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STATUS OF ATLANTIC SALMON IN THE MIRAMICHI RIVER IN 1992

by

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ABSTRACT

In 1992, total returns of large salmon (MSW virgin salmon+previous spawners) were similar to returns in 1991 and 39% greater than average returns over the last five years. Returns of small salmon (1SW virgin salmon) were 80% greater than average returns during the last five years. Estimated returns from Enclosure area traps tag-recapture (31,759 large and 152,647 small) were close to mark-recapture estimates from Millbank trap tag-recapture (31,228 large and 150,036 small salmon). Target egg deposition requirements were exceeded in 1992 (201%). Large salmon contributed 73% of the egg production in 1992. Target egg deposition levels have been achieved or nearly achieved in each of the past 8 years in the Miramichi River. Angling catches of large and small salmon were greater in 1992 than average.

Total returns of large and small salmon to the Northwest Miramichi River were 6,586 and 31,293 respectively. Target egg deposition was met in 1992 (119%) and large salmon contributed 75% of the egg production.

Total returns of large and small salmon to the Southwest Miramichi River were 25,134 and 121,207 respectively. (Disparity between the sum of returns to the Southwest and Northwest tributaries and the whole river are due to sampling and mortality at traps, and the Burnt Church Indian Band fishery.) Target egg deposition was exceeded (243%) and large salmon contributed 72% of the egg production.

RÉSUMÉ

En 1992, les remontées totales de saumon de l'Atlantique (saumons PBM vierges et saumons à pontes antérieures) étaient comparables à celles de 1991 et supérieures de 39 % aux remontées moyennes des cinq dernières années. Les remontées de petits saumons (saumons UBM vierges) étaient elles aussi supérieures aux remontées moyennes des cinq dernières années, dans une proportion de 80 %. Les estimations de remontées de saumons étiquetés recapturés aux pièges de la région de Enclosure (31 759 gros saumons et 152 647 petits saumons) étaient comparables aux estimations découlant des opérations d'étiquetage-recapture au piège de Millbank (31 228 gros saumons et 150 036 petits saumons). La ponte cible a été dépassée en 1992 (201 %). Les gros saumons y ont contribué dans une proportion de 73 %. La ponte cible a d'ailleurs été atteinte au proche d'être atteinte au cours des huit dernières années dans la Miramichi. En 1992, les captures de gros et de petits saumons par les pêcheurs à la ligne ont été supérieures à la moyenne.

Les remontées totales de gros et de petits saumons dans la partie nord-ouest de la Miramichi étaient de 6 586 et de 31 293 respectivement. La ponte cible a été atteinte en 1992 (119 %). Elle était due aux gros saumons dans une proportion de 75 %.

Dans la partie sud-ouest de la Miramichi, les remontées de gros et de petits saunons se chiffraient respectivement à 25 134 et à 121 207. (L'écart entre la somme des remontées dans les tronçons sud-ouest et nord-ouest d'une part et le total des remontées dans la rivière d'autre part est dû à l'échantillonnage et à la mortalité aux pièges ainsi qu'à la pêche par la bande indienne de Burnt Church). La ponte cible a été dépassée (243 %). La part des gros saumons dans cette ponte était de 72 %.

INTRODUCTION

The objective of this document is to evaluate the status of Atlantic salmon in the Miramichi River in 1992. This paper is the 13th annual assessment of salmon stocks in the Miramichi River. Harvests from the angling and native fisheries are summarized and spawning escapement in 1992 is estimated using Millbank mark-and-recapture data and mark-and-recapture data from traps situated in the Enclosure area.

For the first time, estimates of returns and spawners in the Northwest and Southwest Miramichi Rivers are presented.

A five year conservation program was implemented for Atlantic salmon in 1984 to increase spawning levels in rivers of the Maritime Provinces. Under this program commercial fishing for Atlantic salmon in the Maritime Provinces has been prohibited as has the possession or sale of salmon caught in non-salmon gear (by-catch). Anglers have been allowed to keep only small [one-sea-winter (1SW)] salmon (<63 cm in fork length) with possession and daily bag limits of 6 and 2 fish, respectively. In 1992, the season bag limit for anglers was reduced from 10 to 8 fish. Angling season for various sections of the Miramichi River System are summarized in Appendix A. Native food fisheries at Burnt Church on Miramichi Bay and the Eel Ground and Red Bank Reserves on tidal waters of the Northwest Miramichi have not been regulated by season or quota.

A 5 year closure of the insular Newfoundland commercial salmon fishery was initiated in 1992. This program is primarily aimed at increasing spawning levels in Newfoundland rivers but is expected to increase returns of large salmon to Maritime rivers beginning in 1993.

This document uses the following terminology for different life stages of salmon. Kelts are spent salmon which are also referred to as black salmon or slinks. Bright salmon are ripe adult salmon in the river or estuary prior to spawning. Small salmon are adults less than 63 cm in fork length also referred to as 1SW salmon. Large salmon are adults greater than or equal to 63 cm in fork length. Large salmon contain components of previous spawners, virgin 2SW fish, and a few 1SW virgin salmon whereas small salmon are comprised of 1SW virgin salmon only.

METHODS

1. Landings

a. Sport

The Department of Fisheries and Oceans (DFO) provides monthly estimates of angling catches and effort. DFO conservation and protection officers make these estimates based on angling camp log

records, Crown Reserve records, and from personal observations and interviews of anglers fishing in public waters. Estimates of catch and effort from public waters (Crown open waters) are less accurate than estimates from private camps and Crown Reserve waters. Angling data for the Southwest Miramichi River above Boiestown (York and Carleton Counties) were not available. Angling catches for these two counties were estimated from the average proportion of the total angling catch from these two counties from 1974 to 1983. Angling seasons in 1992 were similar to those in 1991 for most Miramichi tributaries (Appendix A).

The New Brunswick Department of Natural Resources and Energy (DNRE) estimates angling catches and total effort in the Miramichi each year. DNRE estimates were based on a licence stub reporting system, whereby a random sample of anglers was selected and asked to return records of their angling catch and the number of days spent fishing. Total angling catches were then estimated from the returns submitted. For the Miramichi River System, DNRE estimates are judged to be more accurate than DFO estimates (Randall and Chadwick 1983). At present these data are not yet available for 1992 and DNRE angling catches were estimated from the available DFO angling catches, based on the relationship between the two estimates in prior years.

Angling for kelts in the Miramichi River occurred from 15 April to 15 May. The angling season for bright salmon was from June 8 to October 7 with variations for many tributaries and river sections (Appendix A).

The numbers of large salmon caught and released by anglers were not used as an index of abundance in this assessment; they were used to estimate the numbers of salmon lost to catch and release mortality only.

b. Native

Numbers of salmon landed in the Indian food fishery at Red Bank and Eel Ground in 1992 were recorded by native fishery guardians on a daily basis and Band Councils reported these catches to the DFO Science Branch weekly. Season totals were provided by Burnt Church Indian Band for their fishery in Miramichi Bay.

Much of the native gillnet fishery was conducted off reserve waters in 1992. A survey of effort in the native gillnet fishery was conducted by DFO Conservation and Protection officers. The results of this survey and associated estimates of catch are being prepared for presentation under separate cover.

c. Other

Other removals of salmon include research samples, broodstock, and trap mortalities at DFO traps.

2. Abundance 1992

a. Counts

Adult salmon entering the Miramichi River during 1992 were monitored at the Millbank trap site from May 21 to October 23. Annual salmon returns to the Miramichi have been monitored at the Millbank trap since 1954.

Adult salmon were enumerated at five counting fences within the Miramichi watershed during 1992: Bartholomew River, Catamaran Brook, and at headwaters of three tributaries, Dungarvon River, North Branch of the Main Southwest Miramichi, and the Northwest Miramichi (Figure 1). Counts of salmon have been available for the Dungarvon and Southwest (SW) Miramichi barriers since 1981, and at the Bartholowmew River since 1977 (Bartholomew has been a major enhancement project on the Miramichi since 1977; Chadwick et al. 1985). Counts of salmon at the Northwest (NW) Miramichi barrier have been made since 1988, and salmon have been counted at Catamaran Brook since 1990.

b. Salmon traps at SW Enclosure and NW Eel Ground

Adult salmon were enumerated, tagged, measured (FL), and scale sampled at traps situated on the SW Miramichi River at the Enclosure Provincial Park (May 28 - October 28) and on the Northwest Miramichi River at Eel Ground (May 18 - November 3) (Figure 1). The objective of this project was to estimate salmon returns to the Northwest and Southwest Miramichi Rivers separately. Both traps were operated as a co-management initiative between DFO and the Eel Ground Indian Band.

c. Salmon traps at Red Bank

Adult salmon were enumerated, tagged, measured (FL), and scale sampled at two traps on the Northwest Miramichi River at Red Bank as a co-management initiative between DFO and the Red Bank Indian Band. One trap was situated at the mouth of the Little Southwest Miramichi River and operated from July 14 to October 28 while the other was situated approximately 200 meters above the mouth of the LSW Miramichi River (see Figure 1) on the Northwest Miramichi River. The NW Red Bank trap operated from July 21 to October 26. The objectives of these traps were to train members of the Red Bank Indian Band in the operation of trap nets and provide DFO and the Band with data on salmon returns and movements in the Northwest Miramichi River.

d. Sampling

All large and approximately 1 in 5 small salmon captured at the Millbank, SW Enclosure, NW Eel Ground, and Red Bank traps were sampled and scales were removed for ageing. Fork length of all

salmon was measured to the nearest millimetre. At the Millbank trap one in ten small salmon was sacrificed for internal sexing and weight determination (nearest 0.1 kg). In addition, sex of salmon tagged after 1 September was identified on the basis of external characteristics. External sexing has been verified and found to be accurate 97% of the time (n=37) after 1 September (Moore et al. 1991). Prior to September, external sexing has not been reliable. All salmon released at each of the traps were tagged with Carlin tags using stainless steel wire.

e. Movement of fish between index traps

Emigration of marked small salmon from the Northwest Miramichi after tagging at the Eel Ground trap was estimated from tag returns from anglers. The mean proportion of the total angling catch from 1987-91 was calculated for the NW and SW Miramichi River systems. The number of NW Eel Ground tags returned by anglers in each of the NW and SW Miramichi River systems in 1992 were weighted by the reciprocal of the proportion of the catch occurring in each branch. The proportion of the NW tags emigrating was then calculated as follows:

P= weighted SW returns/(Weighted SW + Weighted NW)

Returns to the Southwest Miramichi River were calculated by subtracting returns to the Northwest Miramichi River from returns to the Miramichi River system at the Enclosure.

f. Electrofishing Surveys

Electrofishing surveys were conducted at 14 of the 15 standard headwater sites (see Figure 1) within the Miramichi watershed July 7-31 1992. Densities of juvenile Atlantic salmon in the Miramichi have been determined by the removal method (Zippin 1956) at these sites since 1970.

Densities of fry (0+) and parr (1+) measured at the 14 standard sites in 1992 were compared with densities measured at the 15 standard sites since 1970 using the multiplicative model:

LOG(DENSITY) = YEAR + STREAM ORDER + TRIBUTARY

where: DENSITY: juvenile population divided by area @ each site
YEAR: 1970-1992
STREAM ORDER: 2-6, for each electrofishing site.
TRIBUTARY: Little Southwest, Main, Northwest, or Southwest.

Reference categories were chosen as 1992, Southwest Miramichi, and stream order 3; the last two being chosen because sites within them were fished in most years. Cells containing zero counts were

deleted from the database, as preliminary runs indicated that neither the above model,nor models with one or more predictors deleted, fitted the database adequately.

3. Spawning Escapement

a. The Whole River

Spawning escapment to the Miramichi River was estimated as the difference between returns to the system (see below) and removals in the native fisheries and hatchery broodstock program. Returns of small salmon were estimated by mark-recapture (details below). Large salmon returns were estimated from small salmon returns and the large/small ratio observed at Millbank. Note that the estimation of returns by Millbank trap efficiency - used in previous assessments - was not used in this assessment.

For returns estimated from each of the tag-recapture equations, spawning escapement was estimated as returns minus known removals at and above the trap location (harvests by anglers, native fishermen, broodstock removals, trap mortalities, and sampling mortalities).

The mortality rate attributed to the stress of catch and release of large salmon by anglers was assumed to be 0.03 (Currie 1985).

Counts of tagged and untagged small and large salmon were recorded at five counting fences and four salmon traps during 1992 (Figure 1). Returns of small and large salmon to Millbank and to the Enclosure area were each calculated by two methods:

Method 1. Adjusted Petersen Method (Ricker 1975).

$$N = (M+1)(C+1)/(R+1)$$

where: M= number of fish tagged
C= sample examined for tags upstream
R= recaptures
N= population estimate

Confidence limits for the estimate were calculated by treating the number of recaptures (R) as a Poisson variable, obtaining 95% confidence limits for it from a table of the Poisson distribution, and substituting these upper and lower limits for R in the equation above (Ricker 1975).

Method 2. Sequential Bayes Algorithm (Gazey and Staley 1986)

$$P(N_i|R_1,R_2,\ldots R_t)=\frac{\prod_{t=1}^{T}P(R_t|N_i)}{\sum_{i=1}^{K}\prod_{t=1}^{T}P(R_t|N_i)}=\frac{\prod_{t=1}^{T}(\frac{1}{N_i})^{R_t}(1-\frac{M_t}{N_i})^{C_t-R_t}}{\sum_{i=1}^{K}\prod_{t=1}^{T}(\frac{1}{N_i})^{R_t}(1-\frac{M_t}{N_i})^{C_t-R_t}}$$

where: N = population size
M_t = the number of fish marked
C_t = the number of fish examined for marks upstream
R_t = the number of marked fish recaptured in sample C_t
t = 1 to T (the number of sampling intervals - in this case the number of intervals is 1)
i = 1 to K (the number of discrete populations levels for which probabilities have been calculated by the algorithm)
K = 301

The output of the Bayes algorithm gives probabilities for 301 population point estimates. A minimum possible population value and the interval between increasing values are chosen. A series of minimum and interval values are chosen until probabilties begin at zero, rise, and return to zero within the 301 possibilities. Confidence limits for the Bayesian estimate were calculated by determination of the area under the probabilty density function.

For both methods tag loss was assumed to be negligible based on tag retention experiments conducted during 1991 (Moore et al 1992).

b. Northwest Miramichi River

Returns of small salmon to the Northwest Miramichi River were estimated as above, using both the Petersen and Baysian algorithms, from tags put on at the Eel Ground Index trap and recovered from traps at Red Bank and from fences in the headwaters of the Northwest Miramichi and Catamaran Brook. Returns of large salmon were estimated as the product of returns of small salmon and the ratio of large salmon to small salmon observed at Millbank index trap. Spawners were estimated as returns minus known and estimated removals.

c. Southwest Miramichi River

Returns to the Southwest Miramichi River were estimated as the difference between returns to the whole river and returns to the Northwest Miramichi. Spawners were estimated as returns minus known and estimated removals.

d. Egg deposition levels

Total egg deposition requirements for the Miramichi River are 132

million eggs (Randall 1985). Based on the average reproductive potential of Miramichi salmon (number of eggs/fish), 23,600 large salmon are required to produce these egg requirements. An additional 22,600 small salmon are needed to ensure a 1:1 sex ratio at spawning. For 1992, the reproductive potential was estimated from a length-fecundity relationship for Miramichi salmon (Randall 1989) and the average fork lengths and sex ratios as determined from samples collected at Millbank. Total egg deposition in 1992 was calculated as the product of reproductive potential (eggs per spawner) and the estimated numbers of small and large spawners. Egg deposition rate (eggs per square meter) was calculated as the egg deposition divided by the rearing area of the Miramichi River (55 million square meters).

Forty one million eggs from 7,316 large and 7,006 small salmon are required for spawning in the Northwest Miramichi River system (Courtenay et al 1992).

Requirements for the Southwest Miramichi River system are 88 million eggs from 16,284 large and 15,594 small salmon (Courtenay et al 1992).

4. Forecast

Returns of large salmon to the Miramichi in 1992 were forecasted using a probability distribution model. A detailed description of the model and analysis have been presented in a separate document (Claytor et al. 1992).

RESULTS

1. Landings

a. Sport

Small Salmon

Note that all sport fishery catches are estimated from DFO sources because FISHSYS angling catch and effort data are not available yet from the New Brunswick DNRE.

During the 1992 kelt season the catch of small salmon was 33% greater than average catches from 1987-91 (Table 1). Effort was decreased 44% from the mean effort from 1987-91 (Table 1).

Angling effort during the bright salmon season was 25% less than the 1987-91 mean. However, catch and CPUE for small bright salmon increased by 18 and 46% respectively from the 1987 to 1991 mean values (Table 1). Early catches(prior to 1 September) decreased by 30% and late (after 30 August) catches increased by 116% (Table 1).

Large Salmon

The number of large salmon caught and released during the 1992 "bright" season are estimated (Table 2). The total catch increased by 9% from the average 1987-91 catch.

Contributions of hatchery fish to returns and angling fisheries are discussed in Appendix B.

b. Native harvests of salmon in 1992

Harvests in native food fisheries totalled 1,652 small and 608 large salmon in 1992 (Table 3), as reported by the Band Councils for Red Bank, Eel Ground, and Burnt Church Indian Bands.

During 1992, all of the native food fisheries harvested 92 to 100% of their total catch prior to 1 September (Table 4).

Native harvests of small salmon as reported by Band Councils, are 31% greater than average harvests during the past five years. Harvests of large salmon equalled average harvests during the past five years (Table 5).

A study was carried out by DFO Conservation and Protection officers in collaboration with Science Branch, to estimate catch and effort in the native gillnet fishery. Much of this fishery occurred off reserve waters in 1992 and so is not included in the Band Council reports. Estimates of total native catch and effort are preliminary so not included in the assessment but will be published under separate cover.

c. Other removals

In addition to the recorded harvests of salmon (Table 5), known salmon mortalities subtracted from the total returns are shown in Table 3.

2. Abundance 1992

a. Counts

Millbank Trap Counts

The trap counts for the Millbank trap in 1992 were 971 small and 202 large salmon (Table 6). Counts of salmon at the Millbank salmon trap from 1970 to 1992 are shown in Figure 2. The efficiency of the Millbank trap (i.e., the proportion of homing salmon that enter the trap) has changed since 1954 (Randall et al. 1990), and may have been considerably lower in 1992 than in previous years (see below). Comparison of 1992 counts with previous Millbank counts has been limited to the previous five years. Counts of early run small salmon were 12% lower than average counts from 1987 to 1991, while counts of large salmon were decreased by 31% (Table 6). Counts of late run small salmon decreased 55% while late run large salmon counts decreased by 58% compared to 1987 to 1991 averages (Table

6).

Headwater Barrier Counts

In general counts at barrier pools showed that runs were late and counts of small salmon were above average. Counts of large and small salmon at the barrier on the North Branch of the Southwest Miramichi River at Juniper (Figure 1) were 19% and 29% respectively above average counts from 1987 to 1991 (Table 7). Note that 1991 counts at the barrier are not directly comparable with other years since the fence washed out from September 28 until October 3.

Counts of large salmon at the Dungarvon River headwater barrier were 12% below average counts from 1987 to 1991 (Table 7). It should be noted however that 1992 had the fourth highest large salmon count during the 13 years of fence operations. Small salmon numbers were 36% above the 1987-91 average and the second highest on record.

Counts of small and large salmon at the Northwest Miramichi River headwater barrier were 1% above and 14% below, respectively, average counts from 1988 to 1991 (Table 7).

b. Salmon traps at the SW Enclosure and NW Eel Ground

The salmon trap on the Southwest (SW) Miramichi at the Enclosure operated from 28 May to 28 October. During this time 1606 small and 450 large salmon were captured (Table 8). Tags were applied to 1521 small and 422 large salmon.

