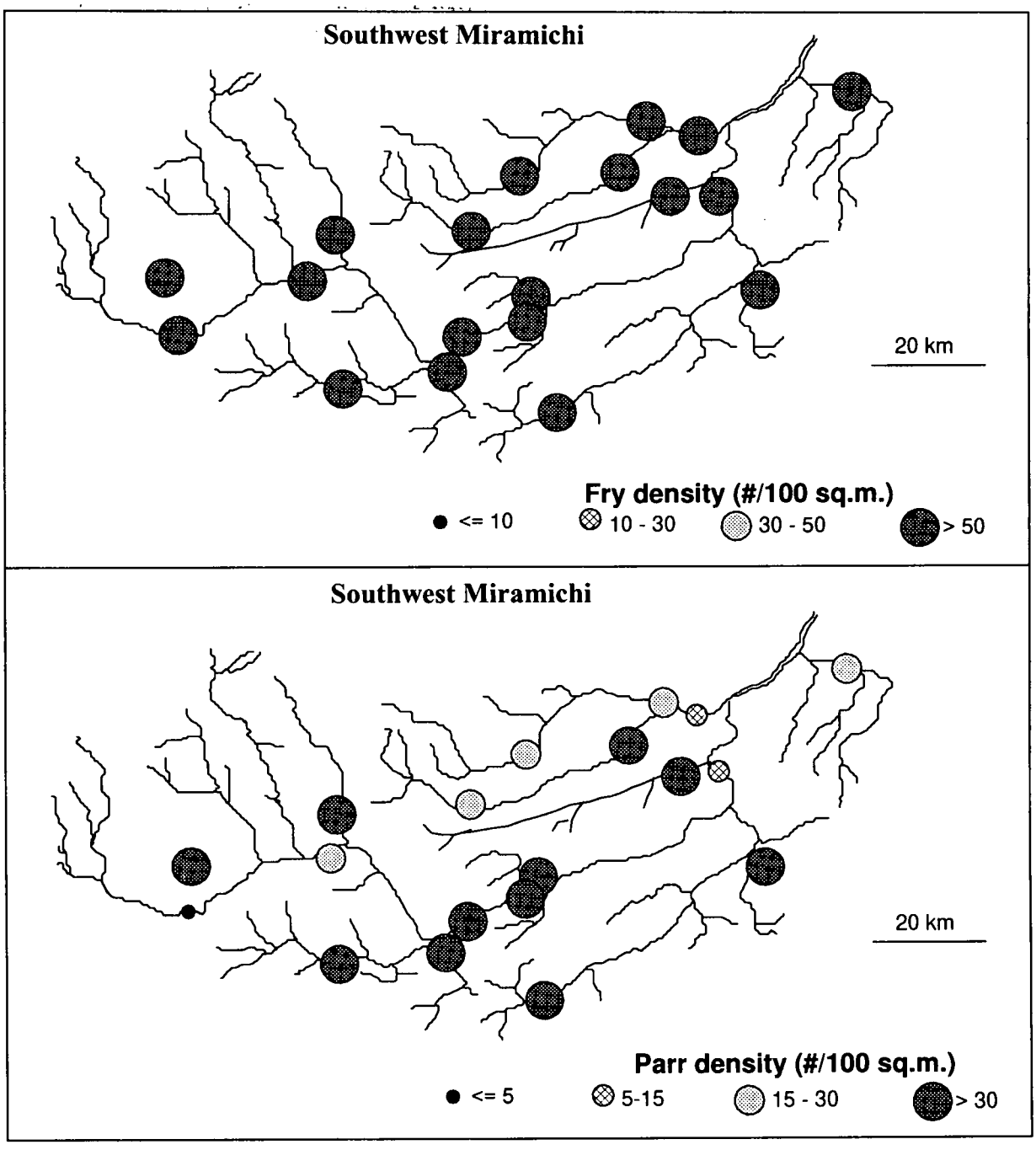



Figure 20. Observed fry (upper) and parr (lower) densities in the Southwest Miramichi in 1995.

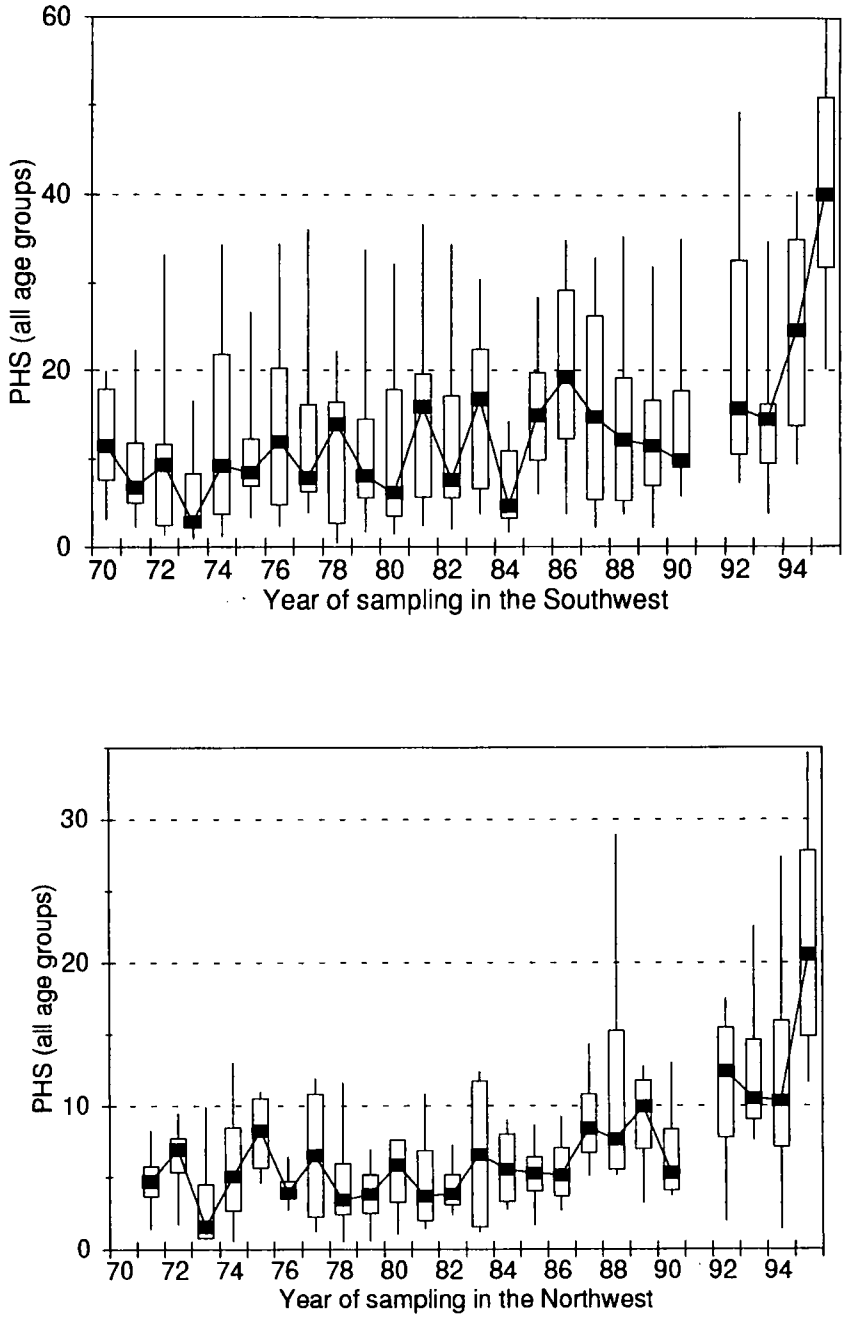



Figure 21. Percent Habitat Saturation (PHS) index of juvenile Atlantic salmon at nine index sites in the Southwest Miramichi (upper) and four index sites in the Northwest Miramichi (lower) for 1970 to 1995. Box plots are interpreted as follows: vertical line = 5th to 95th percentile range, box = 25th to 75th percentile range, square = median value.