The NW Miramichi salmon trap at the Eel Ground operated from 18 May to 3 November. During this time 1064 small and 465 large salmon were captured (Table 8). Tags were applied to 981 small and 422 large salmon.

c. Salmon traps at Red Bank

The salmon trap on the LSW Miramichi at Red Bank operated from 14 July to 28 October. During this time 367 small and 145 large salmon were captured (Table 8). Tags were applied to 173 small and 119 large salmon. The trap on the Northwest Miramichi at Red Bank operated from 21 July to 26 October. During this time 426 small and 142 large salmon were captured. Tags were applied to 244 small and 125 large salmon (Table 8). Unlike at other index traps, a proportion of the grilse caught in the Red Bank traps were harvested by the Red Bank Indian Band throughout the season.

d. Sampling

During 1992, a total of 373 salmon (178 small salmon and 195 large

salmon) were sampled for age composition and fork lengths, and subsamples of these were sexed (Table 9). The sex composition of large salmon was 82.7% female and 16.9% of small salmon were female. Based on the length-fecundity relationship for Miramichi salmon (Randall 1989), the average fork lengths, and sex ratios of salmon in 1992, reproductive potential (average eggs per spawner) was estimated to be 6,209 eggs for large salmon and 567 eggs for small salmon (Table 9).

Smolt ages for 1SW, 2SW and previous spawners (fish that had spawned at least once before) are given in Table 9. Numbers of previous spawners returning to the river were estimated from the proportions of previous spawners observed in fish sampled at Millbank, and total returns to the river (Figure 3).

Seven percent of all salmon returning to the river in 1992 had spawned previously. This proportion is lower than that observed in 1991 (14%) and 1990 (10%), but higher than all other years since 1966 with the exception of 1968. As a proportion of large salmon returning to the river in 1992, previous spawners represented 41% compared to 39%, 38%, 35% and 18% in years from 1991 back to 1988.

The trend of increasing numbers of previous spawners that has been observed since 1989, continued in 1992. Of fish that spawned first as 2SW salmon (i.e., 2SW virgin spawners), more repeat spawners were observed than in any year since 1971 (Figure 3). Most (54%) of these 2SW repeat spawners had spawned only once before, but 28% had spawned twice before and 16% had spawned three times before. For the first time, 2SW repeat spawners were observed that had spawned 4 times before (2%). Among repeat spawners that had spawned first as 1SW salmon (i.e., 1SW virgin spawners), 81% had spawned only once before and 19% had spawned twice before. A more detailed analysis of the changing age structure of Miramichi salmon will be published under separate cover.

e. Movement of fish between index traps.

Timing of catches differed between Millbank and the Enclosure traps (Figures 4-6). Millbank had caught 83% of its small salmon and 70% of its large salmon by September 1 (Table 6) whereas the Enclosure traps had only caught 45-47% of their small salmon and 15-35% of their large salmon by September 1.

No tags put on in the upper estuary (Enclosure and Red Bank traps) were recovered at Millbank and the few Millbank tags that were recovered at Millbank (n=3) were recovered within 2 d (Table 10).

The upriver traps recovered their own and each other's tags, in some cases after long durations (Table 10, 11). For example, fish tagged at NW Eel Ground were recovered in that same trap up to 75d later, in the SW trap up to 59d later, and at Red Bank up to 110d later. Fish tagged in the SW trap were recovered in that trap up

to 61d later, in the NW Eel Ground trap up to 31d later, and at Red Bank up to 64d later.

Other salmon moved quickly through this area (Table 11). Examples of minimum tag-recovery periods are: Millbank to SWEnclosure: 1d
SWEnclosure to Red Bank: 1d
Eel Ground to Red Bank: 1d
SWEnclosure to Bartholomew Fence: 5d
Eel Ground to Bartholomew Fence: 7d
Eel Ground to Catamaran Fence: 7d
Red Bank to Catamaran Fence: 6d

Because some fish moved back and forth between the Enclosure Park and fresh water and between the branches of the river, raw catches at the upriver index traps cannot be used as indicators of returns to each branch of the river, or of run timing. Catches can be corrected by:

a) calculating the percentage of tags put on at a trap that are recovered at that same trap, and reducing the total catch by that percentage. This is necessary in calculating trap efficiency.

b) calculating the percentage of tags put on at a trap in one branch (A) that are lost to the other branch (B), from recoveries of A tags in the angling fishery in B, weighted by the proportion of total angling catch that occurred in B. This is necessary in calculating returns to the Northwest or Southwest Rivers by mark-recapture. Tag recoveries in the angling fisheries of the NW and SW rivers are given in Table 12. The proportion of angling occurring in each branch of the Miramichi over the last 5 years is given in Table 13. With these data, it was calculated that 25% of fish tagged at the Southwest trap were subsequently lost to the Northwest, and 22% of fish tagged at Eel Ground trap subsequently migrated up the Southwest Miramichi. (The latter calculation is shown below.)

The SW, Dungarvon, and NW fences - all headwater fences - return only tags put on in the estuary before September 1 (Table 11). This may be in part due to the removal of the fences before all late-run fish arrived (i.e., October 16 (Dungarvon and NW), October 20 (SW)).

The Catamaran Brook fence (which ceased operation Nov.15) returned predominantly late-run tags (12 of 16 tags recovered).

f. Electrofishing

Mean densities of age 0+ fry averaged 0.74 fish per square meter and 1+ parr averaged 0.22 fish per square meter. Juvenile densities were correlated with egg deposition rates and indices of spawning escapement (Table 14).

Fry (0+) density in 1992 was significantly larger than densities measured in the period 1970-1984 with the exception of 1975, 1977, and 1981 (Table 15, Figure 7a). Predictors stream-order and tributary contributed significantly to the model, which explained 60% (r^2) of the variation in the data base and appeared to fit the data well (Figure 7b). Fry densities were significantly higher in stream order 3 than 6, and in the Southwest Miramichi than in the Northwest, Little Southwest, or in the Main. It should be noted that the Little Southwest is a tributary of the Northwest Miramichi system, and that electrofishing sites designated "Main River" are in fact two sites on the Bartibog River which empties into Miramichi Bay (Figure 1).

Parr (1+) density in 1992 was significantly larger than densities measured in 1988 and in the years 1970-1985, with the exceptions of 1974 and 1978 (Table 16, Figure 8a). Both stream-order and tributary contributed significantly to the model, which explained 48% of the variance in the data and appeared to fit the data well (Figure 8b). Parr densities were significantly greater in stream-order 3 than 6, and in the Southwest tributary than in the other tributaries.

Age 2+ parr density in 1992 was significantly larger than the density measured in 1973 (Table 17, Figure 9a). Stream order and tributary contributed significantly to the model, which explained 31% of the variance in the data. The model appeared to fit the data well (Figure 9b). Fry densities were significantly greater in stream order 3 than in orders 2 and 6, and in the Southwest tributary than in the Main and Little Southwest Rivers.

3. Spawning escapement in 1992

a. Miramichi River System
Method 1. Adjusted Peterson Tag-Recapture estimate

Inputs for the estimation of returns to Millbank were 785 small salmon tagged (M), 14 tags recaptured (R), and a total sample size (C) of 2670. Spawning escapement resulting from returns was estimated to be 112,552 small salmon (95% Confidence interval= 58,282-213,903) (Table 18a).

At the Enclosure area 2502 small salmon were marked (M) resulting in 117 recaptures (R) out of a sample size of 7142 (C). Returns to the Enclosure area were 151,515 small salmon and resulted in spawning escapement of 124,219 (95% C.I.=99,324 - 154,031) small salmon (Table 18a).

Spawning escapement of large salmon was estimated at 28,067 from Millbank data and 30,481 from Enclosure data (Table 18b).

Method 2. Bayes Algorithm Tag-Recapture estimate

Inputs for the Bayes algorithm were the same as those for the Adjusted Peterson tag-recapture estimate.

Tagging at Millbank resulted in an estimated spawning escapement of 122,593 (95% C.I.=60,593-250,593) small salmon (Table 18a and Figure 10a).

Tagging at the Enclosure resulted in an estimated spawning escapement of 125,204 (95% C.I.=100,704-156,704) small salmon (Table 18a and Figure 10b).

Spawning escapement of large salmon was estimated to be 30,155 from Millbank data and 30,686 from Enclosure data (Table 18b).

Numbers of spawners as estimated by Methods 1 and 2 were similar (Tables 18a and 18b). Assuming a reproductive potential of 6209 eggs per large spawner and 567 eggs per small spawner (Table 9), the above spawning escapements indicate total egg depositions of 180 to 197% (Method 1) or 194 to 198% (Method 2) of the target egg deposition for the Miramichi River. Large salmon were responsible for 73% of the egg deposition (Table 18b).

b. Northwest Miramichi River System

The mean proportion of the total Miramichi angling catch coming from the Northwest Miramichi River from 1987-91 was 0.312 (Table 13). Angler recaptures, corrected for angling catch, of Eel Ground (NW Enclosure) tags in the SW and NW rivers respectively (Table 12) were: 45 (31/0.688) and 157 (49/0.312). (Note that the Northwest system includes the Little Southwest tributary.) Therefore 22.3% of NW Eel Ground tags (45/202) were estimated to be lost to emigration into the SW Miramichi River System.

Method 1. Adjusted Peterson Tag-Recapture estimate

Inputs for the estimation of returns to Eel Ground were 981 small salmon tagged (M), 49 tags recaptured (R), and a total sample size (C) of 1986. Spawning escapement resulting from returns was estimated to be 21,152 small salmon (95% C.I.=13,871 -31,695)(Table 18c).

Spawning escapement of large salmon was estimated at 5,773 fish (Table 18c).

Method 2. Bayes Algorithm Tag-Recapture estimate

Inputs for the Bayes algorithm were the same as those for the Adjusted Peterson tag-recapture estimate.

Tagging at Eel Ground resulted in an estimated spawning escapement

of 21,631 (95% C.I.=14,431-32,431) small salmon (Table 18c and Figure 10c).

Spawning escapement of large salmon was estimated to be 5,872 fish (Table 18c).

Numbers of spawners as estimated by Methods 1 and 2 were similar (Table 18c). Assuming a reproductive potential of 6209 eggs per large spawner and 567 eggs per small spawner (Table 8), the above spawning escapements indicate total egg depositions of 117% (Method 1) or 119% (Method 2) of the target egg deposition for the Northwest Miramichi River. Large salmon contributed 75% of the egg deposition (Table 18c).

c. Southwest Miramichi River System
Method 1. Adjusted Peterson Tag-Recapture estimate

Spawning escapement was estimated to be 103,067 small salmon and 24,708 large salmon (Table 18d).

Method 2. Bayes Algorithm Tag-Recapture estimate

Spawning escapement was estimated at 103,573 small salmon and 24,814 large salmon (Table 18c).

Numbers of spawners as estimated by Methods 1 and 2 were similar (Table 18d). Assuming a reproductive potential of 6209 eggs per large spawner and 567 eggs per small spawner (Table 9), the above spawning escapements indicate total egg depositions of 233% (Method 1) or 243% (Method 2) of the target egg deposition for the Southwest Miramichi River (Table 18d). Large salmon contributed 72% of the egg deposition (Table 18d).

Because the Bayesian approach allows a more complete description of the uncertainty of each estimate we have chosen Method 2 to produce final estimates of returns and spawners. Similarly the larger numbers of fish tagged, sampled, and recaptured from the Enclosure area traps produced estimates with less uncertainty and these estimates were used for our final estimates of returns and spawners.

Returns and spawning escapements of small and large salmon in the Miramichi River System from 1970 to 1992 are summarized in Table 19.

d. Egg deposition levels, 1970 to 1992

The egg deposition rate for 1992 was estimated to be 4.8 eggs per square meter; large salmon contributed 73% of the total eggs (Figure 11). Linear correlations between the egg deposition rates and indices of spawning escapement in the Miramichi River, including angling catches of large salmon (bright fish), angling

catches of large salmon kelts, mean 0+ fry densities, and mean 1+ parr densities in the from 1969 to 1992 were all positive and significant (Table 14).

Correlations of egg deposition per square meter and mean juvenile densities (0+ fry and 1+ parr) using a log-log model were significant (r squared=0.54 p=0.0002 n=20 for 1+ parr; r squared=0.52 p=0.0002 n=21 for 0+ fry) (Figure 12).

4. Forecast

The predictive model for MSW returns in the coming year relies on a domed relationship with grilse in the preceding year (Figure 13; Claytor et al. 1992). Forecasts were prepared using grilse estimated by the Bayesian method using fish marked at the Enclosure traps and recovered at traps and fences (152,647).

Based on estimated returns of grilse in 1992 of 152,647, the forecast model estimated that the probability of MSW returns being less than the spawning requirement (23,600) was 79% (Figure 14). The most probable value was 18,315 with a 90% confidence interval of 13,266 - 44,706. It should be noted that the model is considered unreliable with very high or very low grilse counts, and grilse counts estimated in 1992 are the highest in the 1971-1992 data series used to generate the model.

DISCUSSION

In past years, returns to the Miramichi have been estimated by mark-recapture and by dividing Millbank trap by a presumed trap efficiency of 1.5%, and the two estimates have agreed reasonably well (e.g., in 1991: 60.9 vs 61.9 thousand grilse). In 1992, the trap efficiency calculation would yield an estimate of 64.7 thousand grilse, compared to the mark-recapture estimate of 152.6 grilse. DNRE angling catch data were unavailable at the time of writing, but the DFO estimate of angling catch was double the DFO previous 5 year mean. Barrier counts in the Southwest Miramichi also suggested above average grilse returns. If the mark-recapture estimate is accepted, it would seem that the Millbank trap efficiency was roughly half the 1.5% calculated in previous years (0.6% in 1992 cf 1.47% in 1991). The only difference between 1991 and 1992 in calculation of total returns was that tag recoveries at all four upriver index traps and all barrier fences except the Southwest were used in 1991, while only recoveries at the Enclosure traps were used in 1992. This difference does not explain the change in trap efficiency; indeed had returns been calculated in 1992 as they were in 1991, trap efficiency would still have been estimated at 0.6%.

Peterson tag-recapture population estimates have substantial negative bias and overly large confidence intervals if the combination of the animals marked and examined falls too low (Gazey and Staley 1986). The Bayesian appproach does not have this fault. When sample sizes are large, Peterson and Bayesian estimates converge. This can clearly be seen by comparing Method 1 and Method 2 estimates from tagging at Millbank with the Enclosure. The Peterson estimate from Millbank is lower than other estimates because the combination of the number of animals marked and examined was low.

Returns of large salmon are calculated in this and previous Miramichi assessments from the estimate of grilse returns and the salmon to grilse ratio at the Millbank trap. This ratio at Millbank (21%) was quite different from the ratio at the Eel Ground trap (44%) and Southwest trap (28%). The reason for this difference should be investigated. This need is particularly acute in the event that Millbank trap is not operated in 1993.

Egg deposition rate in the Northwest Miramichi River system was lower than that estimated in the Southwest Miramichi. This agrees well with the lower densities of juvenile salmon recorded in the Northwest than Southwest Rivers in this and previous years (Locke et al. 1993). Egg deposition target was met in the Northwest Miramichi only because of a surplus of grilse; large salmon were not sufficiently abundant to meet spawning requirements.

Tagging salmon at the Millbank trap, Enclosure traps, and Red Bank traps in 1992 and the latter half of the 1991 season provided much data on the movements and residence time of salmon within the estuary. More analyses of these data are required. This will be published under separate cover.

It has been noted over the past few years that the Southwest Miramichi barrier fence returns few tags, resulting in a tagged to untagged ratio much lower than that observed at other fences and at traps. In fact, too few tags are recovered from the Southwest Miramichi to permit estimation of the population (2 Millbank tags in 1992). A better estimate of tagged to untagged ratio would be gained from a creel census at Quarryville Pool at the head of tide in the Southwest Miramichi.

Returns of MSW in 1993 will provide a useful addition to the data set used in our predictive model, which lacks data on the relationship between very high grilse numbers and salmon returns in the next year.

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Summary Sheet

Stock: Miramichi River, SFA 16
Life Stage: juveniles (0+,1+,2+), small and large salmon
Target: 132 million eggs (23,600 large, 22,600 small salmon)

	1987	1988	1989	1990	1991	1992	87-91	92/87-91	MIN[1]	MAX[1]
Angling Harvest[2]										
Large	358	303	358	278	184	323	296	+9%	54	358
Small	20765	30620	24426	21372	11300	25593	21697	+18%	8265	30620
Native Harvest[3]										
Large	898	348	540	609	544	608	588	+3%	200[6]	898
Small	1274	944	1085	2110	1111	1652	1305	+27%	100	2110
Other Harvest[4]										
Large	109	114	153	99	131	142	121	+17%	99[7]	153
Small	114	77	155	142	189	198	135	+47%	77[7]	198
Spawning Escapement										
Large (X 1000)	18	21	16	28	29	31	22	+41%	4	34
Small (X 1000)	63	90	48	60	48	125	62	+102%	13	125
Total Returns										
Large (X 1000)	19	22	17	29	30	32	23	+39%	9	52
Small (X 1000)	85	122	75	83	61	153	85	+80%	24	153
% egg target met	142	150	97	151	158	201	140	+44%	23	201
Juvenile Densities[5]										
0+	74.5	95.1	72.2	94.6	44.6	74.0	76.2	-3%	9.4	95.1
1+	13.1	13.9	18.4	12.4	14.3	21.6	14.4	+50%	3.0	18.4
2+	2.5	1.8	2.6	2.9	10.4	4.1	4.0	+2%	0.8	10.4

[1] MIN MAX over the period 1971 to present unless stated otherwise.
[2] Angling harvest of Large salmon is mortality due to catch and release, estimated to be 3% of catch.
[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.
[5] Number per square meter, from electrofishing surveys at 15 standard sites (3 in 1991, 14 in 1992).
[6] 1975 on.
[7] 1987 on.

Recreational catches: Have ranged from 2240 - 14266 large and 8390 - 30620 small salmon during the past 10 years. Effort (rod-days) has increased over recent years. Angling catches in 1992 were estimated from DFO figures as DNRE figures were unavailable. Grilse catches were 18% above average; large salmon catches were 9% above average.

Data and assessment: An index trap has been operated on the Miramichi River since 1954. The trap efficiency, estimated in 1972-73, changed in the early 1980s when the river channel was altered and the trap was recalibrated in 1985-87. Estimated returns from the trap efficiency and mark- recapture have been similar in recent years, but were very different in 1992 suggesting a dramatically lower trap efficiency in 1992. Three index traps were operated in the NW Miramichi estuary and 1 trap in the SW estuary in 1992. Tag recapture estimates of grilse from tags put on at Millbank and recovered at Enclosure traps were similar to estimates from tags put on at Enclosure traps and recovered at estuarine traps and barrier fences. The latter is reported here because the confidence interval is narrower due to more tags placed and recovered. Returns of large salmon were estimated as the product of returns of small salmon and the large salmon to small salmon ratio observed at Millbank trap. Spawners 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 eight years.

Forecast for 1993: The probability distribution model prediction for large salmon returns in 1993 is 18314 with a probability of meeting the spawning target (23600) of 21% (i.e., a 79% chance of returns being less than 23600). However, the model is based on a data set that does not include small salmon returns as large as those estimated for 1992 and therefore is considered unreliable (i.e., the relationship between very large grilse returns and returns of big salmon in the next year is unknown). In addition, closure of the Newfoundland commercial fishery may have resulted in more small salmon returns in 1992 than in previous years, and may result in more large salmon returns in 1993 than predicted.

Summary Sheet

Stock: Northwest Miramichi River, SFA 16
Life Stage: juveniles (0+,1+,2+), small and large salmon
Target: 41 million eggs (7316 large, 7006 small salmon)

	1992
Angling Harvest[1]	
Large	78
Small	7985
Native Harvest[2]	
Large	580
Small	1616
Other Harvest[3]	
Large	56
Small	61
Spawning Escapement	
Large (X1000)	6
Small (X1000)	22
Total Returns	
Large (X1000)	7
Small (X1000)	31
% egg target met	119

[1] Angling harvest of large salmon is mortalities due to catch and release, estimated at 3% of catch.
[2] Native catch is catch reported by the Red Bank and Eel Ground Indian Bands.
[3] Other harvest includes broodstock, mortalities at the Eel Ground index trap, and samples.

Recreational catches: NB DNRE FISHSYS estimates indicate that over the period 1987-1991, 27-34% (mean: 31%) of total angling in the Miramichi River has occurred in the NW Miramichi.

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

State of the Stock: The spawning target for large salmon was not achieved in 1992. Egg deposition was achieved because of a large surplus of small salmon. Juvenile salmon densities in the NW Miramichi are lower than those in the SW Miramichi.

Forecast for 1993: Because 1992 is the first year of data on returns, no forecast can be made of returns in 1993.

Summary Sheet

Stock: Southwest Miramichi River, SFA 16
Life Stage: juveniles (0+,1+,2+), small and large salmon
Target: 88 million eggs (15730 large, 15063 small salmon)

	1992
Angling Harvest[1]	
Large	245
Small	17608
Native Harvest	
Large	0
Small	0
Other Harvest[2]	
Large	75
Small	26
Spawning Escapement	
Large (X1000)	25
Small (X1000)	104
Total Returns	
Large (X1000)	25
Small (X1000)	121
% egg target met	242

[1] Angling Harvest of large salmon is mortalities due to catch and release, estimated at 3% of catch.
[2] Other Harvest includes broodstock, mortalities at the SW Enclosure trap, and samples.

Recreational catches: DNRE FISHSYS estimates indicate that over the period 1987-1991, 66-73% (mean: 69%) of total angling in the Miramichi River has occurred in the SW Miramichi.

Data and assessment: Returns to the SW Miramichi are estimated as the difference between returns to the river as a whole and returns to the Northwest Miramichi.

State of the Stock: Spawning targets for large salmon, small salmon, and eggs were exceeded in 1992.

Forecast for 1993: Because 1992 is the first year of data on returns, no forecast can be provided for 1993.

Table 1. Angling catch and effort data for kelt and bright 1SW salmon in the Miramichi River as estimated by DNRE, 1969 to 1992.

	Kelts			Bright Salmon				
Year	Catch	Rod Days	CPUE	Early Catch	Late Catch	Total Catch	Rod Days	CPUE
1969	2547	21646	0.12	17823	6461	24284	48525	0.50
1970	3719	5746	0.65	13880	5730	19610	56994	0.34
1971	2380	6447	0.37	11276	2451	13727	43074	0.32
1972	1500	3808	0.39	16053	3048	19101	50604	0.38
1973	1538	7997	0.19	12038	1819	13857	59620	0.23
1974	1512	7013	0.22	15542	2690	18232	59843	0.30
1975	1760	7616	0.23	13314	2284	15598	59746	0.26
1976	2316	6197	0.37	23384	3798	27182	66157	0.41
1977	2380	8082	0.29	12546	1044	13590	65266	0.21
1978	1401	7083	0.20	7357	908	8265	68635	0.12
1979	1476	6244	0.24	12654	1854	14508	67599	0.21
1980	2242	7064	0.32	9674	2323	11997	58074	0.21
1981	1732	6373	0.27	19205	3511	22716	72868	0.31
1982	2691	8910	0.30	19233	2169	21402	76041	0.28
1983	2060	6690	0.31	7310	1080	8390	87620	0.10
1984[1]	862	1403	0.61	8472	1925	10397	-	-
1985	2385	4196	0.57	17111	1328	18439	61693	0.30
1986	2473	6394	0.39	20611	5552	26163	67801	0.39
1987	2748	11180	0.25	14824	5941	20765	64453	0.32
1988	4216	4455	0.95	17971	12649	30620	82103	0.37
1989	5361	6124	0.88	17321	7105	24426	72892	0.34
1990	4134	15454	0.27	15256	6116	21372	122470	0.17
1991	2356	11028	0.21	7769	3531	11300	109597	0.10
1992	4994	5450	0.92	10308	15285	25593	67890	0.38
Mean (87-91)	3763	9648	0.51	14628	7068	21697	90303	0.26
Change(92-mean)/mean	+33%	-44%	+80%	-30%	+116%	+18%	-25%	+46%

Footnote: [1] 1984 Catches are from DFO
1992 kelt data are DFO estimates.
1992 bright data are preliminary estimates based on DFO figures.

Table 2. Angling statistics for bright large and small salmon in the Miramichi as reported by N.B. DNRE and DFO.

Year	Large Salmon		Small Salmon	
	DNRE	DFO	DNRE	DFO
1969	3,804	2,827	24,284	26,715
1970	3,268	2,057	19,610	19,662
1971	1,792	1,247	13,727	8,464
1972	8,933	5,456	19,101	15,472
1973	5,977	4,881	13,857	9,033
1974	7,184	5,895	18,232	17,957
1975	6,288	3,756	15,598	9,730
1976	7,374	5,319	27,182	14,749
1977	11,617	14,344	13,590	8,244
1978	4,893	4,196	8,265	5,353
1979	2,656	2,422	14,508	7,625
1980	6,546	5,422	11,997	7,533
1981	3,238	1,602	22,716	7,031
1982	4,608	2,642	21,406	9,217
1983	2,240	1,646	8,390	3,897
1984	4,692	-	10,397	9,892
1985	9,622	-	18,439	11,926
1986	14,266	-	26,163	28,299
1987	11,932	-	20,765	11,363
1988	10,095	-	30,620	13,732
1989	11,933	-	24,426	12,665
1990	9,258	-	21,372	11,584
1991	6,147	-	11,300	9,456
1992	10,759	-	25,593	23,936
Mean 1987-91	9,873	-	21,697	11,760
Change (92-Mean)/Mean	+9%	-	+18%	+104%

Note: 1984-91 Multi-sea - winter salmon statistics represent numbers of fish hooked and released.
1984 DNRE catches are from DFO
1992 small salmon catch (DNRE) was estimated from a correlation between DFO and DNRE estimates between 1969 and 1991c ($r=0.63$, $p<0.0017$).
1992 large salmon catch (DNRE) was estimated from a correlation between DNRE small salmon and DNRE large salmon from 1987 to 1991 ($r=0.67$, $p<0.218$).

Table 3. Preliminary salmon harvest in the Miramichi River above Millbank (HR) and estuary below Millbank (HE1), 1992. Harvests in 1991 are given for comparison.

	1991		1992	
	Small	Large	Small	Large
1. Miramichi River above Millbank				
Native (NW Miramichi)				
Red Bank	899	350	1123	401
Eel Ground	210	112	493	179
Angling Total	11300	184	25593	323
NW Miramichi			7985	78
SW Miramichi			17608	245
Total	12409	646	27209	903
NW Miramichi			9601	658
SW Miramichi			17608	245
2. Miramichi estuary below Millbank				
Native				
Burnt Church reported	2	82	36	28
estimated by DFO	70	130	-	-
Angling	-	-	0	0
Total	2	82	36	28
3. Other Removals (Millbank and above)				
Broodstock	97	99	87	123
NW Miramichi			61	55
SW Miramichi			26	68
Trap mortalities	29	32	32	19
NW Miramichi			0	1
SW Miramichi			0	7
Millbank			32	11
Samples (Millbank)	63	0	79	0
Total	189	131	198	142
NW Miramichi			61	56
SW Miramichi			26	75
Millbank			111	11
4. Total Removals	12600	859	27443	1073

Note: 1. Large salmon angling kills are calculated assuming a catch-and-release mortality rate of 0.03. Food fishery harvests are estimates from DFO C&P and native bands.

2. Large salmon angling kills are separated into NW and SW Miramichi Rivers by multiplying the total hook and release mortality (323) by the mean percentage of the total large salmon catch taken in each from 1987-1991. This yields: NW - 78 (24%), SW - 245 (76%).

Table 4. Catch and effort for native food fisheries on the Miramichi in 1992 for early and late runs by week, as reported by band councils. Red Bank Indian Band harvested some salmon from the two salmon index traps that they operated, in addition to harvest from gillnets. Number of gillnets fished were not reported by Red Bank Indian Band.

Week	Burnt Church			Eel Ground			Red Bank			
							Small		Large	
	Nets	Small	Large	Nets	Small	Large	Traps	Nets	Traps	Nets
Early run										
21	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-
23	-	-	-	4	0	7	-	0	0	70
24	-	-	-	9	48	68	-	6	0	25
25	-	-	-	11	115	40	-	98	0	47
26	-	-	-	9	79	23	-	108	0	40
27	-	-	-	9	89	17	0	120	0	60
28	-	-	-	7	58	4	0	140	0	56
29	-	-	-	7	45	9	0	160	0	30
30	-	-	-	8	28	2	7	120	1	20
31	-	-	-	7	19	5	20	90	0	20
32	-	-	-	3	4	4	25	28	0	16
33	-	-	-	3	0	0	26	15	0	8
34	-	-	-	3	1	0	28	8	0	3
35	-	-	-	2	0	0	32	4	0	3
Subtotal	-	36	28	80	486	179	138	897	1	398
Late run										
36	-	-	-	1	3	0	14	2	0	2
37	-	-	-	1	4	0	17	0	0	0
38	-	-	-	-	-	-	31	0	0	0
39	-	-	-	-	-	-	12	0	0	0
40	-	-	-	-	-	-	6	0	0	0
41	-	-	-	-	-	-	6	0	0	0
Subtotal	-	0	0	2	7	0	86	2	0	2
Total Season	-	36	28	82	493	179	224	899	1	400
% early run	-	100%	100%	98%	98%	100%	62%	100%	100%	100%

Table 5. Recorded catches of salmon in all fisheries, Miramichi River and Bay, 1951-92 (includes commercial, by-catch, recreational, and native). Kelts angled in year i are added to landings in year i-1. 1992 data are preliminary. All data are numbers X 1000.

Year	Commercial Fishery			Angling Fisheries							Native Fishery			All Fisheries
				Kelts (yr i+1)			Brights (yr i)							
	Small	Large	Total	Small	Large	Total	Small	Large	Total	All	Small	Large	Total	
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	10.4	0.0	10.4	12.8	0.4	0.3	0.7	13.5
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	5.0	0.0	5.0	11.3	0.0	11.3	16.3	1.1	0.5	1.6	17.9
1992	0.0	0.0	0.0	-	0.0	-	25.6	0.0	25.6	25.6	1.7	0.6	2.3	27.9
1987-91 Mean											1.3	0.6	1.9	-
change = (92-mean)/mean											+31%	0%	+21%	

Note: Angling catches from 1951-68 are from DFO
Angling catches from 1969-91 are from DNRE FISHSYS
Angling catches for 1992 bright salmon are estimated from catch estimated by DFO, increased using the relationship between DFO and DNRE FISHSYS figures from 1969-1991, because FISHSYS estimates were not yet prepared for 1992.
Angling catches of kelts in 1992 are DFO estimates.

Table 6. Counts of small and large salmon at Millbank, 1954 to 1992. Counts are divided into early (May to August 31) and late periods.

	TIME							
	Early		Late		Total		Proportion	Proportion
YEAR	Small	Large	Small	Large	Small	Large	early small	early large
1954	904	347	925	1783	1829	2130	0.49	0.16
1955	646	99	1161	2747	1807	2846	0.36	0.03
1956	1145	216	2289	3142	3434	3358	0.33	0.06
1957	1322	516	2696	3410	4018	3926	0.33	0.13
1958	2152	549	6250	3823	8402	4372	0.26	0.13
1959	760	209	1400	4094	2160	4303	0.35	0.05
1960	1079	216	3424	4458	4503	4674	0.24	0.05
1961	2213	358	4639	2634	6852	2992	0.32	0.12
1962	1576	254	1387	1661	2963	1915	0.53	0.13
1963	2765	184	11343	1455	14108	1639	0.20	0.11
1964	4674	210	4269	798	8943	1008	0.52	0.21
1965	5023	399	10762	1418	15785	1817	0.32	0.22
1966	4564	310	5426	1323	9989	1632	0.46	0.19
1967	1480	73	6216	924	7723	997	0.19	0.07
1968	2492	292	726	1127	3239	1414	0.77	0.21
1969	3224	333	1116	328	4350	667	0.74	0.50
1970	1826	125	658	120	2484	245	0.74	0.51
1971	1849	370	113	24	1962	394	0.94	0.94
1972	2378	948	164	219	2542	1167	0.94	0.81
1973	1490	478	960	655	2450	1133	0.61	0.42
1974	2948	864	1090	927	4038	1791	0.73	0.48
1975	2954	629	594	580	3548	1209	0.83	0.52
1976	4072	641	867	302	4939	943	0.82	0.68
1977	1249	1189	256	745	1505	1934	0.83	0.61
1978	1150	535	115	58	1265	593	0.91	0.90
1979	2157	257	343	61	2500	318	0.86	0.81
1980	1802	837	337	256	2139	1093	0.84	0.77
1981	2020	173	154	26	2174	199	0.93	0.87
1982	2593	392	72	16	2665	408	0.97	0.96
1983	770	226	40	19	810	245	0.95	0.92
1984	966	294	44	39	1010	333	0.96	0.88
1985	901	287	11	24	912	311	0.99	0.92
1986	1324	345	439	124	1763	469	0.75	0.74
1987	1146	223	126	68	1272	291	0.90	0.77
1988	884	173	944	152	1828	325	0.48	0.53
1989	1062	211	66	46	1128	257	0.94	0.82
1990	858	189	389	238	1247	427	0.69	0.44
1991	597	220	316	228	913	448	0.65	0.49
1992	804	141	167	61	971	202	0.83	0.70
87-91 avg	909	203	368	146	1278	350	0.73	0.61
Change (92-avg)/avg	-12%	-31%	-55%	-58%	-24%	-42%	+14%	+15%

Table 7. Numbers of large and small salmon counted at barriers in three tributaries of the Miramichi River, 1981 to 1992.

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	2334	Jun. 29-Oct. 14	108
	1991	476	495	971	Jun. 30-Oct. 21	107
	1992	1047	1383	2430	Jun. 30-Oct. 20	113
1987-91	Mean	879	1075	1893		
Change (92-avg)/avg		+19%	+29%	+28%		
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
1987-91	Mean	263	606	870		
Change (92-avg)/avg		-12%	+36%	+22%		
Northwest Miramichi River	1988	234	1614	1848	Jun. 27-Oct. 26	122
	1989	234	901	1135	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
1988-91	Mean	256	1150	1405		
Change (92-avg)/avg		-14%	+1%	-1%		

Table 8. NUMBERS OF FISH CAUGHT AND TAGGED AT DFO TRAPS AND FENCES, MIRAMICHI R., 1992

FACILITY	CATCH			NUMBER TAGGED			PERCENT TAGGED		
	1SW	MSW	TOTAL	1SW	MSW	TOTAL	1SW	MSW	TOTAL
MILLBANK T.	971	202	1173	785	189	974	78	94	83
SW T.	1606	450	2056	1521	422	1943	95	94	95
NW-EEL.T	1064	465	1529	981	422	1403	92	91	92
NW-RED.T	426	142	568	244	125	369	57	88	65
LSW-RED.T	367	145	512	173	119	292	47	82	57
TOTAL	4434	1404	5838	3704	1277	4981	84	91	85
NW BARRIER F	1165	219	1384						
CATAMARAN F	128	68	196						
TOTAL	1293	287	1580						
SW BARRIER F	1383	1047	2430						
BARTHOLOMEW F	178	24	202						
DUNGARVON F	825	232	1057						
TOTAL	2386	1303	3689						

Table 9. Biological characteristics of adult salmon sampled at the Millbank trap, 1992.

1. Fork length, sex ratio, and reproductive potential.

Sea age	n	FL	SD	n	% female	eggs/spawner
MSW	195	78.6	12.00	58	82.7	6209
1SW	178	54.5	4.99	77	16.9	567

2. Smolt ages

	Percent at Age							
	n	2	3	4	n	2	3	4
	1SW Salmon				2SW Salmon			
1992	151	46.4	53.0	0.7	109	43.1	55.0	1.8
1991	124	47.6	50.8	1.6	200	61.0	39.0	0.0
1990	252	46.8	50.0	3.2	239	52.3	46.9	0.8
1989	284	32.4	64.1	3.5	134	57.5	42.5	0.0
1988	252	58.7	39.3	2.0	197	62.9	36.6	0.5
1987	199	40.2	58.8	1.0	43	48.8	51.2	0.0
1986	243	55.1	44.0	0.8	133	42.9	57.1	0.0
1985	141	31.9	68.1	0.0	87	57.5	42.5	0.0
1984	148	43.9	56.1	0.0	51	66.7	33.3	0.0
1983	136	41.9	58.1	0.0	33	60.6	39.4	0.0
1982	316	35.4	60.8	3.8	37	27.0	73.0	0.0
1981	418	35.7	62.0	2.4	26	34.6	65.4	0.0
1980	361	45.2	54.0	0.8	204	39.2	60.8	0.0
1979	519	35.5	63.0	1.5	40	30.0	70.0	0.0
1978	260	26.2	69.6	4.2	127	28.3	70.9	0.8
1977	296	31.1	66.5	2.4	355	74.1	25.6	0.3
1976	549	54.8	44.3	0.9	82	36.6	63.4	0.0
1975	733	28.9	68.4	2.7	227	43.6	56.4	0.0
1974	1124	31.9	67.8	0.4	419	56.6	41.8	1.4
1973	605	44.6	43.5	11.9	590	18.8	75.6	5.6
1972	504	8.7	88.1	3.2	414	16.4	81.6	1.9
1971	204	11.3	81.7	6.9	291	10.6	87.3	2.1
	Previous Spawners							
1992	77	61.0	39.0	0.0				
1991	127	64.3	34.1	1.6				
1990	149	68.5	31.5	0.0				
1989	71	53.5	46.5	0.0				
1988	45	57.8	42.2	0.0				
1987	11	63.6	36.4	0.0				
1986	23	34.8	65.2	0.0				
1985	13	53.8	46.2	0.0				
1984	3	33.3	66.7	0.0				
1983	8	50.0	50.0	0.0				
1982	9	0.0	100.0	0.0				
1981	13	15.4	84.6	0.0				
1980	11	18.2	72.7	9.1				
1979	19	52.6	42.1	5.3				
1978	21	57.1	42.9	0.0				
1977	20	35.0	60.0	5.0				
1976	14	57.1	42.9	0.0				
1975	35	42.9	57.1	0.0				
1974	43	39.5	58.1	2.3				
1973	26	15.4	76.9	7.7				
1972	15	6.7	86.6	6.7				
1971	26	15.4	76.9	7.7				

Note: Eggs/spawner are calculated for 1SW and MSW salmon as follows (Randall 1989):

Eggs/spawner (1SW) = % Female X $e^{[3.1710 \times Ln(FL) - 4.5636]}$
Eggs/spawner (MSW) = % Female X $e^{[1.4133 \times Ln(FL) + 2.7560]}$

Table 10. 1992 MIRAMICHI RIVER SALMON TAGS RECOVERED AT DFO TRAPS AND BARRIER FENCES IN 1992.