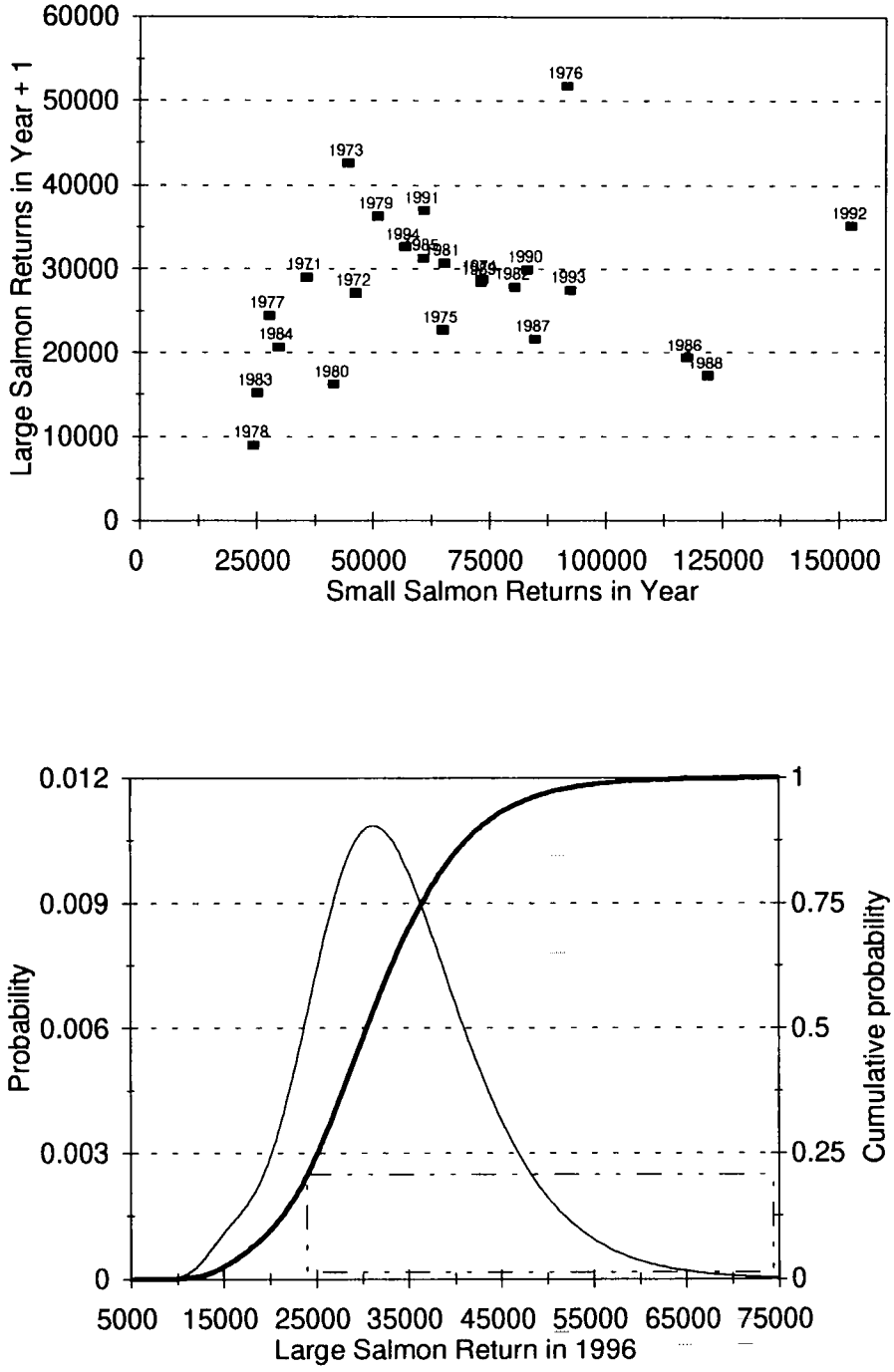



Figure 22. Preseason forecast model of the large salmon returns to the Miramichi (upper) and the 1996 large salmon return forecast probability (lower).

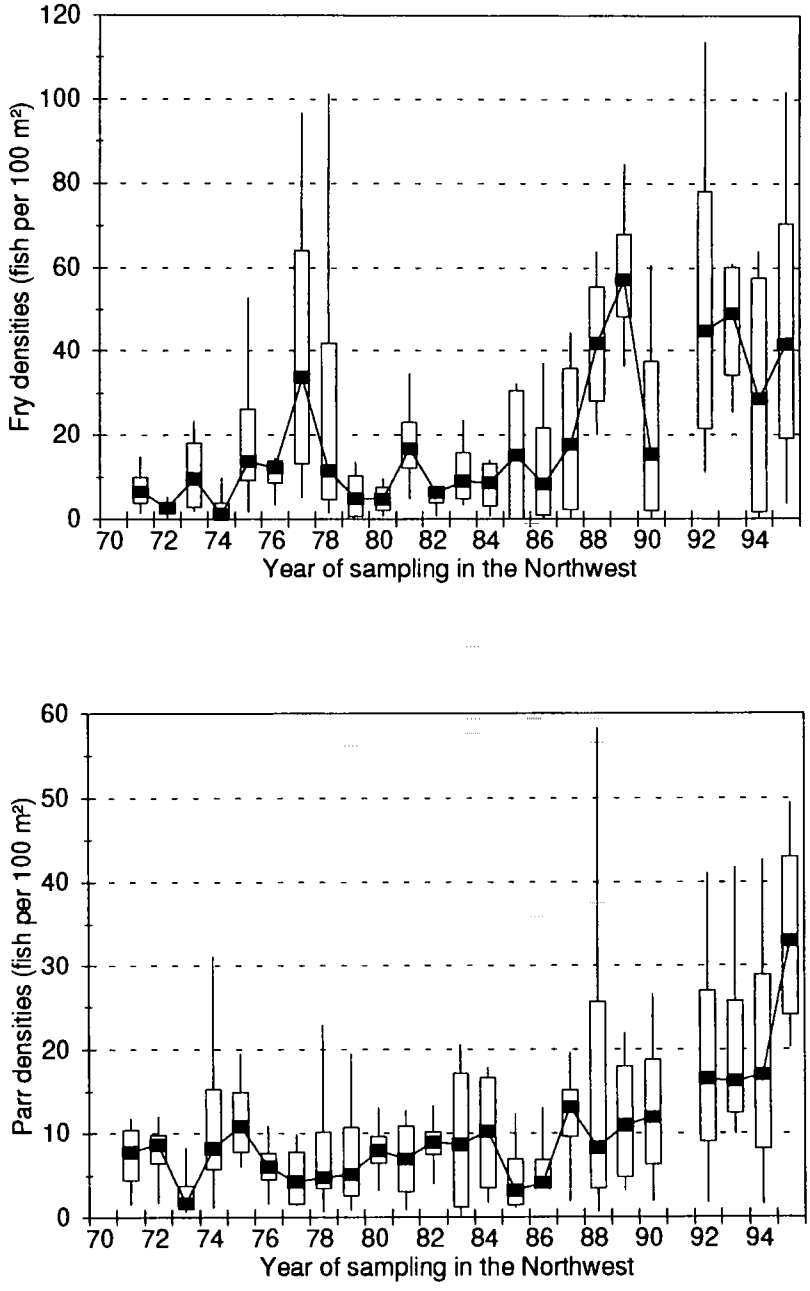



Figure 23. Atlantic salmon fry (upper) and parr (lower) densities at four index sites in the Northwest Miramichi, 1970 to 1995. Box plots are interpreted as in Figure 21.

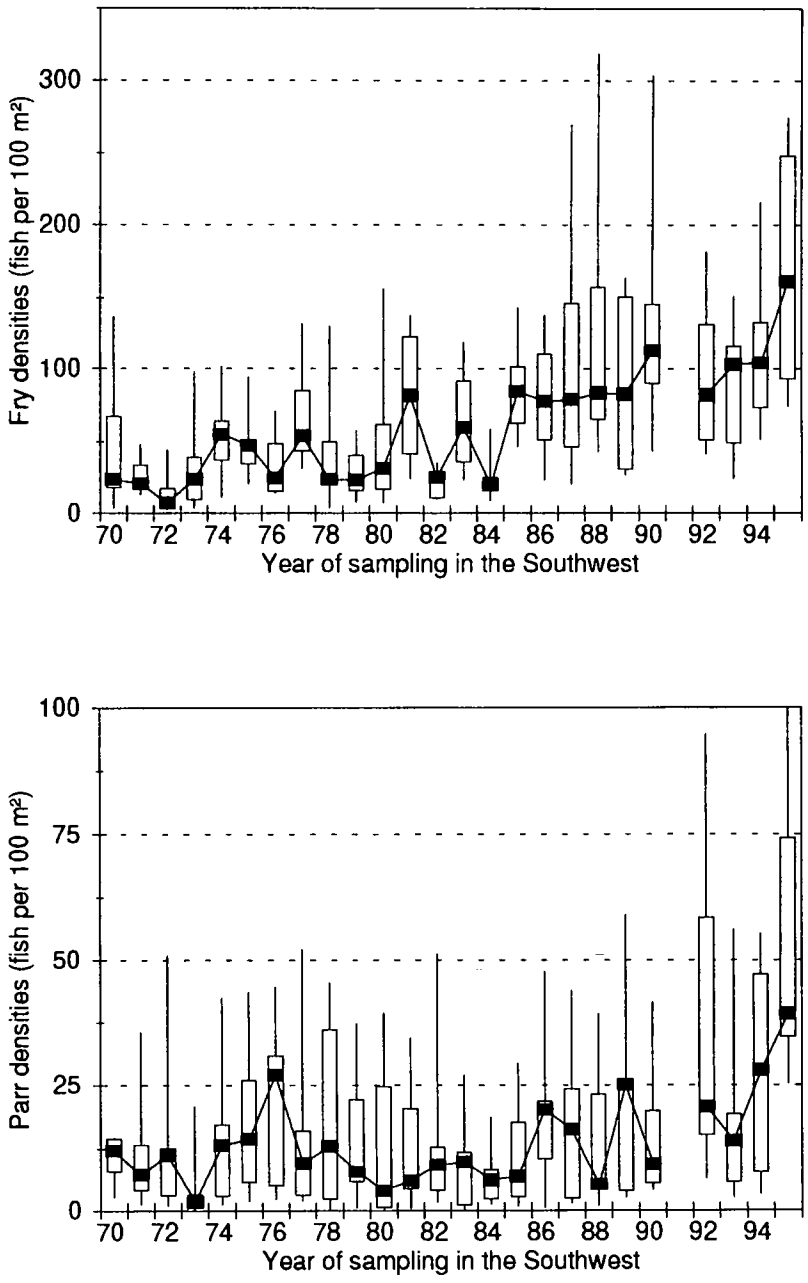



Figure 24. Atlantic salmon fry (upper) and parr (lower) densities at nine index sites in the Southwest Miramichi, 1970 to 1995. Box plots are interpreted as in Figure 21.

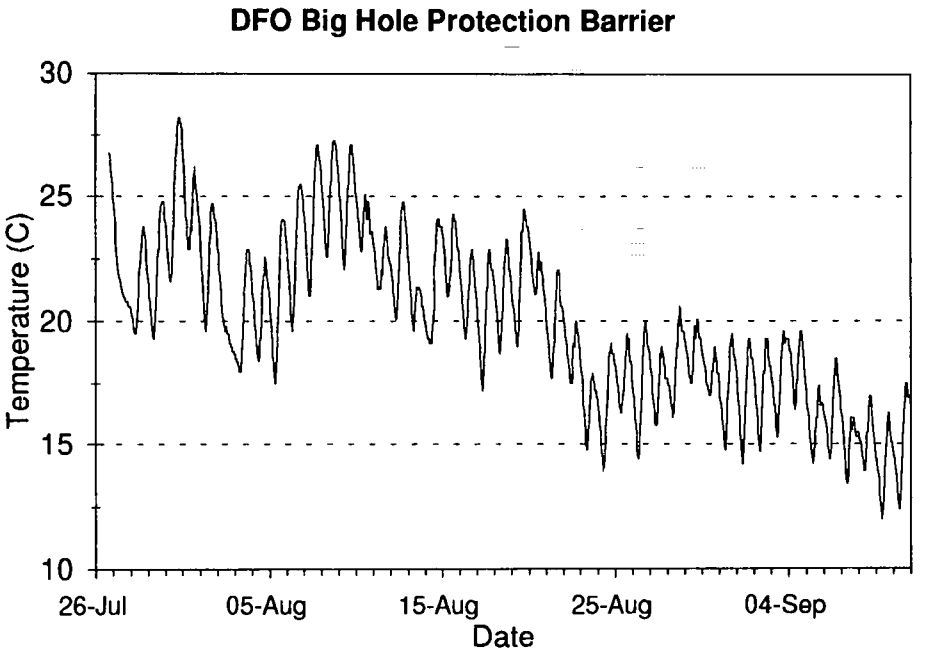



Figure 25. Water temperatures recorded in the Northwest Miramichi at the Big Hole Tract protection barrier in 1995.

**Appendix 1: Minutes of the science workshop on Atlantic salmon stock status, Jan. 11, 1996**

Meeting was held at the Eel Ground First Nations Band Office (9:30 to 16:30, 18:30 to 21:30).

Chairperson:

| | |
|---|---|
| Gérald Chaput | DFO, Science, Moncton |

Day session:

| | |
|---|---|
| Robert Allain | DFO, Tracadie-Sheila |
| Alex Bielak | DNRE, Fredericton |
| Michel Biron* | DFO, Science, Moncton |
| Junior Denny | Eel Ground First Nation, Eel Ground |
| Bernie Dubee | DNRE, Miramichi |
| Dave Dunn | DFO, Moncton |
| Clifford Ginnish* | Eel Ground First Nation, Eel Ground |
| Mark Hambrook* | DFO, Science, Miramichi SEC |
| John Hayward | DFO, Science, Miramichi SEC |
| Bill Hooper | DNRE, Fredericton |
| Rod Hooper | Correctional Services Canada, Miramichi |
| Dave Moore* | DFO, Science, Moncton |
| Wes Myles | Sportfish Advisory Committee, Doaktown |
| Joe Sheasgreen | DFO, Science, Miramichi SEC |
| Bill Scott | DFO, Miramichi |
| Harold Somerville | Burnt Church First Nation, Burnt Church |
| Weldon Ward | Burnt Church First Nation, Burnt Church |
| Bruce Whipple | Northumberland Salmon Protection Association, Miramichi |

Evening session

| | |
|---|---|
| Bernie Duffy | Renous/Dungarvon Rivers Enhancement<br>Miramichi Watershed Management Committee, Renous |
| Tim Lutzac | DFO, Science, Moncton |
| Norm Rogers | Northumberland Salmon Protection Association, Miramichi |

* attended day and evening sessions.

Workshop objectives were described as follows:

- accounting of harvests
- estimation of returns by priority
  1 Miramichi River
  2 Northwest and Southwest branches
  3 by season
- estimation of escapement (spawners)
- escapement compared to target
- confirmation of estimates using abundance indices
- prospects - short term (1996) and long term (beyond 1996)
- management considerations to be included in the assessment
  1 - harvestable surplus
  2 - distribution of harvest by season and branch
  3 - environmental effects on availability
- activities and questions for 1996 and beyond

**Points of Discussion**

Initial definitions:

Small salmon - salmon less than 63 cm fork length, also referred to as 1SW salmon
Large salmon - salmon >= 63 cm fork length, also referred to as MSW salmon
Early run - fish sampled at the trapnets up to and including Aug. 31
Late run - fish sampled at the trapnets after Aug. 31.

**Landings**

Two user groups in 1995: First Nation food fisheries and recreational fisheries

Food fishery agreements were signed with Eel Ground First Nation and Red Bank First Nation. A communal license was issued to Burnt Church First Nation. Harvests from Eel Ground and Red Bank are complete. There was a harvest of small salmon from the Southwest Miramichi by Eel Ground First Nation.

Recreational fisheries seasons affected by river closures - in the Northwest Miramichi, Little Southwest Miramichi, and Renous River. Closures were due to low water, warm temperatures and Big Hole Tract fisheries crisis. Angling catches for 1995 from FISHSYS are expected to be available in mid-February. Crown reserve catches from the Northwest and Little Southwest will be available next week. Preliminary crown reserve data indicated that catch, effort and CPUE were down in all crown reserve stretches.

The only angling data available was from a creel survey conducted at Quarryville Pool at the mouth of the Renous River. Catches of small salmon in 1995 were one-third the catches estimated for similar time period in 1993. Effort distribution was similar in both years. Based on these data, angling catches in 1995 are expected to be down from previous years.

Southwest Miramichi angling was down in 1995 compared to previous years due to low water and warm water. Miramichi Salmon Museum was unable to maintain its angling camp index because outfitters were reluctant to report catches. In Northwest Miramichi, July fishing was poor but there were large numbers of fish in the south and north branches of the Sevogle in the fall.

**Target**

No change in target for the Miramichi from values used in previous years.

Evaluation of habitat areas at Catamaran Brook (DFO) and Bartibog River (DNRE initiative) indicated that the aerial photo measurements for Catamaran underestimated ground surveyed habitat because of the extensive tree cover. Same result for Bartibog River, tributary of the Miramichi Bay. There was concern expressed that the areas for the Miramichi could be underestimated and the target be too low. If techniques for measuring habitat are different than those used to calculate the 2.4 eggs $m^{-2}$ optimal egg deposition target, then 2.4 may no longer be appropriate.