TAGGED AT:		RECOVERED AT:										
		TRAPS					FENCES					TOTAL
							SW MIR			NW MIR		
		Mill	SW	Eel	NWR	LSWR	SW	Bart	Dung	NW	Cat	
Mill.	1SW	3	11	3	2	4	2	0	0	5	1	32
	MSW	0	1	2	0	0	0	0	0	0	0	3
SW	1SW	0	33	22	13	4	1	2	3	4	2	84
	MSW	0	5	4	3	1	1	0	0	0	1	15
NW-EEL.	1SW	0	15	28	23	16	0	1	1	4	6	94
	MSW	0	6	12	5	8	0	0	0	1	2	34
RED.-NW	1SW	0	3	1	11	9	0	0	0	0	1	25
	MSW	0	0	0	0	5	0	0	0	0	1	6
RED.-LSW	1SW	0	0	1	7	10	0	0	0	0	1	19
	MSW	0	0	2	4	4	0	0	0	0	1	11

TABLE 11. MEAN NUMBER OF DAYS BETWEEN TAGGING AT TRAPS AND RECOVERY AT TRAPS AND FENCES. NUMBERS BELOW MEANS REPRESENT RANGE AND (N). EARLY: TAGGED BEFORE SEPTEMBER 1. LATE: TAGGED AFTER AUGUST 31.

TAGGED AT:		RECOVERED AT:									
		TRAPS					FENCES				
		Mill	SW	Eel	NWR	LSWR	SW	Bart	Dung	NW	Cat
Mill. early	1SW	1.0 0-2 (3)	9.6 1-45 (8)	1.5 1-2 (2)	-	63.0 (1)	34.0 26-42 (2)	-	-	62.6 24-113 (5)	68.0 (1)
	MSW	-	-	3 (1)	-	-	-	-	-	-	-
Mill. late	1SW	-	2.0 1-4 (3)	1.0 (1)	17.5 9-26 (2)	24.0 18-33 (3)	-	-	-	-	-
	MSW	-	1.0 (1)	26.0 (1)	-	-	-	-	-	-	-
SW early	1SW	-	7.2 0-61 (13)	16.0 8-31 (4)	15.6 1-64 (5)	1.0 0-2 (2)	24.0 (1)	5.0 (1)	44.0 26-74 (3)	45.3 28-57 (4)	-
	MSW	-	-	-	-	-	55.0 (1)	-	-	-	-
SW late	1SW	-	3.9 1-24 (20)	7.1 1-25 (18)	7.6 2-14 (8)	9.5 6-13 (2)	-	7.0 (1)	-	-	38.0 (1)
	MSW	-	12.0 1-23 (5)	9.3 2-19 (4)	6.7 3-13 (3)	17.0 (1)	-	-	-	-	-
NW Eel. early	1SW	-	57.0 51-59 (2)	30.1 0-75 (7)	18.3 2-43 (3)	31.7 2-50 (3)	-	7.0 (1)	26.0 (1)	31.3 27-39 (4)	59.0 (1)
	MSW	-	-	7.0 (1)	-	110.0 (1)	-	-	-	109.0 (1)	-
NW Eel. late	1SW	-	1.9 1-3 (13)	2.4 1-11 (21)	4.8 1-28 (20)	8.2 1-23 (13)	-	-	-	-	14.7 7-22 (3)
	MSW	-	6.8 1-19 (6)	1.4 1-3 (11)	4.8 1-11 (5)	6.3 1-12 (7)	-	-	-	-	-
RED NW early	1SW	-	-	-	-	-	-	-	-	-	-
	MSW	-	-	-	-	15.5 2-29 (2)	-	-	-	-	-
RED NW late	1SW	-	5.3 2-9 (3)	3.0 (1)	3.5 0-9 (11)	5.7 1-14 (9)	-	-	-	-	22.0 (1)
	MSW	-	-	-	-	4.7 1-11 (3)	-	-	-	-	-
RED LSW early	1SW	-	-	-	-	80.0 (1)	-	-	-	-	-
	MSW	-	-	-	-	50.0 (1)	-	-	-	-	-
RED LSW late	1SW	-	-	14.0 (1)	6.6 2-12 (7)	10.1 1-11 (9)	-	-	-	-	6.0 (1)
	MSW	-	-	4.0 3-5 (2)	1.8 1-3 (4)	2.7 1-6 (3)	-	-	-	-	-

NB: 8 Catamaran Brook recoveries lacked date recovered (3 grilse, 5 salmon) so are not included here.

TABLE 12. Miramichi tags put on in 1992, recovered in fisheries. NAT.ANG.: Native angling. Nat.Nets: Native gillnetting. Miscellaneous: found tag, dead fish, observed in pool, seining brood stock, etc. SW: Southwest Miramichi, NW: Northwest Miramichi, LSW: Little Southwest Miramichi, BARTI: Bartibog R., ?: Recovered somewhere in the Miramichi R.

TAGGED AT	AGE	FISHERY	RECOVERED AT SW	NW	LSW	BARTI.	?	TOTAL
MILLBANK	1SW	ANGLING	66	32	8	0	0	106
		NAT.ANG.	0	2	2	0	0	4
		NAT.NETS	0	7	0	0	0	7
	MSW	ANGLING	3	1	1	1	0	6
		NAT.NETS	0	1	0	0	0	1
SW ENCLOSURE	1SW	ANGLING	161	10	13	0	3	187
		NAT.NETS	0	3	0	0	0	3
		MISCELL.	1	0	1	0	0	2
	MSW	ANGLING	18	0	0	0	0	18
		NAT.NETS	0	1	0	0	0	1
		MISCELL.	1	0	0	0	0	1
NW ENCLOSURE	1SW	ANGLING	31	33	16	0	2	82
		NAT.ANG.	0	0	1	0	0	1
		NAT.NETS	0	14	0	0	0	14
	MSW	ANGLING	8	1	1	0	0	10
		NAT.NETS	0	1	0	0	0	1
NW Red Bank	1SW	ANGLING	4	0	2	0	0	6
LSW Red Bank	1SW	ANGLING	2	0	2	0	0	4
		MISCELL.	0	0	1	0	0	1
	MSW	ANGLING	0	1	0	0	0	1
		NAT.NETS	0	2	0	0	0	2
TOTAL	1SW	ANGLING	264	75	41	0	5	385
		NAT.ANG.	0	2	3	0	0	5
		NAT.NETS	0	24	0	0	0	24
		MISCELL.	1	0	2	0	0	3
	MSW	ANGLING	29	3	2	1	0	35
		NAT.ANG.	0	0	0	0	0	0
		NAT.NETS	0	5	0	0	0	5
		MISCELL.	1	0	0	0	0	1

Table 13. Angling catches (DNRE FISHSYS) in the Southwest and Northwest Miramichi River systems for 1987-91. Percentages of the catch taken in the NW Miramichi are shown.

Year	Southwest	Northwest	Total	% Northwest
1987	13670	7095	20765	34.2
1988	20786	9834	30620	32.1
1989	16858	7568	24426	31.0
1990	14547	6825	21372	31.9
1991	8244	3056	11300	27.0
Mean				31.2

Table 14. Indices of spawning escapement in the Miramichi River, 1970 to 1991.

Year (i) 1	Angled Large Kelt (i) 2	Angled Large Bright (i-1) 3	0+ fry* (i) 4	1+ parr* (i+1) 5	Eggs/sq meter (i-1) 6
1969	1,828	1,512	-	6.1	-
1970	1,647	3,804	35.3	7.9	-
1971	1,352	3,268	20.1	8.3	-
1972	547	1,792	9.8	3.0	0.56
1973	2,970	8,933	24.9	11.0	1.85
1974	3,037	5,977	34.2	12.8	2.39
1975	3,111	7,184	40.0	11.7	4.61
1976	1,446	6,288	25.1	8.4	3.06
1977	2,156	7,374	51.8	10.7	2.38
1978	2,126	11,617	36.4	9.0	3.88
1979	1,668	4,893	19.7	8.3	1.45
1980	1,504	2,656	34.5	7.0	0.95
1981	2,118	6,546	53.6	9.8	2.44
1982	1,368	3,238	15.0	6.7	0.86
1983	960	4,608	44.5	6.5	2.16
1984	666	2,240	19.1	8.9	1.03
1985	3,771	4,692	56.4	12.2	1.81
1986	6,856	9,622	55.4	13.1	2.49
1987	5,099	14,266	74.5	13.9	4.27
1988	5,700	11,932	95.1	18.4	3.40
1989	7,382	10,095	72.2	12.4	3.61
1990	5,641	11,933	94.6	14.3	2.33
1991	2,997	9,258	44.6	21.6	3.63
1992	-	6,147	74.0	-	3.79
1993	-	10,759	-	-	4.82

* Number per 100 m^2

Correlations:

	n	r	p
2 with 3	23	0.76	0.0001
2 with 4	22	0.83	0.0001
2 with 5	23	0.69	0.0003
2 with 6	20	0.52	0.0201
3 with 4	23	0.72	0.0001
3 with 5	22	0.79	0.0001
3 with 6	22	0.74	0.0001
4 with 5	22	0.67	0.0007
4 with 6	20	0.55	0.0092
5 with 6	19	0.61	0.0047

Notes: a. Eggs per sq meter are estimated from spawning escapements given in Table 16.
b. Angling catches are DNRE Fishsys values.

Table 15. SAS output from the multiplicative model comparing fry (0+) densities in 1992 to prior years.

General Linear Models Procedure

Dependent Variable: DENS0

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	29	271.16621226	9.35055904	14.30	0.0001
Error	281	183.76623968	0.65397238		
Corrected Total	310	454.93245194			

R-Square	C.V.	Root MSE	DENS0 Mean
0.596058	24.79119	0.80868559	3.26198725

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	22	113.87576576	5.17617117	7.91	0.0001
STRORD	4	29.90706484	7.47676621	11.43	0.0001
TRIB	3	127.38338166	42.46112722	64.93	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	22	117.61238439	5.34601747	8.17	0.0001
STRORD	4	31.95524306	7.98881076	12.22	0.0001
TRIB	3	127.38338166	42.46112722	64.93	0.0001

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		4.950360243 B	18.25	0.0001	0.27121069
YEAR	1970	-1.228387500 B	-3.27	0.0012	0.37586288
	1971	-1.131139627 B	-3.70	0.0003	0.30584983
	1972	-2.119151251 B	-6.79	0.0001	0.31215317
	1973	-1.281050949 B	-4.26	0.0001	0.30058749
	1974	-1.221543764 B	-4.06	0.0001	0.30058749
	1975	-0.452503747 B	-1.48	0.1405	0.30612157
	1976	-1.031491319 B	-3.43	0.0007	0.30058749
	1977	-0.499512955 B	-1.66	0.0977	0.30058749
	1978	-1.110916791 B	-3.70	0.0003	0.30058749
	1979	-1.481311313 B	-4.93	0.0001	0.30058749
	1980	-1.264723535 B	-4.13	0.0001	0.30591835
	1981	-0.517986199 B	-1.72	0.0859	0.30058749
	1982	-1.420432340 B	-4.64	0.0001	0.30612157
	1983	-0.632660690 B	-2.10	0.0362	0.30058749
	1984	-1.221617638 B	-3.99	0.0001	0.30612157
	1985	-0.141442179 B	-0.45	0.6533	0.31902209
	1986	-0.335941315 B	-1.10	0.2737	0.30600600
	1987	-0.179727701 B	-0.59	0.5576	0.30612157
	1988	0.226508299 B	0.75	0.4517	0.30058749
	1989	0.058828583 B	0.20	0.8450	0.30058749
	1990	0.099509630 B	0.33	0.7454	0.30612157
	1991	-0.094267970 B	-0.18	0.8572	0.52338089
	1992	0.000000000 B	.	.	.
STRORD	2	-0.154500460 B	-1.11	0.2678	0.31926620
	4	-0.200847203 B	-1.03	0.3037	0.19490716
	5	-0.181327021 B	-0.88	0.3772	0.20524488
	6	-1.010665235 B	-5.11	0.0001	0.19777907
	10	0.000000000 B	.	.	.
TRIB	LSWR	-1.510201289 B	-6.91	0.0001	0.16955727
	MWR	-1.894614769 B	-11.26	0.0001	0.15052121
	SWWR	-1.456181176 B	-5.96	0.0001	0.24451761
	LSWR	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

Table 16. SAS output from the multiplicative model comparing 1+ parr densities in 1992 to prior years.

General Linear Models Procedure

Dependent Variable: DENS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	29	124.77624841	4.30262926	7.45	0.0001
Error	267	154.17645238	0.57743990		
Corrected Total	296	278.95270079			

R-Square	C.V.	Root MSE	DENS1 Mean
0.447303	36.96859	0.75989466	2.05551459

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	22	36.06268287	1.63921286	2.84	0.0001
STRORD	4	66.11458483	16.52864621	28.62	0.0001
TRIB	3	22.59898071	7.53299357	13.05	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	22	36.11224893	1.64146586	2.84	0.0001
STRORD	4	82.31156674	20.57789168	35.64	0.0001
TRIB	3	22.59898071	7.53299357	13.05	0.0001

Parameter		Estimate		T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		3.351004837	B	12.86	0.0001	0.26059286
YEAR	1970	-0.858642178	B	-2.40	0.0170	0.35765743
	1971	-1.005503932	B	-3.43	0.0007	0.29305001
	1972	-0.955309459	B	-3.32	0.0010	0.28814573
	1973	-1.750614750	B	-5.75	0.0001	0.30430799
	1974	-0.568965478	B	-1.91	0.0575	0.29824555
	1975	-0.571677340	B	-1.98	0.0483	0.28814573
	1976	-0.624442261	B	-2.17	0.0311	0.28814573
	1977	-0.940434619	B	-3.26	0.0012	0.28814573
	1978	-0.549299811	B	-1.72	0.0872	0.32001181
	1979	-0.788278717	B	-2.69	0.0076	0.29284185
	1980	-1.064128280	B	-3.63	0.0003	0.29284185
	1981	-1.068949179	B	-3.58	0.0004	0.29805521
	1982	-0.758496523	B	-2.58	0.0103	0.29284185
	1983	-0.911481504	B	-3.06	0.0025	0.29805521
	1984	-0.901994216	B	-3.08	0.0023	0.29276816
	1985	-0.693545746	B	-2.28	0.0234	0.30426832
	1986	-0.417103066	B	-1.40	0.1635	0.29852255
	1987	-0.408117432	B	-1.39	0.1645	0.29276816
	1988	-0.620301369	B	-2.12	0.0350	0.29276816
	1989	-0.181265848	B	-0.63	0.5298	0.28814573
	1990	-0.420570056	B	-1.46	0.1456	0.28814573
	1991	-0.521343722	B	-1.06	0.2920	0.49374988
	1992	0.000000000	B	.	.	.
STRORD	2	0.308527275	B	1.07	0.2869	0.28912122
	4	0.113107162	B	0.62	0.5384	0.18360503
	5	-0.321726420	B	-1.68	0.0951	0.19326243
	6	-1.412234907	B	-7.49	0.0001	0.19120420
	10	0.000000000	B	.	.	.
TRIB	LSMR	-0.712666174	B	-4.07	0.0001	0.17521666
	MSR	-0.667184971	B	-4.83	0.0001	0.13805882
	RMR	-0.622677939	B	-2.78	0.0058	0.22408071
	LSMR	0.000000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

Table 17. SAS output from the multiplicative model comparing 2+ parr densities in 1992 to prior years.

General Linear Models Procedure

Dependent Variable: DENS2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	29	42.14947813	1.45343028	3.59	0.0001
Error	230	93.05030815	0.40456656		
Corrected Total	259	135.19978628			

R-Square	C.V.	Root MSE	DENS2 Mean
0.311757	50.71472	0.63605547	1.25418322

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	22	16.76126919	0.76187587	1.88	0.0117
STRORD	4	15.90040648	3.97510162	9.83	0.0001
TRIB	3	9.48780246	3.16260082	7.82	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	22	15.49789634	0.70444983	1.74	0.0240
STRORD	4	21.13436118	5.28359030	13.06	0.0001
TRIB	3	9.48780246	3.16260082	7.82	0.0001

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		1.685948887 B	7.05	0.0001	0.23913428
YEAR	1970	0.352774975 B	1.16	0.2453	0.30281390
	1971	-0.254990227 B	-0.95	0.3432	0.26844293
	1972	-0.166782659 B	-0.63	0.5285	0.26422569
	1973	-0.740706874 B	-2.72	0.0071	0.27267983
	1974	-0.273426105 B	-0.96	0.3383	0.28495865
	1975	-0.360114377 B	-1.36	0.1742	0.26422569
	1976	-0.180431976 B	-0.67	0.5022	0.26844293
	1977	-0.158841308 B	-0.59	0.5556	0.26909939
	1978	0.110544607 B	0.41	0.6856	0.27267983
	1979	-0.210070851 B	-0.77	0.4417	0.27259336
	1980	-0.387247924 B	-1.42	0.1569	0.27267983
	1981	-0.154351704 B	-0.58	0.5597	0.26422569
	1982	-0.129268648 B	-0.48	0.6300	0.26863307
	1983	0.083621690 B	0.29	0.7694	0.28494765
	1984	-0.394980016 B	-1.38	0.1686	0.28600949
	1985	-0.587190167 B	-1.94	0.0534	0.30242646
	1986	0.154144532 B	0.56	0.5737	0.27358988
	1987	-0.207193023 B	-0.76	0.4481	0.27267983
	1988	-0.449954110 B	-1.68	0.0945	0.26796211
	1989	-0.142679369 B	-0.50	0.6170	0.28494765
	1990	-0.163310018 B	-0.60	0.5498	0.27267983
	1991	0.684317287 B	1.61	0.1078	0.42392802
	1992	0.000000000 B	.	.	.
STRORD	2	0.584106021 B	2.35	0.0197	0.24881294
	4	0.094448757 B	0.58	0.5643	0.15665594
	6	-0.098814509 B	-0.57	0.5705	0.17041304
	8	-0.760770018 B	-4.24	0.0001	0.17944484
	10	0.000000000 B	.	.	.
TRIB	LSMNR	-0.528537633 B	-3.34	0.0010	0.15819247
	MNR	-0.484101865 B	-3.95	0.0001	0.12147749
	UMNR	-0.301145195 B	-1.57	0.1165	0.19218041
	LSMNR	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

Table 18a. Spawning escapement of small salmon as estimated by Methods 1 (adjusted Peterson tag-recapture) and 2 (Bayesian tag-recapture). 95% confidence limits for estimates of returns, spawning escapement, and % of required spawners are shown in brackets.

	Method 1		Method 2	
Miramichi River System - Millbank tagging - recaptures at SW Enclosure and Eel Ground traps M = 785 C = 2670 R = 14				
1. Total returns	139995		150036	
2. Harvest below Millbank	36		36	
3. Returns to Millbank	139959	(85689-241310)	150000	(88000-278000)
4. Harvest above Millbank	27209		27209	
5. Broodstock/trap mortalities	198		198	
6. Spawners	112552	(58282-213903)	122593	(60593-250593)
7. Required spawners	22600		22600	
% achieved	498	(258-946)	542	(268-1109)
Miramichi River System - SW Enclosure and Eel Ground tagging - recaptures at traps and fences M = 2502 C = 7142 R = 117				
1. Total returns	151662		152647	
2. Harvest below Millbank	36		36	
3. Millbank samples and trap mortalities	111		111	
4. Returns to Enclosure area	151515	(126620-181327)	152500	(128000-184000)
5. Harvest above Millbank	27209		27209	
6. Broodstock/Trap mortalities	87		87	
7. Spawners	124219	(99324-154031)	125204	(100704-156704)
8. Required spawners	22600		22600	
% achieved	550	(440-682)	554	(446-693)

Table 18b. Spawning escapement of large salmon as calculated from small salmon returns and small : large ratios in the trap catches (see Methods). A range of values (from the 95% confidence limits for small salmon) for returns, spawning escapement, and % of required spawners are shown in brackets.

	Method 1		Method 2	
Miramichi River System - Millbank tagging				
1. Total returns	29140		31228	
2. Harvest below Millbank	28		28	
3. Returns to Millbank	29112	(17824-50193)	31200	(18304-57825)
4. Harvest above Millbank	903		903	
5. Broodstock/Trap mortalities	142		142	
6. Spawners	28067	(16779-49148)	30155	(17259-56780)
7. Required spawners	23600		23600	
% achieved	119	(71-208)	128	(73-241)
% target egg deposition	180	(73% from large salmon)	194	(73%)
Miramichi River System - Enclosure tagging				
1. Total returns	31554		31759	
2. Harvest below Millbank	28		28	
3. Millbank samples and trap mortalities	11		11	
4. Returns to Enclosure area	31515	(26337-37716)	31720	(26624-38272)
5. Harvest above Millbank	903		903	
6. Broodstock/Trap mortalities	131		131	
7. Spawners	30481	(25523-36682)	30686	(25590-37238)
8. Required spawners	23600		23600	
% achieved	129	(108-155)	130	(108-158)
% target egg deposition	197	(73% from large salmon)	198	(73%)

Table 18c. Spawning escapement of large and small salmon for the Northwest Miramichi River as calculated by Methods 1 (adjusted Peterson tag-recapture) and 2 (Bayesian tag-recapture). 95% confidence intervals are shown for estimates of small salmon returns and a range of values (from the 95% confidence limits for small salmon returns) are shown in brackets for returns of large salmon.

	Method 1		Method 2	
Small salmon - Eel Ground tagging M = (981*.777) C = 1986 R = 49				
1. Total returns	30814		31293	
2. Harvest below Eel Ground (NW only)	493		493	
3. Returns to Eel Ground	30321	(23040-40864)	30800	(23600-41600)
4. Harvest above Eel Ground	9108		9108	
5. Broodstock	61		61	
6. Spawners	21152	(13871-31695)	21631	(14431-32431)
7. Required spawners	7006		7006	
% achieved	302	(198-452)	309	(206-463)
Large salmon - Eel Ground tagging				
1. Total returns	6487		6586	
2. Harvest below Eel Ground (NW only)	179		179	
3. Returns to Eel Ground	6308	(4793-8501)	6407	(4910-8654)
4. Harvest above Eel Ground	479		479	
5. Broodstock	56		56	
6. Spawners	5773	(4258-7966)	5872	(4375-8119)
7. Required spawners	7316		7316	
% achieved	79	(58-109)	86	(60-111)
% target egg deposition	117	(75% from large salmon)	119	(75%)

Table 18d. Spawning escapement of large and small salmon for the Southwest Miramichi River as calculated from Methods 1 (adjusted Peterson tag-recapture) and 2 (Bayesian tag-recapture) values for returns to the Miramichi System at the Enclosure minus return to the NW Miramichi River. A range of values (from the 95% confidence limits for returns) are shown in brackets.

	Method 1		Method 2	
Southwest Miramichi River System - small salmon				
1. Total returns	120701	(85263-157794)	121207	(85907-159907)
2. Harvest above Enclosure	17608		17608	
3. Broodstock/trap mortalities	26		26	
4. Spawners	103067	(67629-140160)	103573	(68273-142273)
5. Required spawners	15594		15594	
% achieved	661	(434-899)	664	(438-913)
Southwest Miramichi River System - large salmon				
1. Total Returns	25028	(17657-32744)	25134	(17792-33184)
2. Harvest above Enclosure	245		245	
3. Broodstock/Trap Mortalities	75		75	
4. Spawners	24708	(17337-32424)	24814	(17472-32864)
5. Required spawners	16284		16284	
% achieved	152	(106-199)	152	(107-202)
% target egg deposition	241	(72% from large salmon)	242	(72%)

Table 19. Estimates of spawning escapement (S) and total returns (R) of large and small salmon (from Method 1) in the Miramichi River, 1971 to 1992. Note that returns and spawning escapements for 1992 were calculated from mark-recapture data for Enclosure traps.

Year	HE1	HE2	HR	MIL	E1	MILR	S	R	S/R
Large Salmon									
1971	15,128	3,140	1,792	399	0.043	9,279	4,347	24,407	0.18
1972	2,282	163	8,933	1,151	0.043	26,767	17,671	29,049	0.61
1973	866	0	5,977	1,13	0.043	26,326	20,349	27,192	0.75
1974	941	22	7,184	1,791	0.043	41,651	34,445	42,592	0.81
1975	724	19	6,626	1,208	0.043	28,093	21,448	28,817	0.74
1976	871	7	7,591	943	0.043	21,930	14,332	22,801	0.63
1977	6,865	0	12,060	1,934	0.043	44,977	32,917	51,842	0.63
1978	8,377	0	5,287	693	0.043	16,116	10,829	24,493	0.44
1979	1,659	0	2,854	318	0.043	7,395	4,541	9,054	0.50
1980	10,899	0	6,546	1,093	0.043	25,419	18,873	36,318	0.52
1981	7,137	699	3,738	199	0.022	9,045	4,608	16,182	0.28
1982	12,213	298	4,989	408	0.022	18,545	13,258	30,758	0.43
1983	16,788	269	2,409	245	0.022	11,136	8,458	27,924	0.30
1984	1	0	449	333	0.022	15,136	14,687	15,137	0.97
1985	5	0	611	311	0.015	20,733	20,122	20,738	0.97
1986	18	0	1,051	469	0.015	31,267	30,216	31,285	0.97
1987	21	0	1,344	291	0.015	19,400	18,056	19,421	0.93
1988	78	0	687	325	0.015	21,667	20,980	21,745	0.96
1989	78	0	1,593	257	0.015	17,133	15,540	17,211	0.90
1990	107	0	879	427	0.015	28,467	27,588	28,574	0.97
1991	82	0	778	448	0.015	29,867	29,089	29,949	0.97
1992	28	0	1045	202	0.006	31,731	30,686	31,759	0.97
Mean 1987-91			1,056			23,307	22,251	23,380	
Change=(92-mean)/mean			-1%			+36%	+38%	+36%	
Small Salmon									
1971	0	0	13,727	1,962	0.055	35,673	21,946	35,673	0.62
1972	39	0	19,101	2,543	0.055	46,236	27,135	46,275	0.59
1973	0	0	13,857	2,540	0.055	44,545	30,688	44,545	0.69
1974	0	0	18,232	4,038	0.055	73,418	55,186	73,418	0.75
1975	393	0	16,040	3,548	0.055	64,509	48,469	64,902	0.75
1976	1,780	39	27,381	4,939	0.055	89,800	62,380	91,580	0.68
1977	379	28	14,089	1,505	0.055	27,364	13,247	27,743	0.48
1978	1,232	2	8,700	1,268	0.055	23,055	14,353	24,287	0.59
1979	5,510	2	14,605	2,500	0.055	45,455	30,848	50,965	0.61
1980	2,697	0	11,997	2,139	0.055	38,891	26,894	41,588	0.65
1981	1,332	296	23,716	2,174	0.034	63,941	39,929	65,273	0.61
1982	1,997	314	22,068	2,665	0.034	78,382	56,000	80,379	0.70
1983	1,360	229	8,746	810	0.034	23,824	14,849	25,184	0.59
1984	1	0	10,777	1,010	0.034	29,706	18,929	29,707	0.64
1985	0	0	18,985	912	0.015	60,800	41,815	60,800	0.69
1986	16	0	28,135	1,763	0.015	117,533	89,398	117,549	0.76
1987	16	0	22,023	1,272	0.015	84,800	62,777	84,816	0.74
1988	52	0	31,589	1,828	0.015	121,867	90,278	121,919	0.74
1989	31	0	26,815	1,128	0.015	75,200	48,385	75,231	0.66
1990	15	0	23,609	1,247	0.015	83,133	59,724	83,448	0.72
1991	2	0	12,409	913	0.015	60,867	48,259	60,869	0.79
1992	36	0	27,407	971	0.006	152,611	125,204	152,647	0.82
1987-91 Mean			23,289			85,173	61,885	85,257	0.73
Change=(92-Mean)/Mean			+18%			+79%	+102%	+79%	

HE1 = Harvest in estuary below Millbank
HE2 = Harvest in estuary above Millbank
HR = Harvest in river (includes angling, native fishery above Millbank, broodstock, millbank trap mortalities, and samples)
MIL = Millbank trap count
E1 = Millbank catch efficiencies
MILR = Returns to Millbank
S = Spawners
R = Total returns

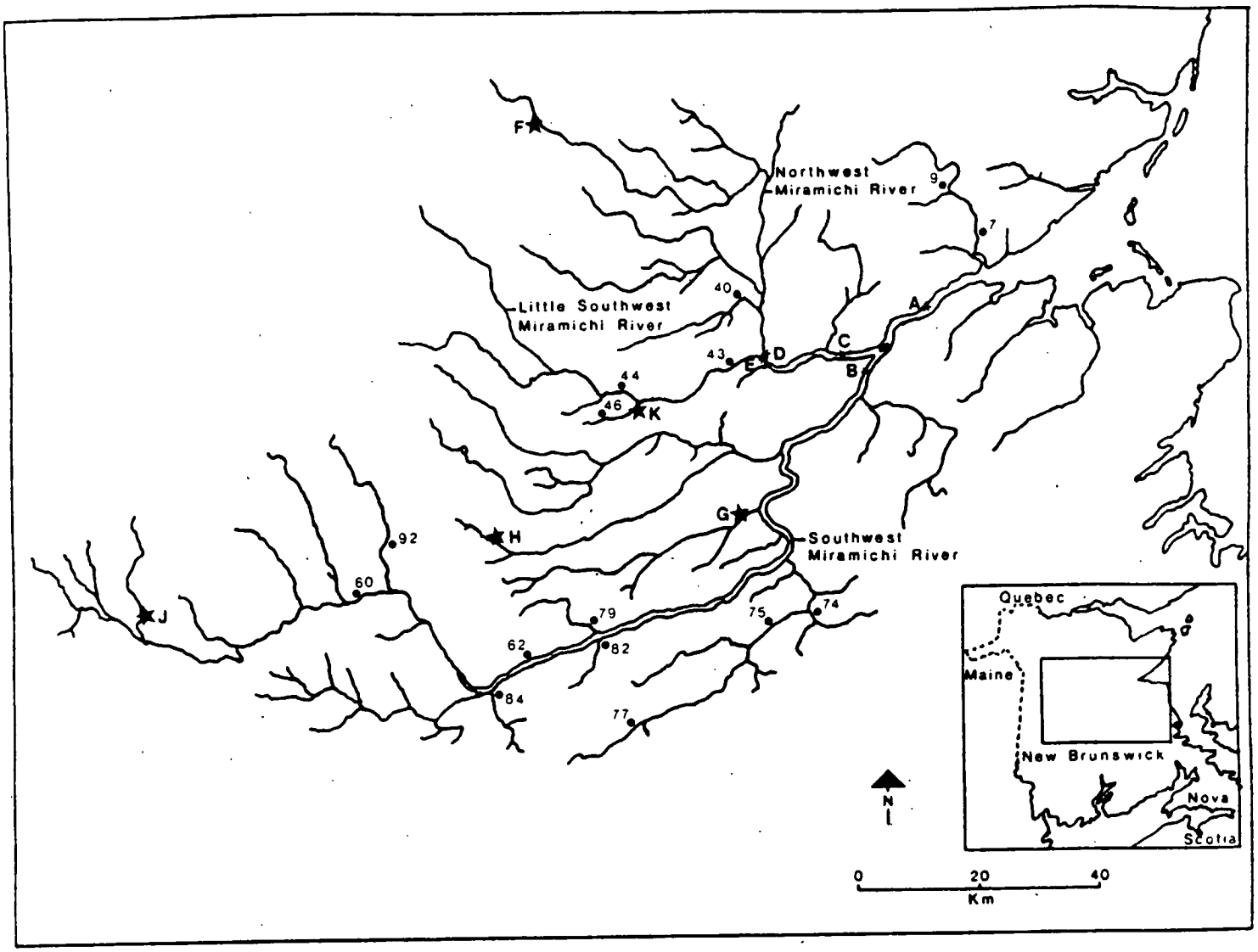


Figure 1. The Miramichi River system. Electrofishing sites are denoted by numbered dots. Counting fences and traps are labelled as follows:

A = Millbank trap
B = SW Miramichi Enclosure trap
C = NW Eel Ground trap
D = NW Red Bank trap
E = LSW Red Bank trap
F = NW Miramichi R. fence
G = Bartholomew R. fence
H = Dungarvon R. fence
J = N Br. SW Miramichi R. fence
K = Catamaran Brook fence

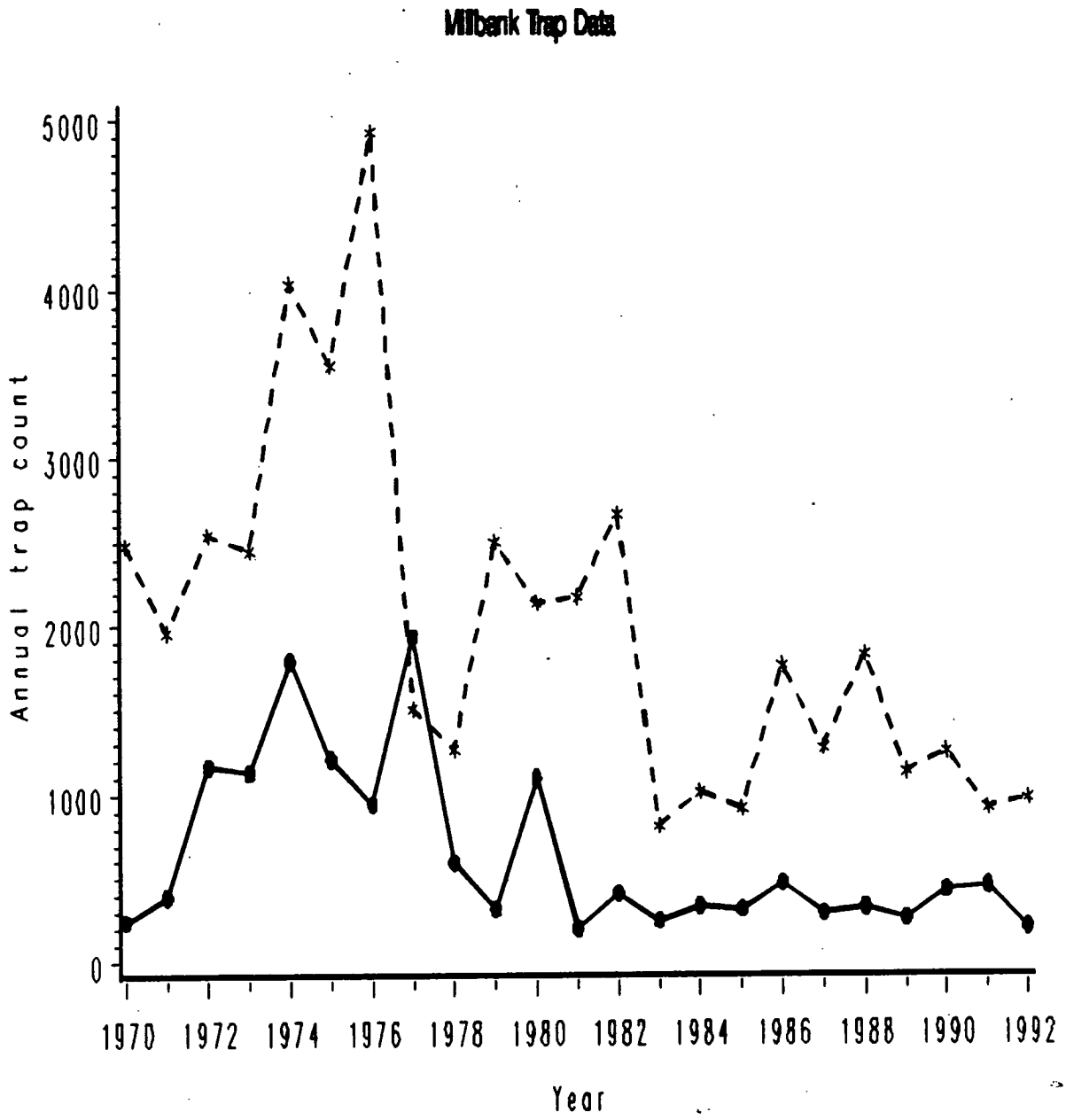


Figure 2. Annual counts of large (solid line) and small (dashed line) at the Millbank trap 1970 to 1992.

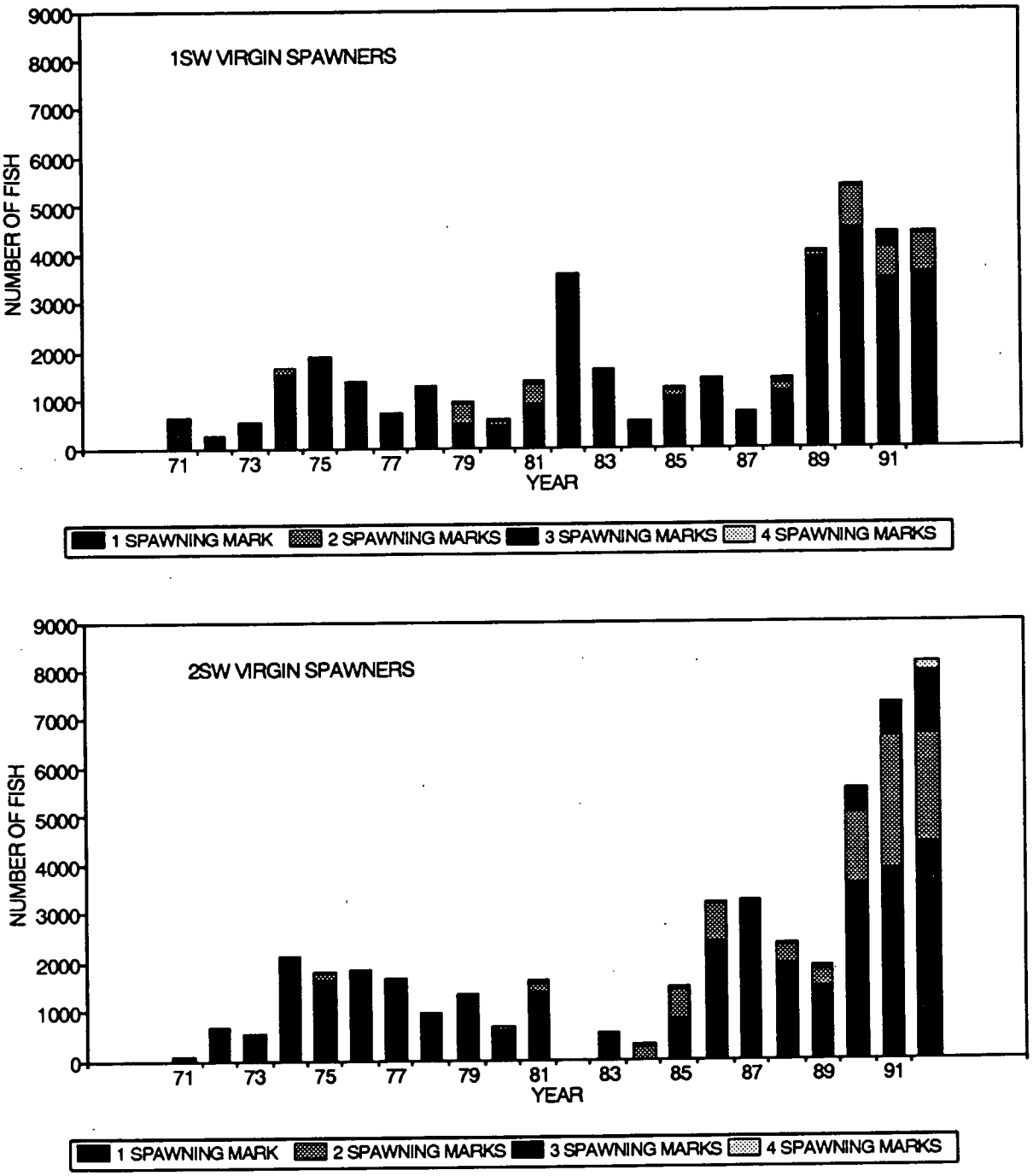


Figure 3. Returns of previously spawned 1SW and 2SW salmon with 1,2,3 and 4 spawning marks to Millbank 1971 - 1992.