**Data**

Returns were estimated using mark and recapture experiments.

Recaptures from the recreational fishery are used to estimate the emigration rates of tagged fish between the branches. Estimate in 1995 was not as precise because of the smaller number of recaptures than expected, especially in the Northwest Miramichi (result of angling closures).

Returns to the Miramichi were estimated at 32000 large salmon and 52000 small salmon.

Removals

- Angling data for 1995 were not available, the average of the previous five years was used. Large salmon angling removals are calculated as 3% for hook and release mortality.
- Seizures by DFO officers were included in the removals. DNRE enforcement activity was not tabled but numerous nets were seized. Concerns that poaching may be important on some parts of the system and is likely

more detrimental on smaller tributaries than on the main branches. Poaching removals are not possible to quantify but juvenile abundance trends indicate that substantial escapement has occurred.

Biological characteristics

- age determinations for 1995 not available but based on age-length key from previous years, about 20% of large salmon would have been previous spawners.
- sex ratio: internal sex determinations of food fishery catches of small salmon from Eel Ground and small as well as large salmon from Red Bank. External determinations for fall fish. Early run fish have a higher proportion of females, both small and large salmon. Trapnet ratios were consistent with barrier pool seining samples.
- fecundity: calculated using mean length and length-fecundity relationship derived from counts of oocytes of unripe ovaries. Preliminary comparisons of hatchery (ripe, stripped eggs) fecundities indicate that unripe oocyte estimates are higher than hatchery derived values. Verification of the fecundity values used in the derivation of the target is required before a different fecundity relationship is to be used.

Egg depositions:

Miramichi received 178% of target, Southwest Miramichi received 139%, Northwest Miramichi received 265%. More than 80% of eggs were contributed by late-run fish which prompted the comment that a late-run fishery was being developed.

**Abundance Indices**

Barrier fences

Trends in estimated returns in 1995 correspond to returns of large salmon at the Northwest Miramichi barrier and the North Branch of the Southwest Miramichi (Juniper) barriers. Dungarvon barrier counts were lowest since 1984. Small salmon counts were also consistent with mark and recapture estimates.

Juvenile surveys

Historical sites from the Northwest Miramichi sampled in the 1950's and 1960's (Fisheries Research Board) were presented. These sites showed the same trend as the index sites: fry and parr abundances were low in the 1970's and increased in the late 1980's. Southwest Miramichi sites also showed improvement from the 1970's and early 1980's. Fry and parr densities in 1995 were among the highest or the highest in the time series. A verification of the possible effects of low water conditions in 1995 on the estimated densities is required - could low water in 1995 have resulted in crowding of salmon such that high densities are misinterpreted as high abundance?

**Ecological considerations**

Average monthly discharge conditions in the Southwest Miramichi in June to October were deficient (below the 25th percentile). Discharge in November was excessive. The Southwest Miramichi station is the only remaining active station for the watershed.

Water temperatures were high in July and August. Cooler temperatures were registered at the headwater barriers than at the estuary trapnets. Warmest temperatures were recorded in the Little Southwest Miramichi (above Catamaran Brook) where maximum of 30C was recorded on Aug. 11. Temperature range was also the greatest on the Little Southwest Miramichi.

Low water levels had a dramatic effect on the movements of salmon through the Southwest Miramichi (Juniper ) barrier; 90% of the small salmon and 95% of the large salmon moved through the fence during Oct. 10 to 30. In other years, 10% to 80% of the fish have been counted by Sept. 15.

Low water levels held back fish in the estuary. In previous years, tags recovered at the Juniper barrier were exclusively from fish tagged before Sept. In 1995, almost half of the tags recovered at the Juniper barrier were of fish tagged in the estuary during September and October.

Juvenile salmon densities around the headwater barrier site in the Northwest Miramichi were very high, PHS values of 55 to 87. Juvenile surveys throughout Northwest and Southwest Miramichi indicated that spawning had occurred throughout the watershed in 1994.

**Prospects**

Short term

Large salmon returns to the Miramichi are predicted from small salmon returns the year before. Predicted return of large salmon to the Miramichi River in 1996, based on a return of 52000 small salmon in 1995 is in the order of 30000 fish. Smolt counts at Catamaran Brook in 1995 were similar to 1994 suggesting a similar return of small salmon in 1996 to that of 1995.

Long term

Juvenile densities have been increasing since 1984. Returns of large salmon in 1992 to 1995 are the result of fry present in 1987 to 1991 (assume 2 and 3 year smolt production). Densities have not changed since 1985. We expect returns of large salmon to be at least as high as those observed in 1992 to 1995.

**Enhancement Initiatives**

Stocking in 1995 by life stage and tributary was summarized. 2-year smolt stocking was only half the anticipated amount because of BKD infected Northwest Miramichi smolts from semi-natural ponds were destroyed. Broodstock in 1995 were collected from the Little Southwest, Dungarvon and smaller quantities from Southwest and Northwest to support the satellite rearing program.

Adipose-clipped salmon were counted at estuary trapnets, Renous River partial fence, and at the Little River fence in late October. The Little River fence was installed to monitor the returns of adipose-clipped cage-reared smolts released in 1994. Generally, adipose-clipped grilse represented less than 1% of total fish sampled, Renous River partial fence had 3% adipose-clipped grilse returning before September.

**Management Considerations**

There were concerns about the state of the stock of the Little Southwest Miramichi. Although a surplus to conservation for the Miramichi is expected in 1996, how can we reduce the impact on the Little Southwest Miramichi? Based on broodstock seining efforts in 1995, large salmon were not abundant in the upper stretches of the Little Southwest, even into October. In 1994, juvenile densities were lower than in the Northwest. More extensive juvenile surveys in the Little Southwest could help define its status relative to the Northwest Miramichi. This is something that user groups could undertake.

Allocations of surpluses should take into account the relative state of the stocks on a finer scale than presently used: suggested Little Southwest, Northwest, Renous/Dungarvon, Southwest.

FISHSYS provides the only estimate of angling catch for the Miramichi. The data are not available for the assessment and there is an indication that this survey may take place every two years if at all. Stock status can only be determined if the losses to spawning are known. It becomes more difficult to obtain harvest data from First Nations if there is no effort to quantify the removals from the largest user group (recreational fishery).

**Research recommendations and initiatives**

Proposal has been submitted by DFO Science to estimate the smolt production from the Southwest Miramichi. A portion of the available resources would have to be reallocated to the smolt program - juvenile surveys was identified as the program which would be affected.

Habitat surveying was suggested as a more pressing initiative - especially in view of the findings from Catamaran and Bartibog. Habitat surveys will not provide information which will allow the development of a target specific to the Miramichi. Estimates of freshwater production (smolts) and subsequent adult returns are the only way of developing a river-specific target.

A report looking at the implications to angling potential as a result of closures due to warm water is being prepared (A. Bielak, DNRE). It will be reviewed in March.

FISHSYS statistical review is nearing finalization. Report addresses the gain to precision of surveying 15% versus 30% of angling license holders.

**Other initiatives of potential interest**

Habitat database compatible with GIS format is being developed for the Miramichi.

Habitat surveys of Catamaran Brook and Bartibog River have been completed and data are being structured to fit the GIS format. Surveys should be described in reports from the client groups supported by Cooperative Agreement on Recreational Fisheries.

Habitat surveys of headwaters of the North and South branches of the Southwest Miramichi have been completed. Same requirement for reporting.