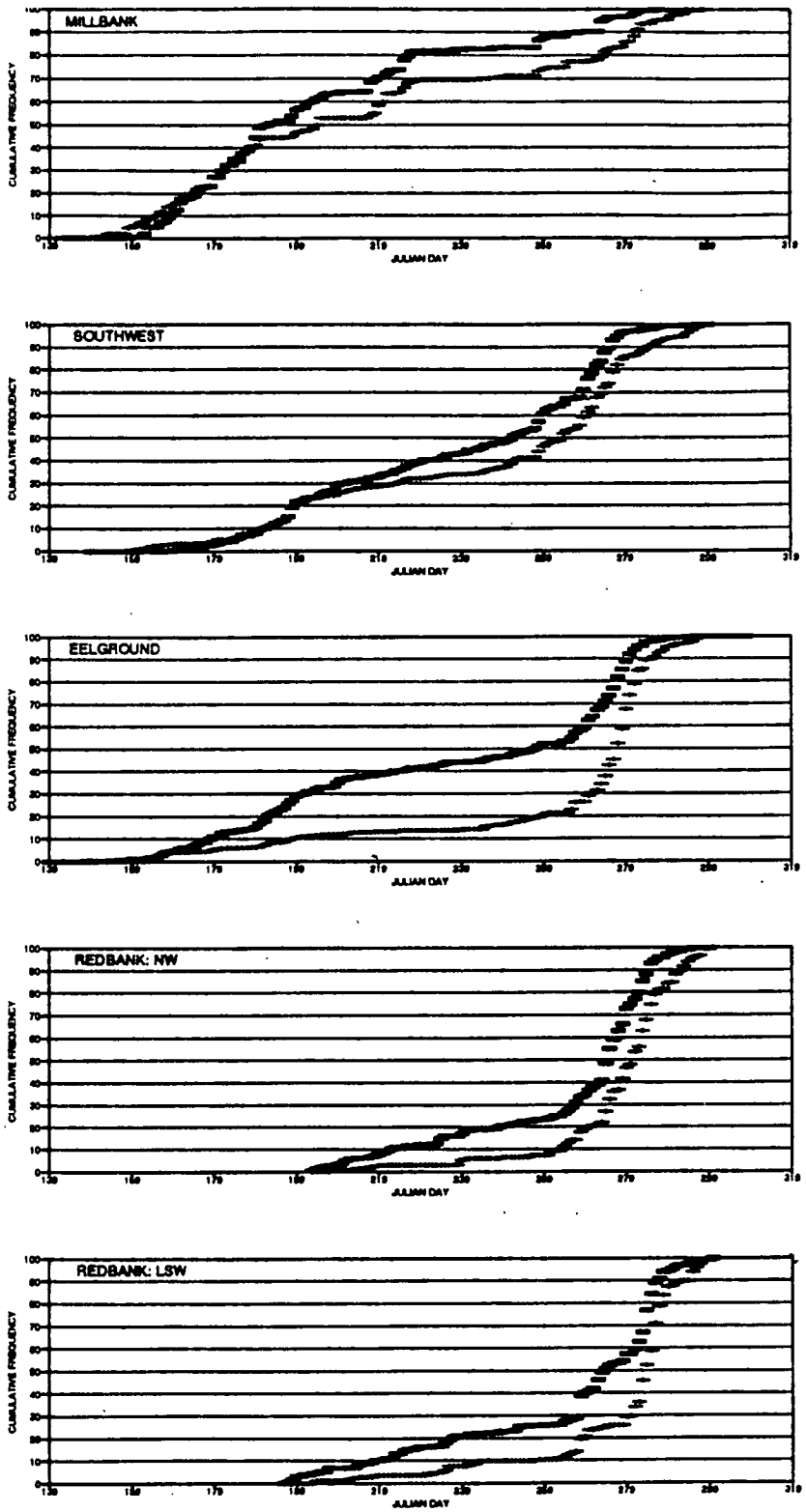


Figure 4. Cumulative frequency of catches at Miramichi estuarine traps in 1992. Solid rectangles denote small salmon. Crosses denote large salmon.

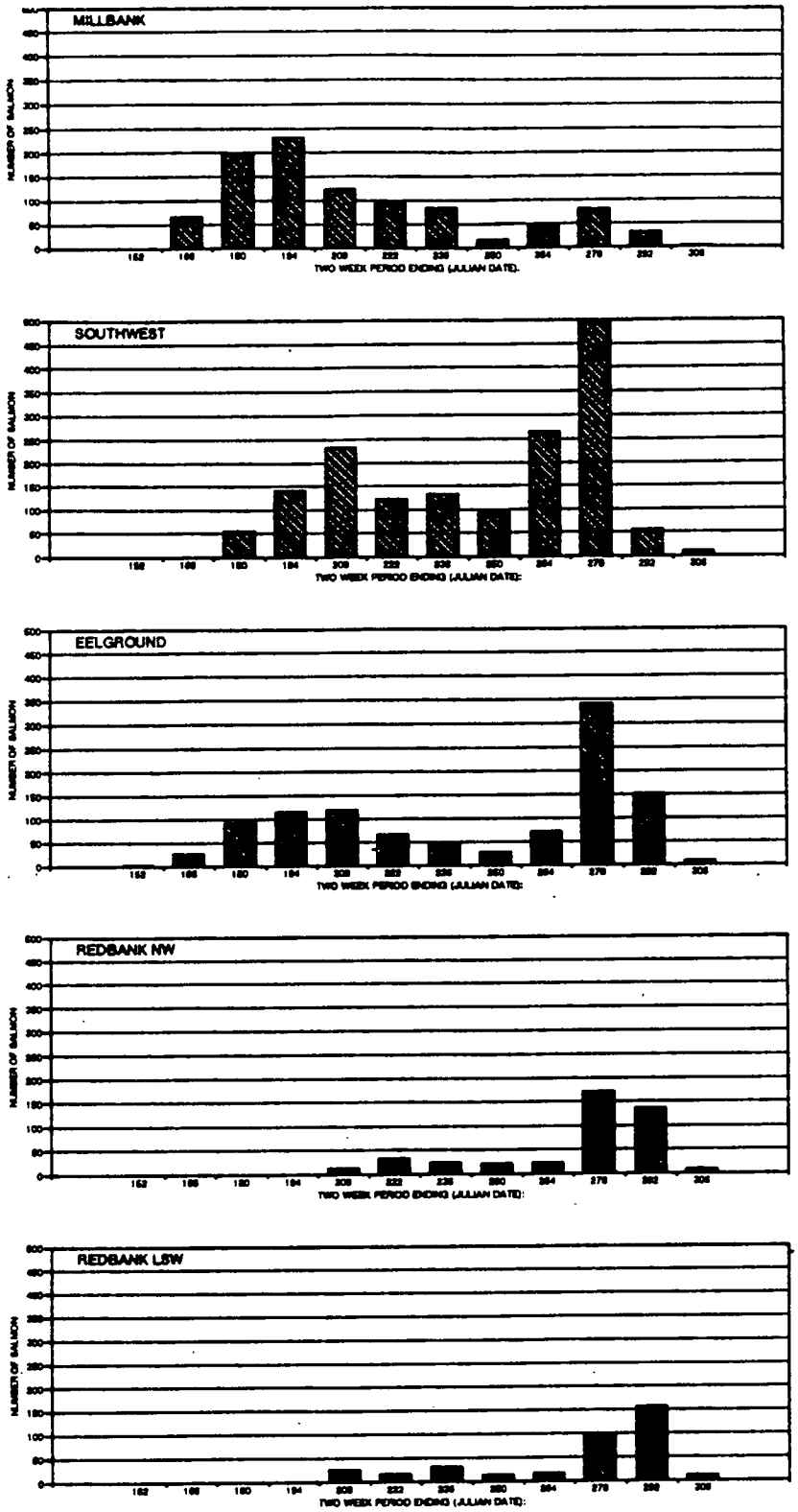


Figure 5. Bi-weekly catches of small salmon at Miramichi estuarine traps. (Day 152 = May 31; Day 245 = Sept. 1; Day 306 = Nov. 1)

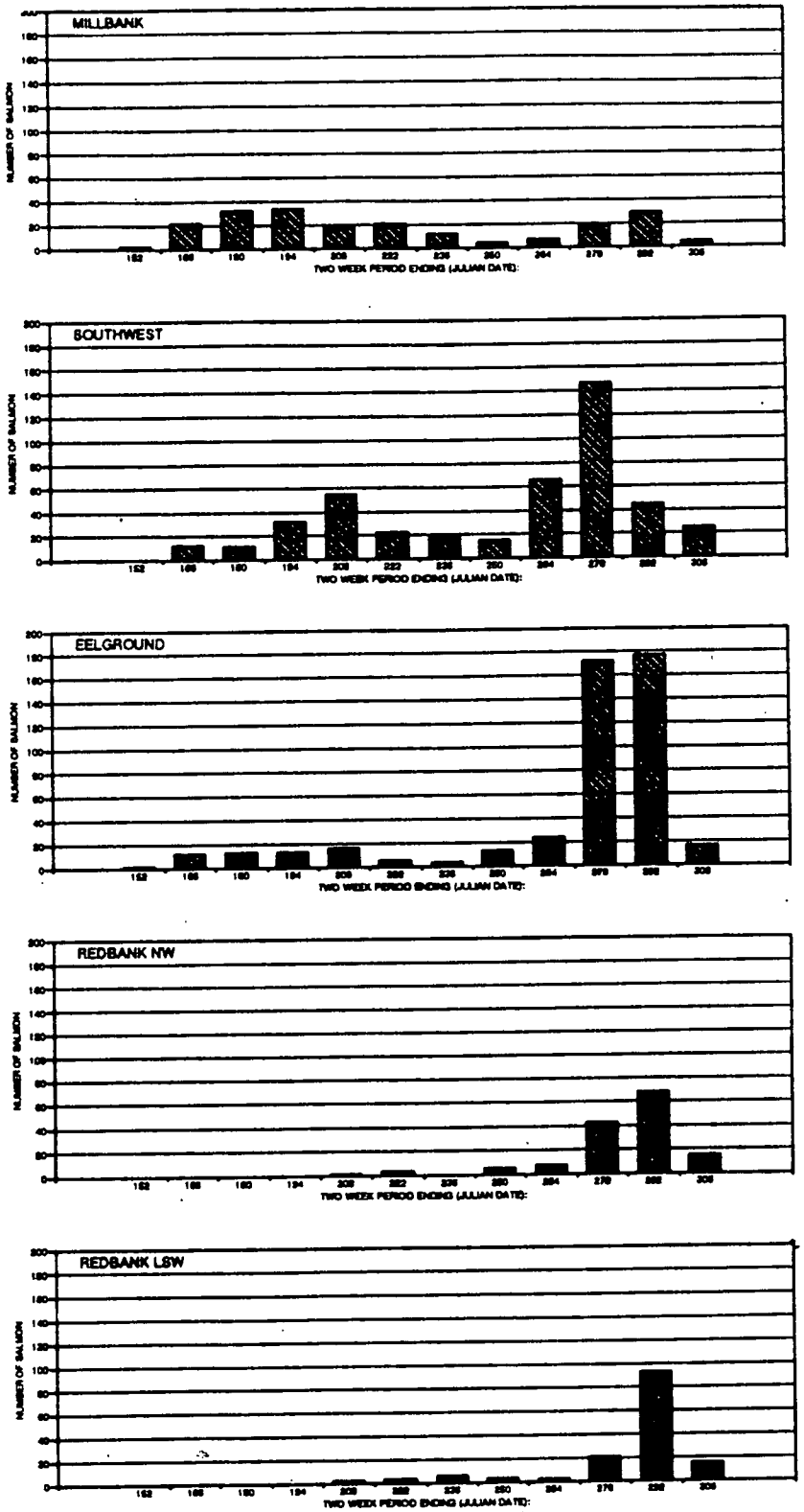


Figure 6. Bi-weekly catches of large salmon at Miramichi estuarine traps. (Day 152 = May 31; Day 245 = Sept. 1; Day 306 = Nov. 1)

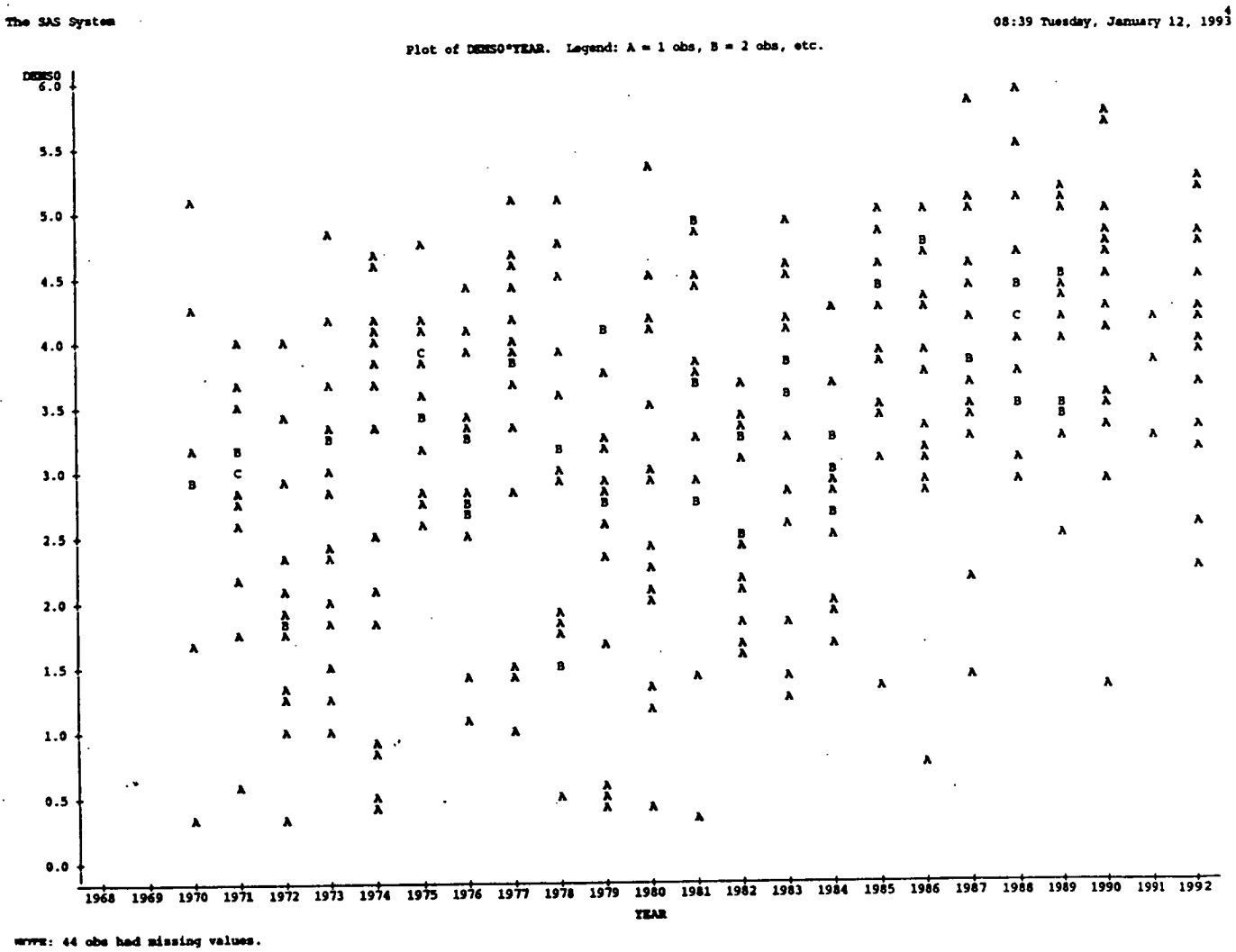
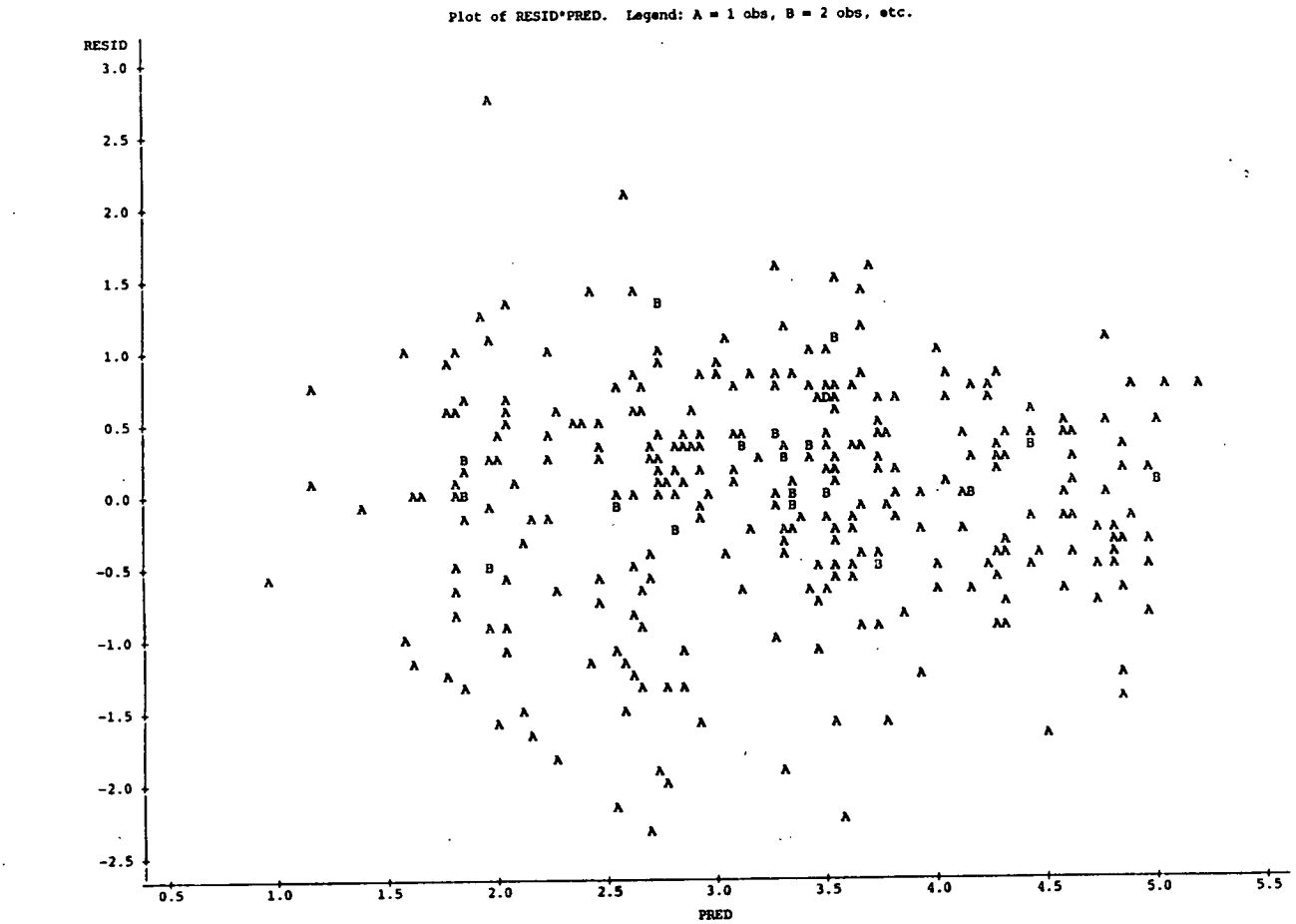


Figure 7a. Density of 0+ fry versus year at 15 standard electrofishing sites.