**Appendix 2. Tag and recapture histories for small salmon in the Southwest Miramichi, 1995.**

| Tagging Area | | Southwest Enclosure | | | | | | | Southwest Food Fishery Trapnet | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | June | July | August | Sept. | Oct. 1-15 | > Oct. 15 | Total | June | July | August | Sept. | Total |
| **Tags Placed** | | 46 | 312 | 86 | 341 | 367 | 17 | 1169 | 0 | 1 | 1 | 0 | 2 |
| **Recapture Data** | | | | | | | | | | | | | |
| Percent reported | | | | | | | | | | | | | |
| Angling | Total | 2.2% | 6.4% | 5.8% | 4.4% | 1.9% | | 4.1% | . | 0.0% | 0.0% | . | 0.0% |
| Traps | NW | 4.3% | 2.9% | 2.3% | 5.9% | 5.2% | | 4.4% | . | 0.0% | 0.0% | . | 0.0% |
| | SW | 8.7% | 8.0% | 11.6% | 15.0% | 14.7% | | 12.4% | . | 0.0% | 0.0% | . | 0.0% |
| **Angling Recaptures** | | | | | | | | | | | | | |
| In Southwest | | 1 | 16 | 5 | 13 | 7 | 0 | 42 | 0 | 0 | 0 | 0 | 0 |
| | Unknown | . | 1 | 2 | 1 | 1 | . | 5 | . | . | . | . | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | 1 | 5 | . | . | . | . | 6 | . | . | . | . | 0 |
| | August | . | 6 | 1 | . | . | . | 7 | . | . | . | . | 0 |
| | Sept. | . | 3 | 2 | 3 | . | . | 8 | . | . | . | . | 0 |
| | Oct. | . | 1 | . | 9 | 6 | . | 16 | . | . | . | . | 0 |
| In Northwest | | 0 | 4 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |
| | Unknown | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | 3 | . | . | . | . | 3 | . | . | . | . | 0 |
| | August | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Oct. | . | . | . | 2 | . | . | 2 | . | . | . | . | 0 |
| Miramichi | Unknown | . | . | . | . | . | | 0 | . | . | . | . | 0 |
| **Mortalities recovered upriver (in freshwater)** | | | | | | | | | | | | | |
| Northwest | | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Southwest | | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Unmarked fish recovered at facility above** | | 52 | 323 | 87 | 345 | 377 | 17 | 1201 | 34 | 847 | 266 | 34 | 1181 |
| **Fish with tagging scars recovered at facility above** | | . | . | . | . | 1 | . | 1 | . | . | . | . | 0 |
| **Recoveries of tags placed at facility above** | | | | | | | | | | | | | |
| **Enclosure Trapnet** | | . | 1 | 3 | 20 | 27 | 0 | 51 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | August | . | . | 1 | . | . | . | 1 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | 10 | . | . | 11 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 1 | 10 | 27 | . | 38 | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Southwest Food Fishery Trap** | | 0 | 0 | 7 | 2 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 6 | . | . | . | 6 | . | . | . | . | 0 |
| | August | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | 1 | . | . | 2 | . | . | . | . | 0 |
| **Millerton Trapnet** | | 1 | 12 | 6 | 31 | 27 | 1 | 78 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | 1 | 10 | . | . | . | . | 11 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | 2 | 5 | 13 | . | . | 20 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 1 | 18 | 23 | . | 42 | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | 4 | 1 | 5 | . | . | . | . | 0 |
| **Renous River fence** | | 0 | 8 | 1 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | 7 | . | . | . | . | 7 | . | . | . | . | 0 |
| | August | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | . | . | . | 1 | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Nov. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Northwest Eel Ground Trapnet** | | 1 | 4 | 1 | 8 | 14 | | 28 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | 1 | 4 | . | . | . | . | 5 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 1 | 7 | 14 | . | 22 | . | . | . | . | 0 |
| **Red Bank Trapnets** | | 1 | 5 | 1 | 12 | 5 | | 24 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | 1 | 4 | . | . | . | . | 5 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | 7 | . | . | 8 | . | . | . | . | 0 |
| | Oct. 1-15 | . | 1 | . | 5 | 5 | . | 11 | . | . | . | . | 0 |
| **Barrier Fences** | | 3 | 4 | 0 | 2 | 6 | 0 | 15 | 0 | 0 | 0 | 0 | 0 |
| Dungarvon | June-Aug. | 3 | 3 | . | . | . | . | 6 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| SW Miramichi | June-Aug. | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | 1 | 2 | . | 3 | . | . | . | . | 0 |
| NW Miramichi | June-Aug. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Catamaran | June-Aug. | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Nov. | . | . | . | 1 | 4 | . | 5 | . | . | . | . | 0 |
| **Broodstock Seining** | | 0 | 1 | 0 | 0 | 0 | | 1 | 0 | 0 | 0 | 0 | 0 |
| | Dungarvon | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Southwest | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Little Southwest | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Sevogle | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Northwest | . | . | . | . | . | . | 0 | . | . | . | . | 0 |

**Appendix 2. Tag and recapture histories for small salmon in the Southwest Miramichi, 1995.**

| | Tagging Area | Millerton Trapnet - Southwest Miramichi | | | | | | | | Renous River - Partial Fence - | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | May | June | July | August | Sept. | Oct. 1-15 | >Oct. 15 | Total | June | July | Aug. | Sept. | Total |
| | **Tags Placed** | 1 | 17 | 787 | 219 | 693 | 481 | 65 | 2203 | 38 | 308 | 69 | 29 | 444 |
| **Recapture Data** | | | | | | | | | | | | | | |
| Percent reported | | | | | | | | | | | | | | |
| Angling | Total | . | 5.9% | 5.2% | 3.2% | 2.8% | 2.1% | | 3.5% | 13.2% | 3.6% | 1.4% | | 3.8% |
| Traps | NW | . | 0.0% | 2.4% | 1.4% | 3.2% | 1.5% | | 2.2% | 0.0% | 1.0% | 1.4% | | 1.1% |
| | SW | . | 11.8% | 8.8% | 10.5% | 13.9% | 8.9% | | 10.3% | 0.0% | 1.0% | 4.3% | | 1.4% |
| **Angling Recaptures** | | | | | | | | | | | | | | |
| In Southwest | | 0 | 1 | 41 | 7 | 15 | 10 | 0 | **74** | 5 | 11 | 1 | | **17** |
| | Unknown | . | . | 7 | . | . | . | . | 7 | . | 4 | . | | 4 |
| | June | . | . | . | . | . | . | . | 0 | 1 | . | . | | 1 |
| | July | . | 1 | 16 | . | . | . | . | 17 | 4 | 5 | . | | 9 |
| | August | . | . | 8 | . | . | . | . | 8 | . | 1 | . | | 1 |
| | Sept. | . | . | 5 | 5 | 5 | . | . | 15 | . | 1 | . | | 1 |
| | Oct. | . | . | 5 | 2 | 10 | 10 | . | 27 | . | . | 1 | | 1 |
| In Northwest | | 0 | 0 | 0 | 0 | 3 | 0 | 0 | **3** | 0 | 0 | 0 | | **0** |
| | Unknown | . | . | . | . | 1 | . | . | 1 | . | . | . | | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | | 0 |
| | Oct. | . | . | . | . | 2 | . | . | 2 | . | . | . | | 0 |
| Miramichi | Unknown | . | . | . | . | 1 | . | | 1 | . | 1 | . | | 1 |
| **Mortalities recovered upriver (in freshwater)** | | | | | | | | | | | | | | |
| Northwest | | . | . | . | . | . | . | . | 0 | . | . | . | | 0 |
| Southwest | July | . | . | 2 | . | . | . | . | 2 | . | . | . | | 0 |
| **Unmarked fish recovered at facility above** | | | | | | | | | | | | | | |
| | | 1 | 17 | 864 | 225 | 679 | 497 | 75 | **2358** | 38 | 312 | 70 | 29 | **449** |
| **Fish with tagging scars recovered at facility above** | | | | | | | | | | | | | | |
| | | . | . | . | . | 1 | 4 | . | 5 | . | . | . | . | 0 |
| **Recoveries of tags placed at facility above** | | | | | | | | | | | | | | |
| **Enclosure Trapnet** | | 0 | 0 | 8 | 1 | 22 | 12 | 1 | **44** | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | August | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Sept. | . | . | 2 | . | 7 | . | . | 9 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 4 | 1 | 15 | 11 | . | 31 | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | . | 1 | 1 | 2 | . | . | . | . | 0 |
| **Southwest Food Fishery Trap** | | 0 | 0 | 5 | 0 | 0 | 0 | 0 | **5** | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 4 | . | . | . | . | 4 | . | . | . | . | 0 |
| | August | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Millerton Trapnet** | | 0 | 1 | 44 | 14 | 65 | 31 | 1 | **156** | 0 | 2 | 1 | 0 | **3** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 33 | . | . | . | . | 33 | . | 2 | . | . | 2 |
| | August | . | . | 3 | 9 | . | . | . | 12 | . | . | . | . | 0 |
| | Sept. | . | . | 5 | 3 | 41 | . | . | 49 | . | . | 1 | . | 1 |
| | Oct. 1-15 | . | 1 | 3 | 2 | 23 | 24 | . | 53 | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | 1 | 7 | 1 | 9 | . | . | . | . | 0 |
| **Renous River fence** | | 0 | 1 | 17 | 8 | 1 | 0 | 0 | **27** | 0 | 1 | 2 | 0 | **3** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | 1 | 15 | . | . | . | . | 16 | . | . | . | . | 0 |
| | August | . | . | 1 | 7 | . | . | . | 8 | . | 1 | 2 | . | 3 |
| | Sept. | . | . | 1 | 1 | 1 | . | . | 3 | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Nov. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Northwest Eel Ground Trapnet** | | 0 | 0 | 8 | 1 | 8 | 5 | 0 | **22** | 0 | 0 | 0 | 1 | **1** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 3 | . | . | . | . | 3 | . | . | . | . | 0 |
| | August | . | . | 2 | 1 | . | . | . | 3 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 3 | . | 8 | 5 | . | 16 | . | . | . | 1 | 1 |
| **Red Bank Trapnets** | | 0 | 0 | 5 | 2 | 12 | 2 | 0 | **21** | 0 | 0 | 1 | 0 | **1** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 2 | . | . | . | . | 2 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | 1 | 3 | . | . | 5 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 2 | 1 | 9 | 2 | . | 14 | . | . | 1 | . | 1 |
| **Barrier Fences** | | 0 | 0 | 14 | 2 | 5 | 2 | 0 | **23** | 3 | 11 | 1 | 0 | **15** |
| Dungarvon | June-Aug. | . | . | 4 | . | . | . | . | 4 | 3 | 10 | . | . | 13 |
| | Sept.-Oct. | . | . | 3 | . | . | . | . | 3 | . | 1 | . | . | 1 |
| SW Miramichi | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | 5 | 1 | 3 | 2 | . | 11 | . | . | . | . | 0 |
| NW Miramichi | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| Catamaran | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Nov. | . | . | 2 | 1 | 1 | . | . | 4 | . | . | 1 | . | 1 |
| **Broodstock Seining** | | 0 | 0 | 6 | 0 | 0 | 0 | 0 | **6** | 0 | 3 | 0 | 0 | **3** |
| | Dungarvon | . | . | 3 | . | . | . | . | 3 | . | 3 | . | . | 3 |
| | Southwest | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Little Southwest | . | . | 2 | . | . | . | . | 2 | . | . | . | . | 0 |
| | Sevogle | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Northwest | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |

**Appendix 2. Tag and recapture histories for large salmon in the Southwest Miramichi, 1995.**

| | Tagging Area | Southwest Enclosure | | | | | | | | Southwest Food Fishery Trapnet | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | May | June | July | August | Sept. | Oct. 1-15 | > Oct. 15 | Total | June | July | August | Sept. | Total |
| | **Tags Placed** | 2 | 17 | 43 | 34 | 182 | 469 | 50 | **797** | 4 | 128 | 186 | 38 | **356** |
| **Recapture Data** | | | | | | | | | | | | | | |
| Percent reported | | | | | | | | | | | | | | |
| Angling | Total | 0.0% | 0.0% | 4.7% | 2.9% | 2.2% | 1.9% | . | 2.0% | 0.0% | 1.6% | 2.2% | 0.0% | 1.7% |
| Traps | NW | 0.0% | 0.0% | 0.0% | 8.8% | 3.8% | 1.1% | 0.0% | 1.9% | 0.0% | 2.3% | 3.8% | 2.6% | 3.1% |
| | SW | 0.0% | 0.0% | 4.7% | 5.9% | 9.9% | 10.4% | 8.0% | 9.4% | 0.0% | 8.6% | 9.1% | 10.5% | 9.0% |
| **Angling Recaptures** | | | | | | | | | | | | | | |
| In Southwest | | 0 | 0 | 2 | 1 | 4 | 9 | 0 | **16** | 0 | 2 | 4 | 0 | **6** |
| | Unknown | . | . | . | . | 2 | 2 | . | 4 | . | . | 1 | . | 1 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | 1 | 2 | . | . | 4 | . | 1 | 1 | . | 2 |
| | Oct. | . | . | 1 | . | . | 7 | . | 8 | . | 1 | 2 | . | 3 |
| In Northwest | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | **0** |
| | Unknown | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Unknown | Oct. | | . | . | . | 1 | . | | **1** | . | . | . | | 1 |
| **Mortalities recovered upriver (in freshwater)** | | | | | | | | | | | | | | |
| Northwest | | . | . | . | . | . | . | . | **0** | . | . | . | . | **0** |
| Southwest | | . | . | . | . | . | . | . | **0** | . | . | . | . | **0** |
| **Unmarked fish recovered at facility** | | 3 | 20 | 45 | 38 | 184 | 474 | 50 | **814** | 4 | 158 | 190 | 38 | **390** |
| **Fish with tagging scars recovered at facility** | | | | | | | | | | | | | | |
| | | . | . | . | . | . | 2 | . | **2** | . | 1 | 1 | . | **2** |
| **Recoveries of tags placed at facility above** | | | | | | | | | | | | | | |
| **Enclosure Trapnet** | | 0 | 0 | 0 | 0 | 6 | 22 | 0 | **28** | 0 | 2 | 2 | 2 | **6** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | 1 | . | . | 1 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | 4 | . | . | 4 | . | . | . | 1 | 1 |
| | Oct. 1-15 | . | . | . | . | 1 | 22 | . | 23 | . | 1 | 2 | 1 | 4 |
| | > Oct. 15 | . | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| **Southwest Food Fishery Trap** | | 0 | 0 | 1 | 1 | 0 | 0 | 0 | **2** | 0 | 0 | 5 | 0 | **5** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | August | . | . | . | 1 | . | . | . | 1 | . | . | 3 | . | 3 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | 2 | . | 2 |
| **Millerton Trapnet** | | 0 | 0 | 2 | 2 | 12 | 27 | 4 | **47** | 0 | 8 | 15 | 2 | **25** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 1 | . | . | . | . | 1 | . | 5 | . | . | 5 |
| | August | . | . | 1 | . | . | . | . | 1 | . | 1 | 3 | . | 4 |
| | Sept. | . | . | . | 1 | 5 | . | . | 6 | . | . | 7 | 1 | 8 |
| | Oct. 1-15 | . | . | . | . | 7 | 21 | . | 28 | . | 2 | 5 | . | 7 |
| | > Oct. 15 | . | . | . | 1 | . | 6 | 4 | 11 | . | . | . | 1 | 1 |
| **Renous River fence** | | 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. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Nov. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Northwest Eel Ground Trapnet** | | 0 | 0 | 0 | 0 | 3 | 5 | 0 | **8** | 0 | 1 | 2 | 0 | **3** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | 1 | . | . | 1 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | . | 2 | 5 | . | 7 | . | . | 2 | . | 2 |
| **Red Bank Trapnets** | | 0 | 0 | 0 | 3 | 4 | 0 | 0 | **7** | 0 | 2 | 5 | 1 | **8** |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | 1 | . | . | 1 | . | 1 | 3 | 1 | 5 |
| | Oct. 1-15 | . | . | . | 3 | 3 | . | . | 6 | . | 1 | 2 | . | 3 |
| **Barrier Fences** | | 0 | 2 | 0 | 0 | 2 | 2 | 0 | **6** | 0 | 3 | 3 | 0 | **6** |
| Dungarvon | June-Aug. | . | . | . | . | . | . | . | 0 | . | 1 | . | . | 1 |
| | Sept.-Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| SW Miramichi | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | 2 | . | . | . | 2 | . | 4 | . | 2 | 3 | . | 5 |
| NW Miramichi | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Catamaran | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Nov. | . | . | . | . | 2 | . | . | 2 | . | . | . | . | 0 |
| **Broodstock Seining** | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | **0** |
| | Dungarvon | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Southwest | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Little Southwest | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sevogle | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Northwest | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |

**Appendix 2. Tag and recapture histories for large salmon in the Southwest Miramichi, 1995.**

| | Tagging Area | Millerton Trapnet - Southwest Miramichi | | | | | | | | Renous River - Partial Fence - | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | May | June | July | August | Sept. | Oct. 1-15 | >Oct. 15 | Total | June | July | Aug. | Sept. | Total |
| | **Tags Placed** | 2 | 26 | 160 | 106 | 570 | 525 | 93 | 1482 | 4 | 22 | 11 | 6 | 43 |
| **Recapture Data** | | | | | | | | | | | | | | |
| Percent reported | | | | | | | | | | | | | | |
| Angling | Total | 0.0% | 3.8% | 5.6% | 1.9% | 3.7% | 1.9% | . | 2.9% | 0.0% | 4.5% | 0.0% | 0.0% | 2.3% |
| Traps | NW | 0.0% | 3.8% | 1.9% | 0.0% | 1.9% | 1.3% | 0.0% | 1.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | SW | 0.0% | 0.0% | 5.6% | 8.5% | 12.3% | 7.0% | 1.1% | 8.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Angling Recaptures** | | | | | | | | | | | | | | |
| In Southwest | | 0 | 1 | 9 | 2 | 21 | 10 | 0 | 43 | 0 | 1 | 0 | 0 | 1 |
| | Unknown | . | . | 1 | . | 6 | 1 | . | 8 | . | . | . | . | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | August | . | . | 2 | . | . | . | . | 2 | . | 1 | . | . | 1 |
| | Sept. | . | 1 | 1 | 2 | 4 | . | . | 8 | . | . | . | . | 0 |
| | Oct. | . | . | 4 | . | 11 | 9 | . | 24 | . | . | . | . | 0 |
| In Northwest | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Unknown | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Unknown | Oct. | | . | 1 | . | . | . | | 1 | . | . | . | . | 0 |
| **Mortalities recovered upriver (in freshwater)** | | | | | | | | | | | | | | |
| Northwest | | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Southwest | | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Unmarked fish recovered at facility above** | | 2 | 32 | 171 | 110 | 589 | 529 | 113 | 1546 | 4 | 24 | 11 | 6 | 45 |
| **Fish with tagging scars recovered at facility above** | | | | | | | | | | | | | | |
| | | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| **Recoveries of tags placed at facility above** | | | | | | | | | | | | | | |
| **Enclosure Trapnet** | | 0 | 0 | 1 | 1 | 19 | 8 | 0 | 29 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | 3 | . | . | 3 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 1 | 1 | 15 | 7 | . | 24 | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | 1 | 1 | . | 2 | . | . | . | . | 0 |
| **Southwest Food Fishery Trap** | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Millerton Trapnet** | | 0 | 0 | 5 | 8 | 51 | 29 | 1 | 94 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | August | . | . | 1 | 1 | . | . | . | 2 | . | . | . | . | 0 |
| | Sept. | . | . | 1 | 4 | 31 | . | . | 36 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 2 | 2 | 18 | 26 | . | 48 | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | 1 | 2 | 3 | 1 | 7 | . | . | . | . | 0 |
| **Renous River fence** | | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | 3 | . | . | . | . | 3 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Nov. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| **Northwest Eel Ground Trapnet** | | 0 | 0 | 1 | 0 | 4 | 5 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 1 | . | 3 | 5 | . | 9 | . | . | . | . | 0 |
| **Red Bank Trapnets** | | 0 | 0 | 1 | 0 | 7 | 2 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | July | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | August | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept. | . | . | . | . | 1 | . | . | 1 | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | 1 | . | 6 | 2 | . | 9 | . | . | . | . | 0 |
| **Barrier Fences** | | 1 | 3 | 0 | 4 | 5 | 2 | 0 | 15 | 0 | 1 | 0 | 0 | 1 |
| Dungarvon | June-Aug. | 1 | 2 | . | . | . | . | . | 3 | . | 1 | . | . | 1 |
| | Sept.-Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| SW Miramichi | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | 1 | . | 2 | 4 | . | . | 7 | . | . | . | . | 0 |
| NW Miramichi | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| Catamaran | June-Aug. | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sept.-Nov. | . | . | . | 2 | 1 | 2 | . | 5 | . | . | . | . | 0 |
| **Broodstock Seining** | | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| | Dungarvon | . | . | 1 | . | . | . | . | 1 | . | . | . | . | 0 |
| | Southwest | . | 1 | . | . | . | . | . | 1 | | | | | |
| | Little Southwest | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Sevogle | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |
| | Northwest | . | . | . | . | . | . | . | 0 | . | . | . | . | 0 |

**Appendix 2. Tag and recapture histories for small salmon from the Northwest Miramichi River, 1995.**

| Tagging Area | | Northwest Index Trapnet | | | | | | Eel Ground Food Fishery Trapnet | | | | | | Red Bank Traps - Northwest Miramichi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | June | July | August | Sept. | Oct. | Total | June | July | August | Sept. | Oct. | Total | June | July | August | Sept. | Oct. | Total |
| **Tags Placed** | | 31 | 67 | 5 | 128 | 161 | **392** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Recapture Data** | | | | | | | | | | | | | | | | | | | |
| Percent reported | | | | | | | | | | | | | | | | | | | |
| Angling | Total | 3.2% | 3.0% | 0.0% | 1.6% | 0.6% | 1.5% | . | . | . | . | . | . | . | . | . | . | . | . |
| Traps | NW | 6.5% | 3.0% | 0.0% | 7.8% | 2.5% | 4.6% | . | . | . | . | . | . | . | . | . | . | . | . |
| | SW | 0.0% | 4.5% | 20.0% | 7.0% | 5.6% | 5.6% | . | . | . | . | . | . | . | . | . | . | . | . |
| **Angling Recaptures** | | | | | | | | | | | | | | | | | | | |
| In Southwest | | 0 | 1 | 0 | 1 | 1 | **3** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | Unknown | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 1 | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | . | 1 | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| In Northwest | | 1 | 1 | 0 | 1 | 0 | **3** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | Unknown | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | June | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 1 | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Miramichi | | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| **Mortalities recovered upriver (in freshwater)** | | | | | | | | | | | | | | | | | | | |
| Northwest | | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Southwest | | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| **Unmarked fish recovered at facility above** | | 33 | 73 | 6 | 129 | 163 | **404** | 33 | 483 | 110 | 5 | . | **631** | 23 | 402 | 123 | 362 | 451 | **1361** |
| **Fish with tagging scars recovered at facility above** | | . | 1 | . | . | . | **1** | . | 1 | . | . | . | **1** | . | . | . | 1 | 2 | **3** |
| **Recoveries of tags at facility above** | | | | | | | | | | | | | | | | | | | |
| Enclosure Trap | | 0 | 0 | 0 | 7 | 4 | **11** | 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. | . | . | . | 3 | . | 3 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | 4 | 4 | 8 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | . | | . | . | . | . | . | | . | . | . | . | . | |
| Southwest Food Fishery Trap | | 0 | 1 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Millerton Trap | | 0 | 0 | 1 | 2 | 5 | **8** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | 1 | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 1 | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | 1 | 3 | 4 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | 2 | 2 | . | . | . | . | . | | . | . | . | . | . | |
| Renous River fence | | 0 | 2 | 0 | 0 | 0 | **2** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Aug. | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Nov. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| NW Index Trapnet | | 0 | 0 | 0 | 3 | 3 | **6** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 1 | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | 2 | 3 | 5 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Eel Ground Food Fishery Trap | | 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. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Red Bank Traps | | 1 | 2 | 0 | 10 | 4 | **17** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | 1 | 2 | . | . | . | 3 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 2 | . | 2 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | 8 | 4 | 12 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Barrier Fences | | 1 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| Dungarvon | June-Aug. | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | 0 | | | | | | | | | | | | |
| SW Miramichi | June-Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | 0 | | | | | | | | | | | | |
| NW Miramichi | June-Aug. | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | 0 | | | | | | | | | | | | |
| Catamaran | June-Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Nov. | . | . | . | . | 1 | 1 | | | | | | | | | | | | |
| **Broodstock Seining** | | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | 0 | 0 | 0 | **0** |
| | Dungarvon | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Little Southwest | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sevogle | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Northwest | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |

Appendix 2. Tag and recapture histories for large salmon from the Northwest Miramichi River, 1995.