NOTE: 44 obs had missing values.

Figure 7b. Residuals versus predicteds for the multiplicative model of fry densities.

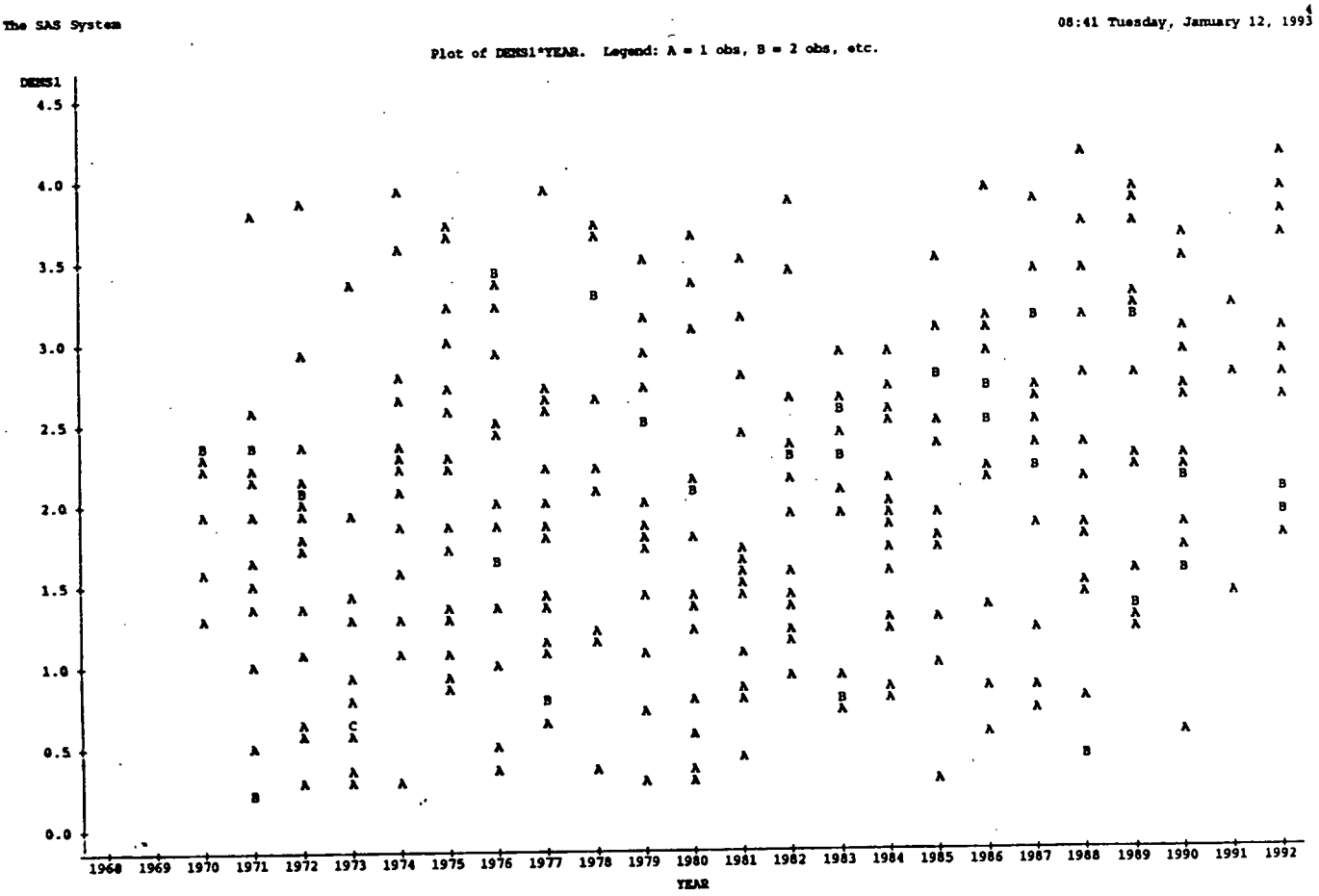


Figure 8a. Density of 1+ parr versus year at 15 standard electrofishing sites.

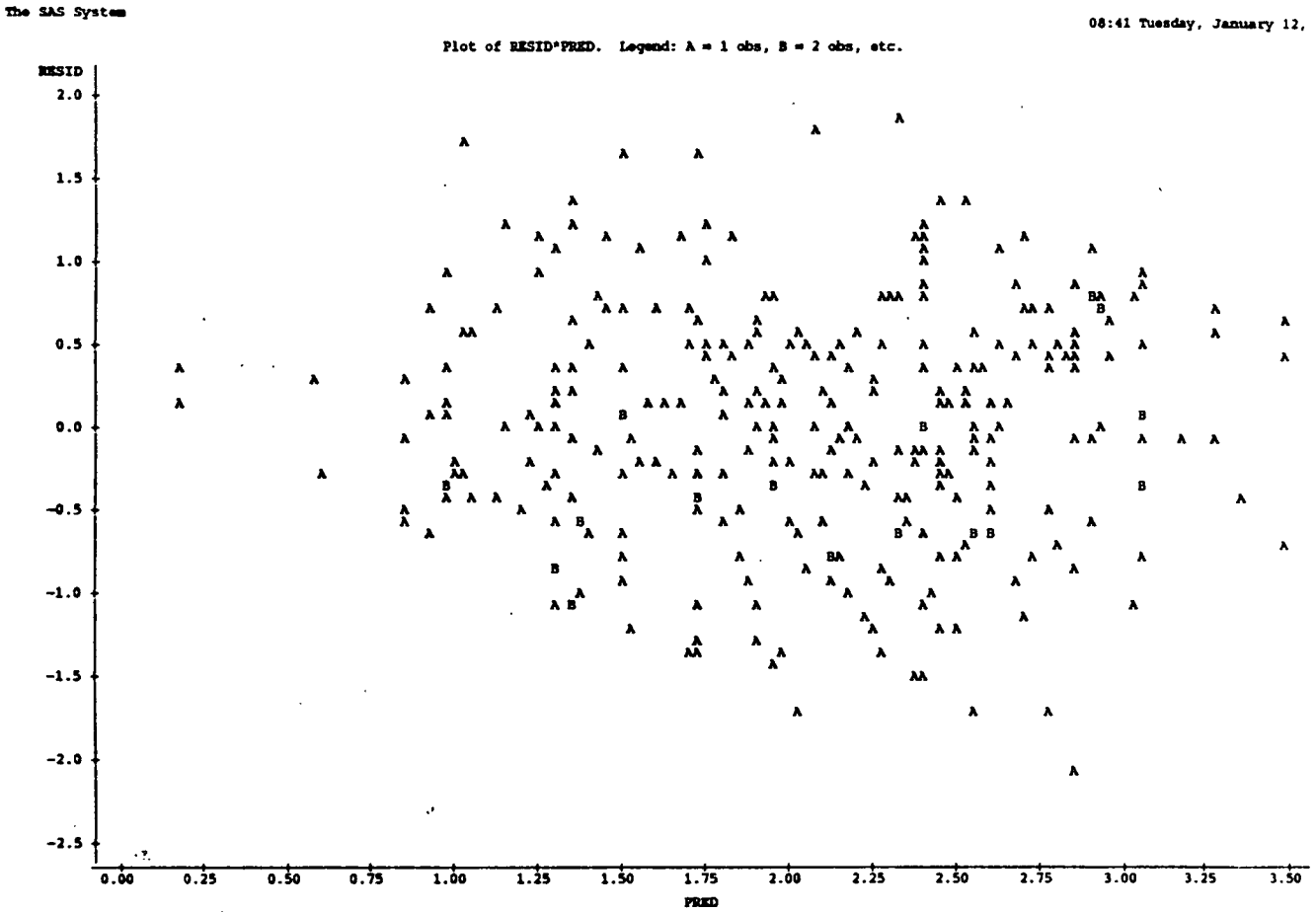


Figure 8b. Residuals versus predicteds for multiplicative model of 1+ parr densities.

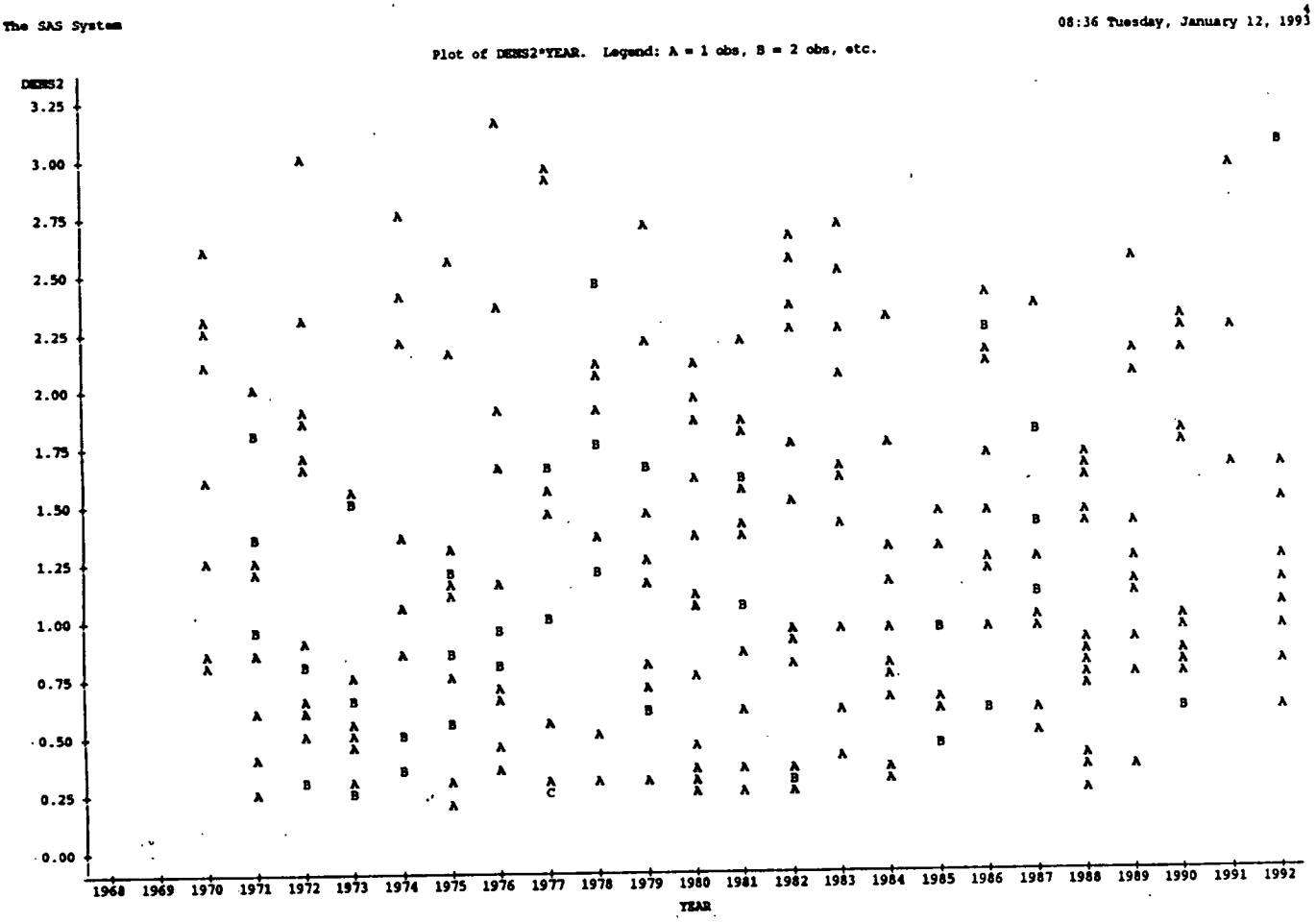
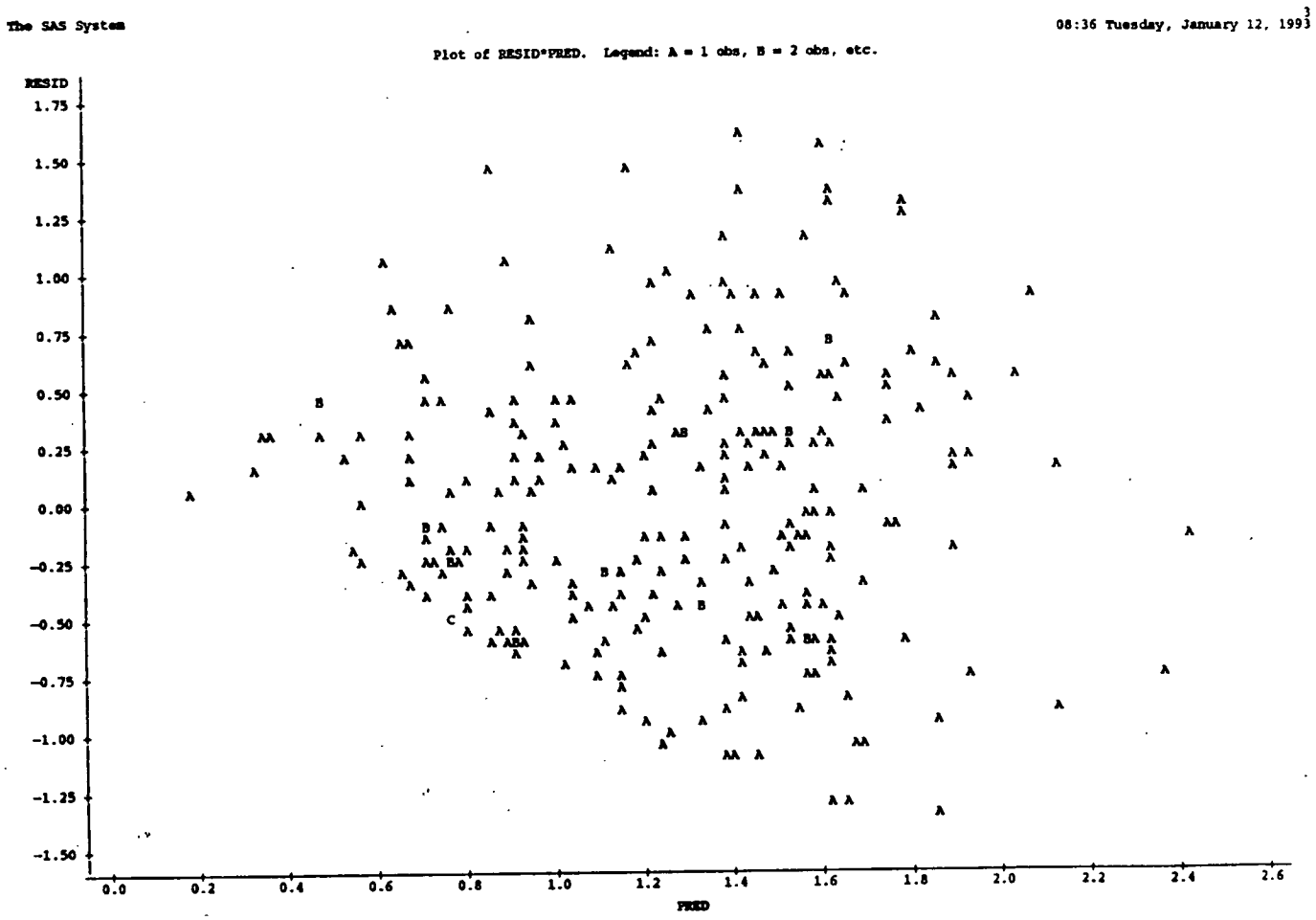


Figure 9a. Density of 2+ parr versus year at 15 standard electrofishing sites.



Note: 44 obs had missing values

Figure 9b. Residuals versus predicteds for multiplicative model of 2+ parr densities.

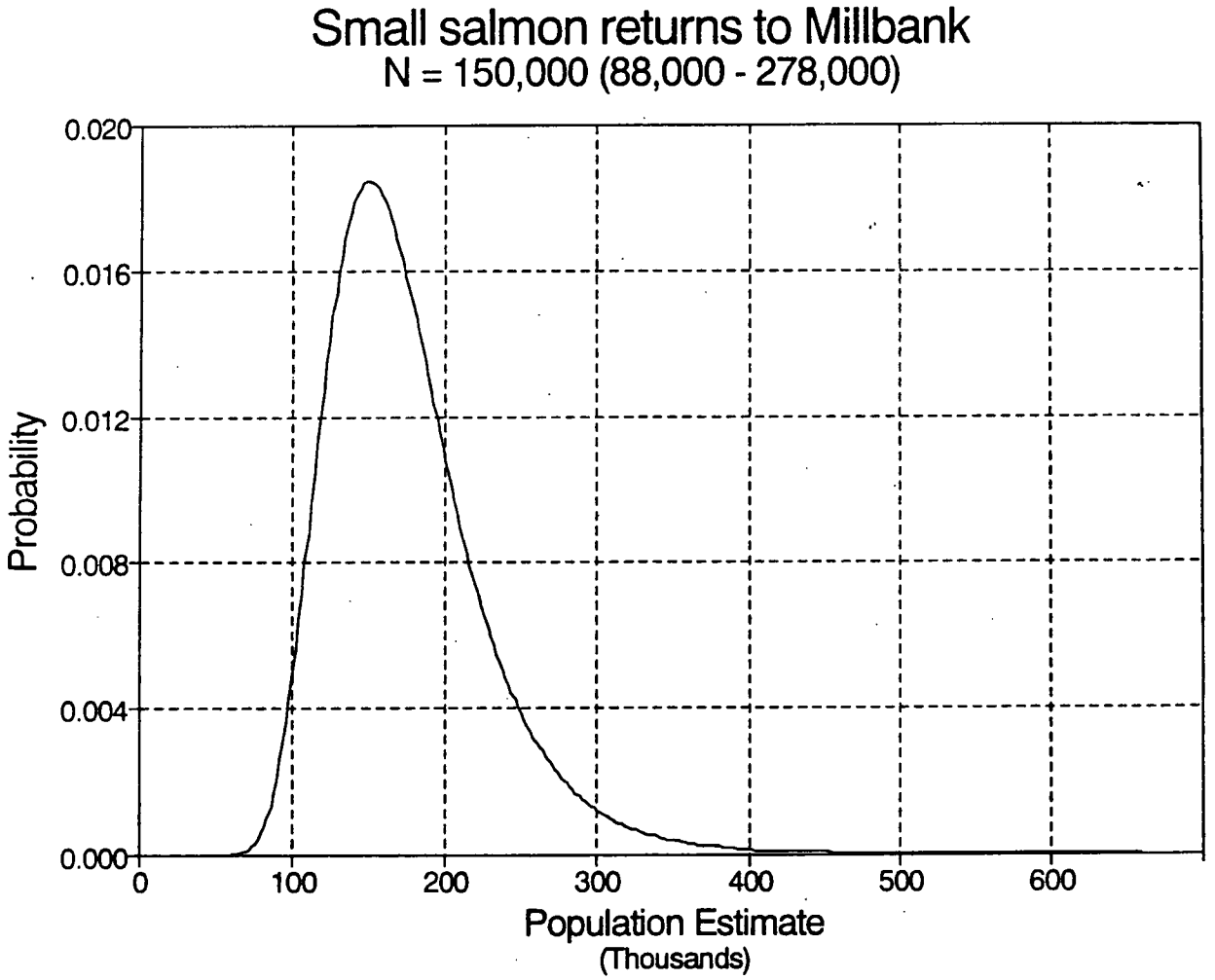


Figure 10a. Bayesian probability density plot for estimated small salmon returns to the Miramichi River at Millbank.