| Tagging Area | | Northwest Index Trapnet | | | | | | Eel Ground Food Fishery Trapnet | | | | | | Red Bank Trapnets - Northwest Miramichi | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | June | July | August | Sept. | Oct. | Total | June | July | August | Sept. | Oct. | Total | June | July | August | Sept. | Oct. | Total |
| Tags Placed | | 11 | 11 | 3 | 63 | 141 | 229 | 23 | 55 | 52 | 4 | 0 | 134 | 0 | 0 | 1 | 1 | 1 | 3 |
| **Recapture Data** | | | | | | | | | | | | | | | | | | | |
| Percent reported | | | | | | | | | | | | | | | | | | | |
| Angling | Total | 9.1% | 0.0% | 0.0% | 1.6% | 2.1% | 2.2% | . | . | . | . | . | . | . | . | . | . | . | . |
| Traps | NW | 18.2% | 0.0% | 0.0% | 6.3% | 0.7% | 3.1% | . | . | . | . | . | . | . | . | . | . | . | . |
| | SW | 9.1% | 0.0% | 0.0% | 3.2% | 10.6% | 7.9% | . | . | . | . | . | . | . | . | . | . | . | . |
| **Angling Recaptures** | | | | | | | | | | | | | | | | | | | |
| In Southwest | | 0 | 0 | 0 | 1 | 2 | 3 | 0 | 1 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Unknown | . | . | . | . | 1 | 1 | . | . | 2 | . | . | 2 | . | . | . | . | . | 0 |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | 1 | 1 | 2 | . | 1 | 1 | . | . | 2 | . | . | . | . | . | 0 |
| In Northwest | | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Unknown | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | . | 1 | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Unknown | July | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Mortalities recovered upriver (in freshwater)** | | | | | | | | | | | | | | | | | | | |
| Northwest | | . | . | . | . | . | 0 | . | . | 1 | . | . | 1 | . | . | . | . | . | 0 |
| Southwest | | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| **Unmarked fish recovered at facility above** | | 11 | 11 | 3 | 65 | 141 | 231 | 29 | 60 | 53 | 4 | . | 146 | 11 | 92 | 52 | 301 | 372 | 828 |
| **Fish with tagging scars recovered at facility above** | | | | | | | | | | | | | | | | | | | |
| | | . | . | . | . | . | 0 | 1 | . | . | . | . | 1 | . | . | . | 1 | . | 1 |
| **Recoveries of tags placed at facility above** | | | | | | | | | | | | | | | | | | | |
| Enclosure Trap | | 0 | 0 | 0 | 1 | 8 | 9 | 2 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | 0 | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | 1 | 5 | 6 | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | 3 | 3 | . | . | . | . | . | | . | . | . | . | . | |
| Southwest Food Fishery Trap | | 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 |
| Millerton Trap | | 1 | 0 | 0 | 1 | 7 | 9 | 1 | 1 | 3 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | June | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | 1 | 1 | 1 | . | . | 3 | . | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | 1 | 3 | 4 | . | . | 2 | . | . | 2 | . | . | . | . | . | 0 |
| | > Oct. 15 | . | . | . | . | 4 | 4 | . | . | . | . | . | | . | . | . | . | . | |
| Renous River fence | | 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 |
| | Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Nov. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| NW Index Trapnet | | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | June | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 |
| | Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 1 | . | 1 | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 |
| | Oct. 1-15 | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Eel Ground Food Fishery Trap | | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | June | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | 1 | 1 | . | . | 2 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| Red Bank Traps | | 1 | 0 | 0 | 4 | 1 | 6 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | June | 1 | . | . | . | . | 1 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | July | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | August | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept. | . | . | . | 2 | . | 2 | . | 1 | . | . | . | 1 | . | . | . | . | . | 0 |
| | Oct. | . | . | . | 2 | 1 | 3 | . | . | 1 | . | . | 1 | . | . | . | . | . | 0 |
| Barrier Fences | | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dungarvon | June-Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | | | | | | |
| SW Miramichi | June-Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | 1 | . | 1 | . | . | 1 | . | . | 1 | | | | | | |
| NW Miramichi | June-Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Oct. | . | . | . | . | 1 | 1 | . | . | . | . | . | 0 | | | | | | |
| Catamaran | June-Aug. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sept.-Nov. | . | . | . | . | . | 0 | . | . | . | . | . | 0 | | | | | | |
| Broodstock Seining | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dungarvon | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Southwest | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Little Southwest | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Sevogle | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |
| | Northwest | . | . | . | . | . | 0 | . | . | . | . | . | 0 | . | . | . | . | . | 0 |

**Appendix 3.** Detailed information on the distribution of juvenile salmon in the Miramichi River System in 1995.

| River | Life Stage | Date | Stock | Tributaries | Site | Mark | Number of Fish Stocked | Total by Life Stage |
|---|---|---|---|---|---|---|---|---|
| **Northwest** | $2^+$ smolts | 05/25/95 | NWM | Little River | 47 14 66 03 | AC | 2,734 | 2,734 |
| | $2^+$ parr | 05/25/95 | NWM | Little River | 47 14 66 03 | AC | 137 | 137 |
| | $0^+$ parr | - | - | - | - | - | - | 0 |
| | Non-feeding fry | 06/10/95 | LSW | L. S. W. | Tractor & Equip. | NM | 25,000 | |
| | | " | " | " | Devils Brook | NM | 10,000 | |
| | | " | " | " | Father Murdock Bk | NM | 5,000 | |
| | | " | " | " | Libbies Bk | NM | 10,000 | |
| | | " | " | " | Above DFO Camp | NM | 15,000 | |
| | | " | " | " | Moose Landing | NM | 10,000 | |
| | | " | " | " | Smith Forks | NM | 15,000 | |
| | | " | " | " | Tuadook Stream | NM | 10,000 | |
| | | " | " | " | Upper LSW,Bridge | NM | 15,000 | |
| | | " | " | " | L.North Pole Bk | NM | 10,000 | |
| | | " | " | " | Trib. to L.N.PoleBk | NM | 10,000 | |
| | | " | " | " | Parks Brook | NM | 15,000 | |
| | | " | " | " | Shore Camp Bk | NM | 10,000 | |
| | | " | " | " | Harris Brook | NM | 5,000 | |
| | | 06/12/95 | SEV | Sevogle | Narrows | NM | 10,000 | |
| | | 06/12/95 | SEV | S. Br. Sevogle | Mouth Clearwater | NM | 10,000 | |
| | | " | " | " | Travis Brook | NM | 10,000 | |
| | | " | " | " | Johnson Brook | NM | 10,000 | |
| | | " | " | " | Chestermine Bridge | NM | 10,000 | |
| | | " | " | " | Old Bridge | NM | 10,000 | |
| | | " | " | " | Bridge Repap Camp | NM | 5,000 | |
| | | " | " | " | Slacks Lake Road | NM | 10,000 | 240,000 |
| | Satellite distribution | 09/27/95 | - | N. W. | Gillman Brook | AC | 9,420 | |
| | | 10/09/95 | - | N. W. | Camp Adam | AC | 2,300 | |
| | | 10/14/95 | - | S. Sevogle | Barracks Brook | AC | 9,423 | 21,143 |
| **Southwest** | $2^+$ smolts | 05/01/95 | DUN | Dungarvon | 1/2 Inn | AC | 4,888 | |
| | | 05/02/95 | " | " | " | AC | 12,696 | |
| | | 05/03/95 | " | " | " | AC | 2,303 | |
| | | 05/01/95 | " | S. Br. Renous | Red Rock | AC | 3,481 | |
| | | 05/02/95 | " | " | " | AC | 3,755 | 27,123 |
| | $2^+$ parr | 05/01/95 | DUN | Dungarvon | 1/2 Inn | AC | 899 | |
| | | 05/02/95 | " | " | " | AC | 1,627 | |
| | | 05/03/95 | " | " | " | AC | 485 | |
| | | 05/01/95 | " | S. Br. Renous | Red Rock | AC | 767 | |
| | | 05/02/95 | " | " | " | AC | 532 | |
| | | 05/03/95 | " | Renous | Below B.Duffy Cam | AC | 1,583 | 5,893 |
| | $0^+$ parr | 11/10/95 | CLR | Clearwater | Upper Clearwater | AC | 15,575 | 15,575 |
| | Non-feeding fry | 06/11/95 | DUN | Dungarvon | Iron Bridge | NM | 20,000 | |
| | | " | " | " | Russell & Swim Brd | NM | 20,000 | 40,000 |
| | Satellite distribution | 09/05/95 | - | Main S.W. | Salmon Bk, Hayesvi | AC | 4,500 | |
| | | 09/27/95 | - | " | Buttermilk | AC | | |
| | | " | - | " | Deadman Brook | AC | 4,720 | |
| | | " | - | " | Salmon Bk, Blackvil | AC | | |
| | | " | - | " | L.Bk, Camp Thomas | AC | 4,780 | |
| | | " | - | " | Duffy Brook | AC | 900 | |
| | | 10/10/95 | - | " | Harris Brook | AC | 4,458 | |
| | | 10/../95 | - | " | Clearwater | AC | 11,278 | |
| | | 09/27/95 | - | Clearwater | Clearwater | AC | 4,652 | |
| | | " | - | Rocky Brook | Rocky Brook | AC | 10,190 | |
| | | " | - | Hurd Brook | Rocky Brook | AC | 4,915 | |
| | | " | - | Sisters | Sisters | AC | 4,780 | |
| | | 10/11/95 | - | Cains | Abv. Island Pool | AC | 4,345 | |
| | | 09/27/95 | - | Black Brook | Black Brook | AC | 5,500 | |
| | | 10/../95 | - | Renous | Mouth Duffy Brook | NM | 150 | 65,168 |