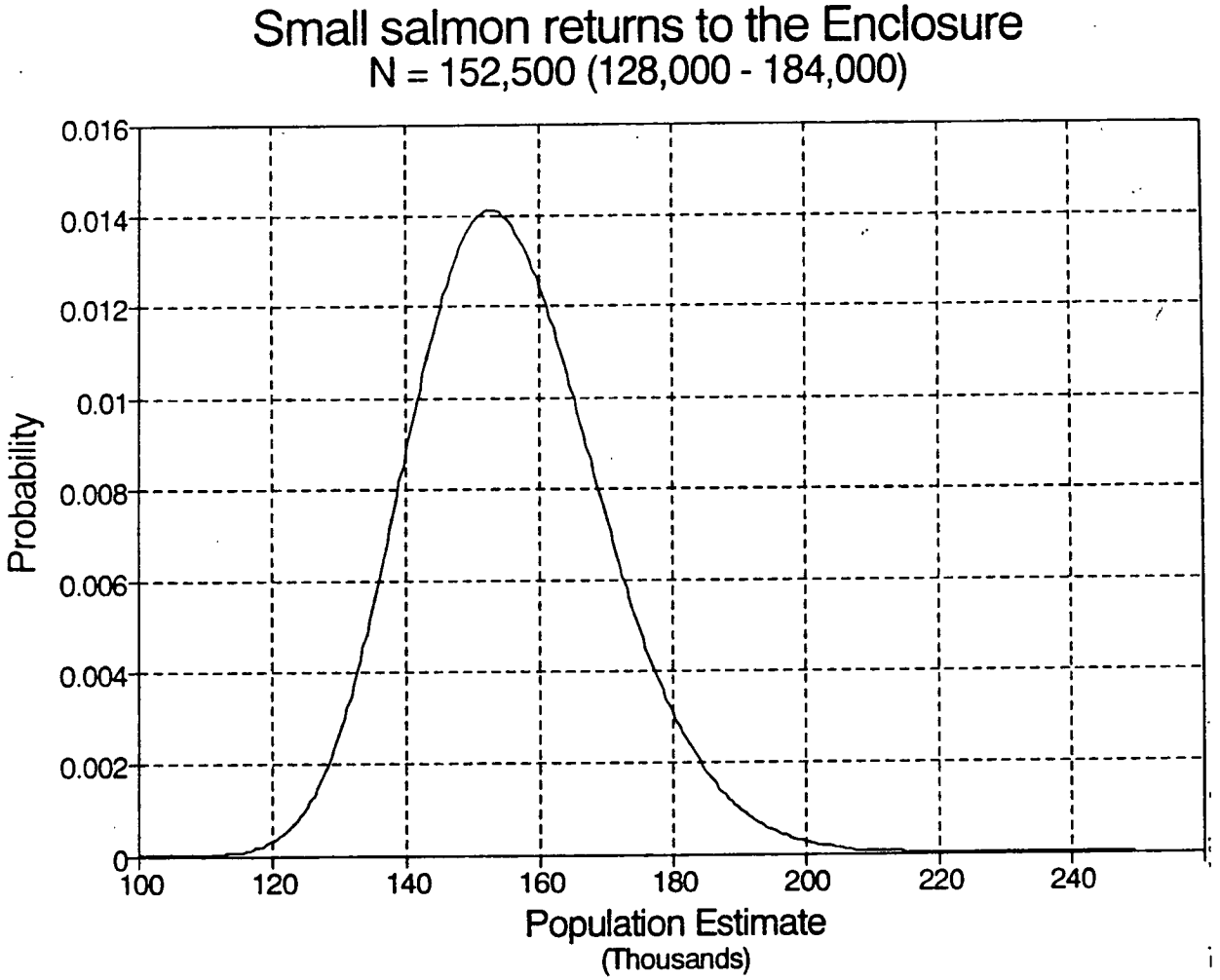


Figure 10b. Bayesian probability density plot for estimated small salmon returns to the Miramichi River at the Enclosure Park.

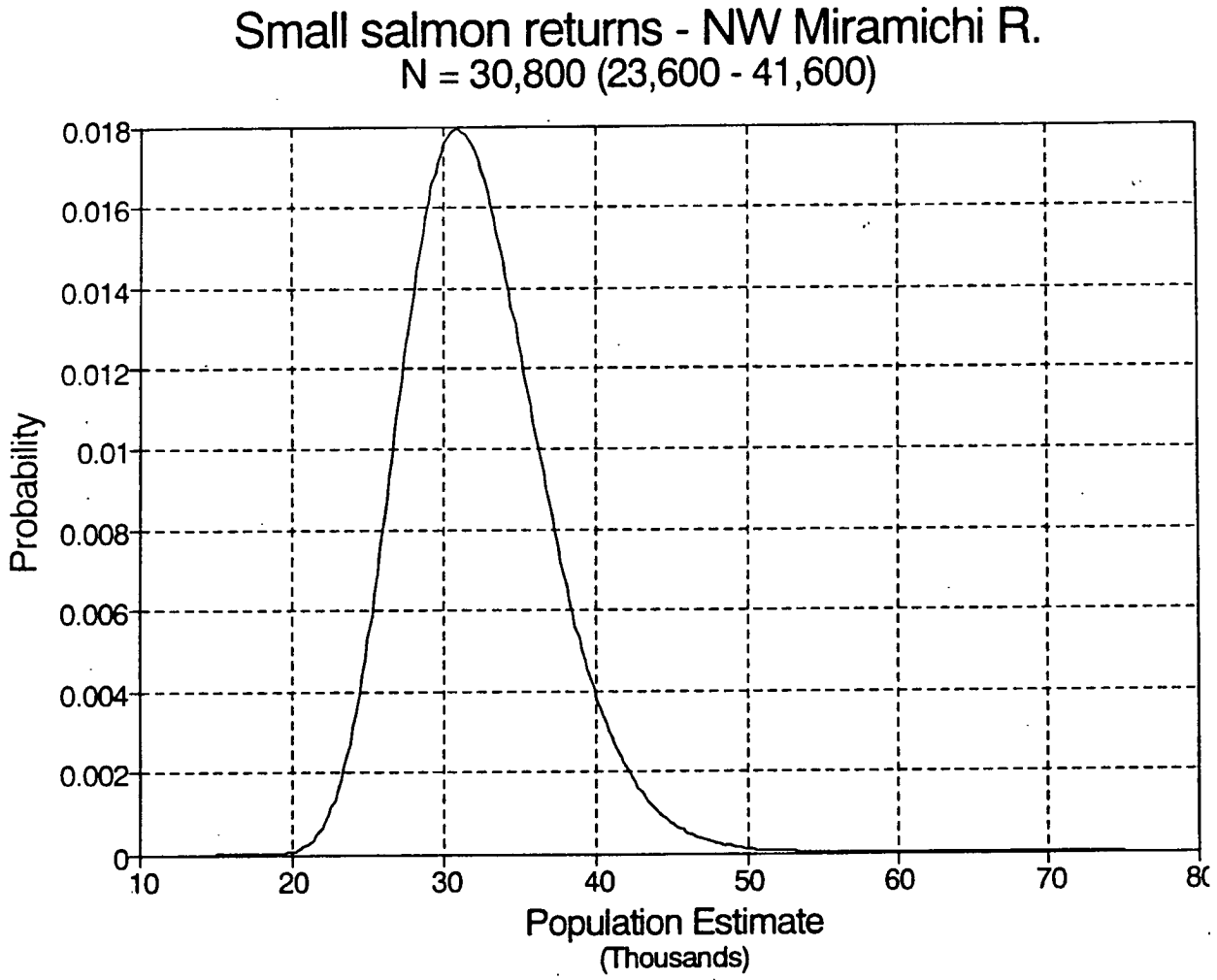


Figure 10c. Bayesian probability density plot for estimated small salmon returns to the NW Miramichi River at Eel Ground.

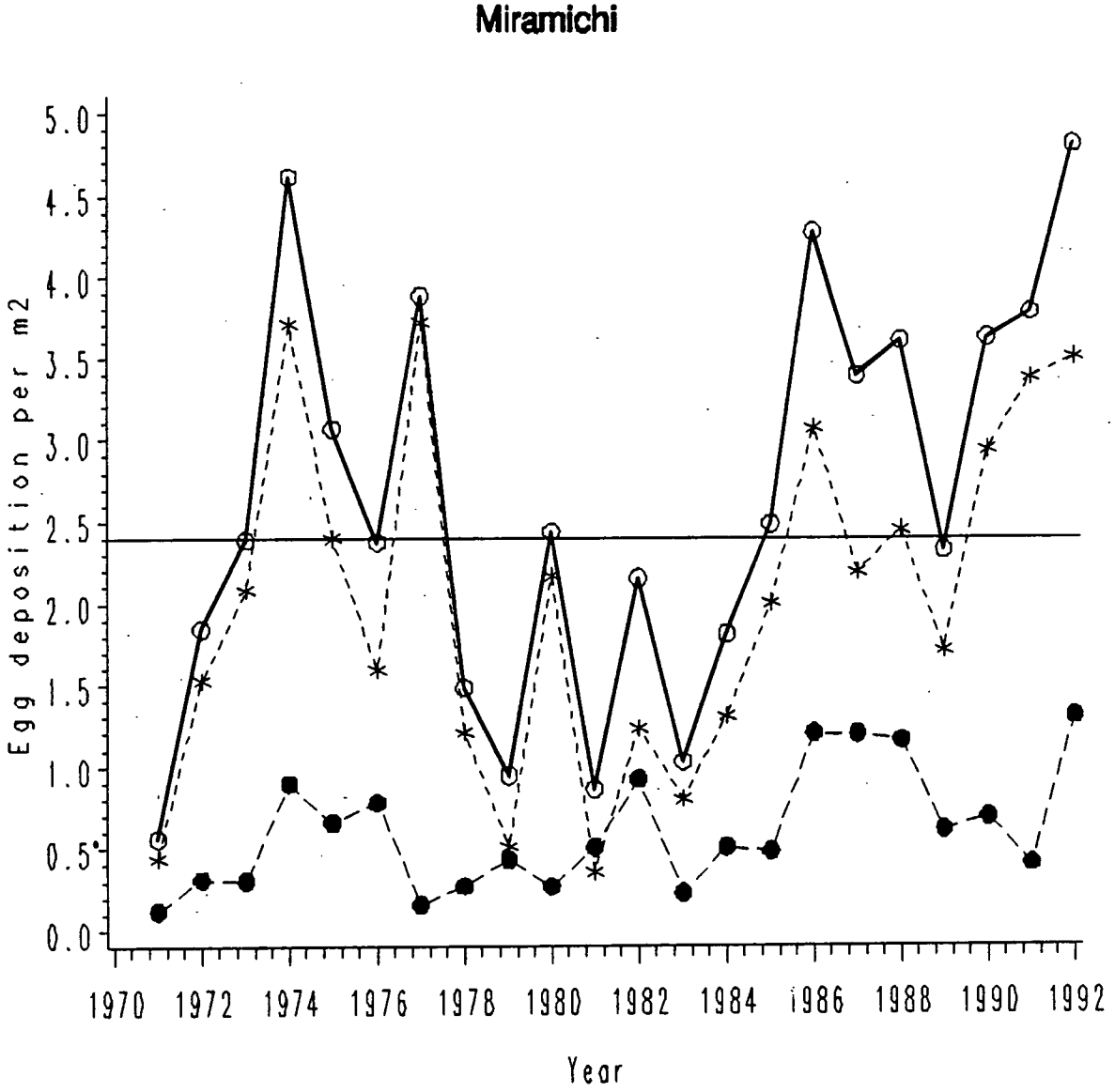


Figure 11. Estimated egg deposition rates (number of eggs per square meter) in the Miramichi River, 1971-92. Egg deposition from small salmon (dots), large salmon (stars), and total egg deposition (circles) are shown separately in relation to the target of 2.4 eggs per square meter.

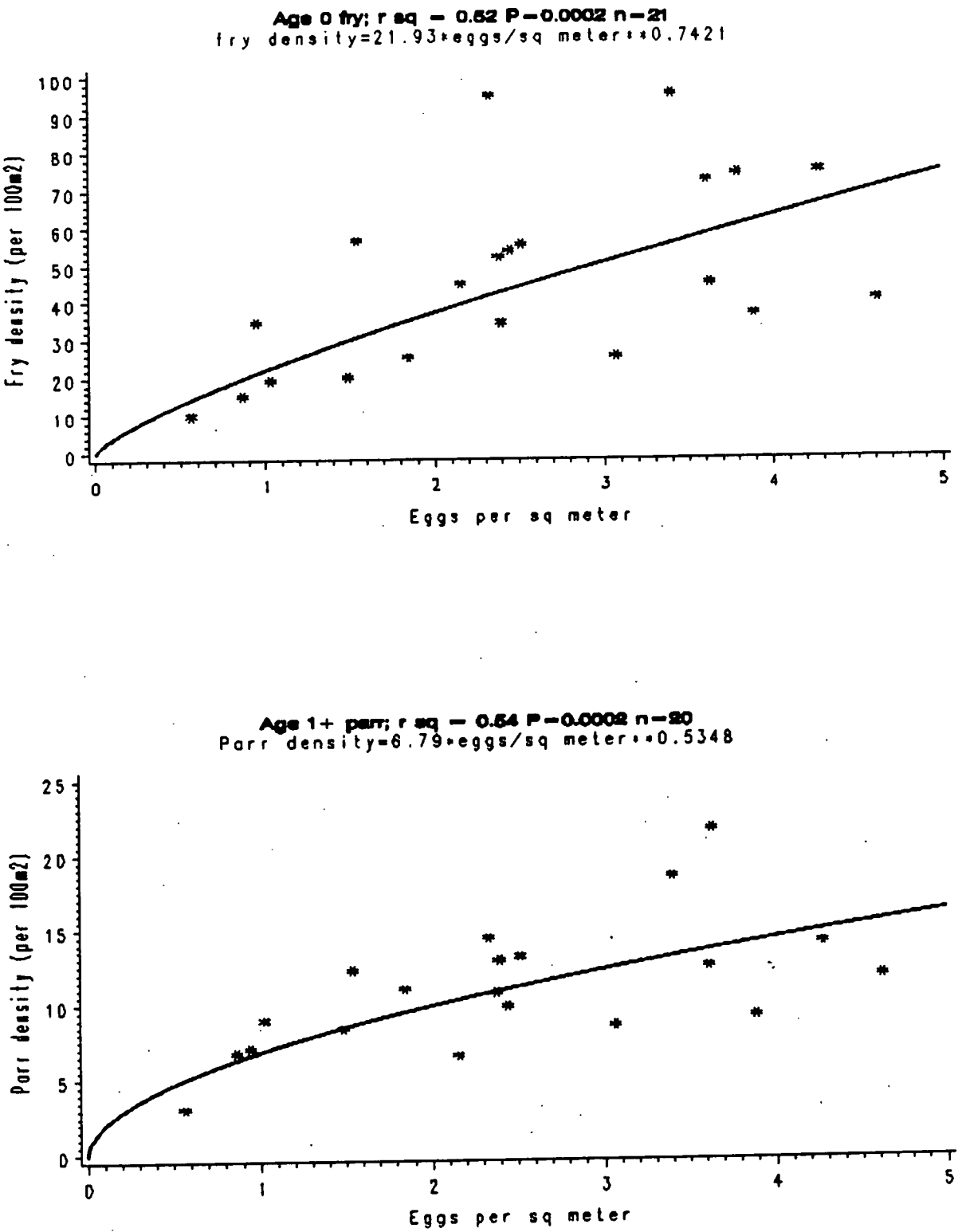


Figure 12. Relationship between egg deposition rates and resulting age 0+ (upper) and age 1+ (lower) parr densities in the Miramichi River for 1970 to 1992.

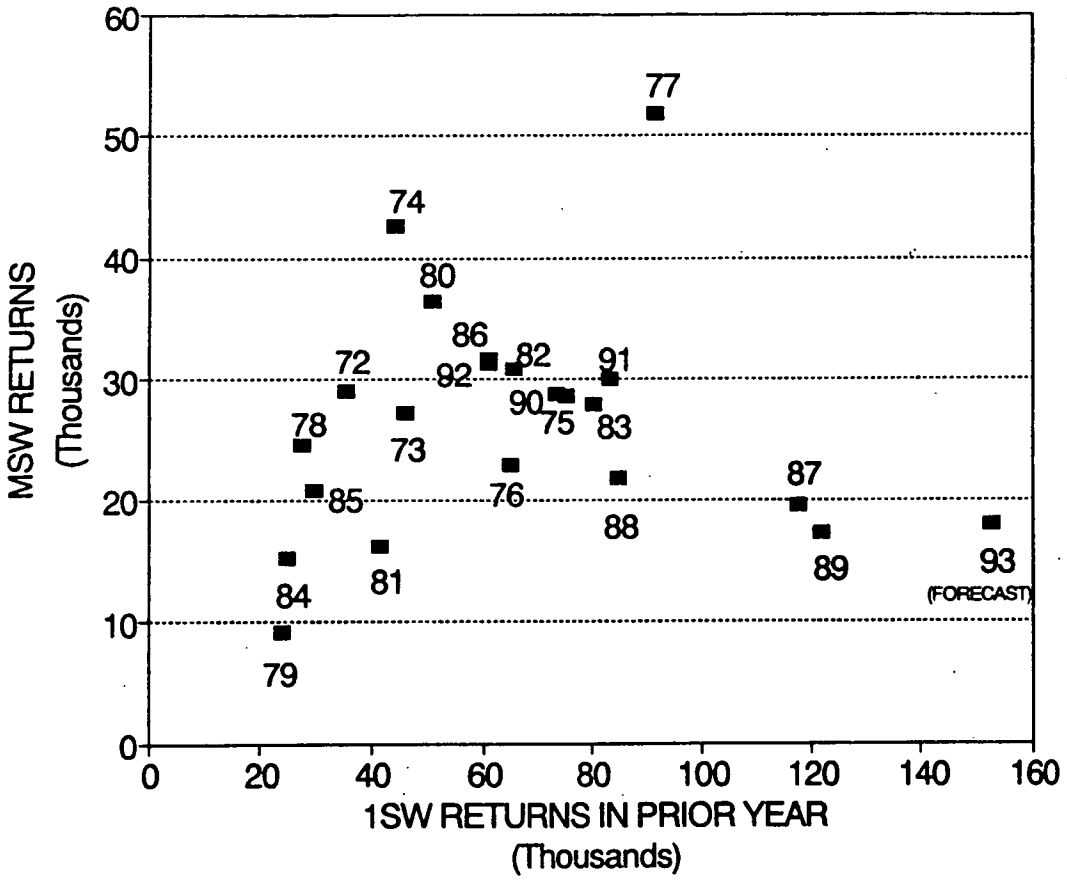


Figure 13. Relationship between large salmon returns to the Miramichi River 1972-93 and 1SW returns in the previous year.

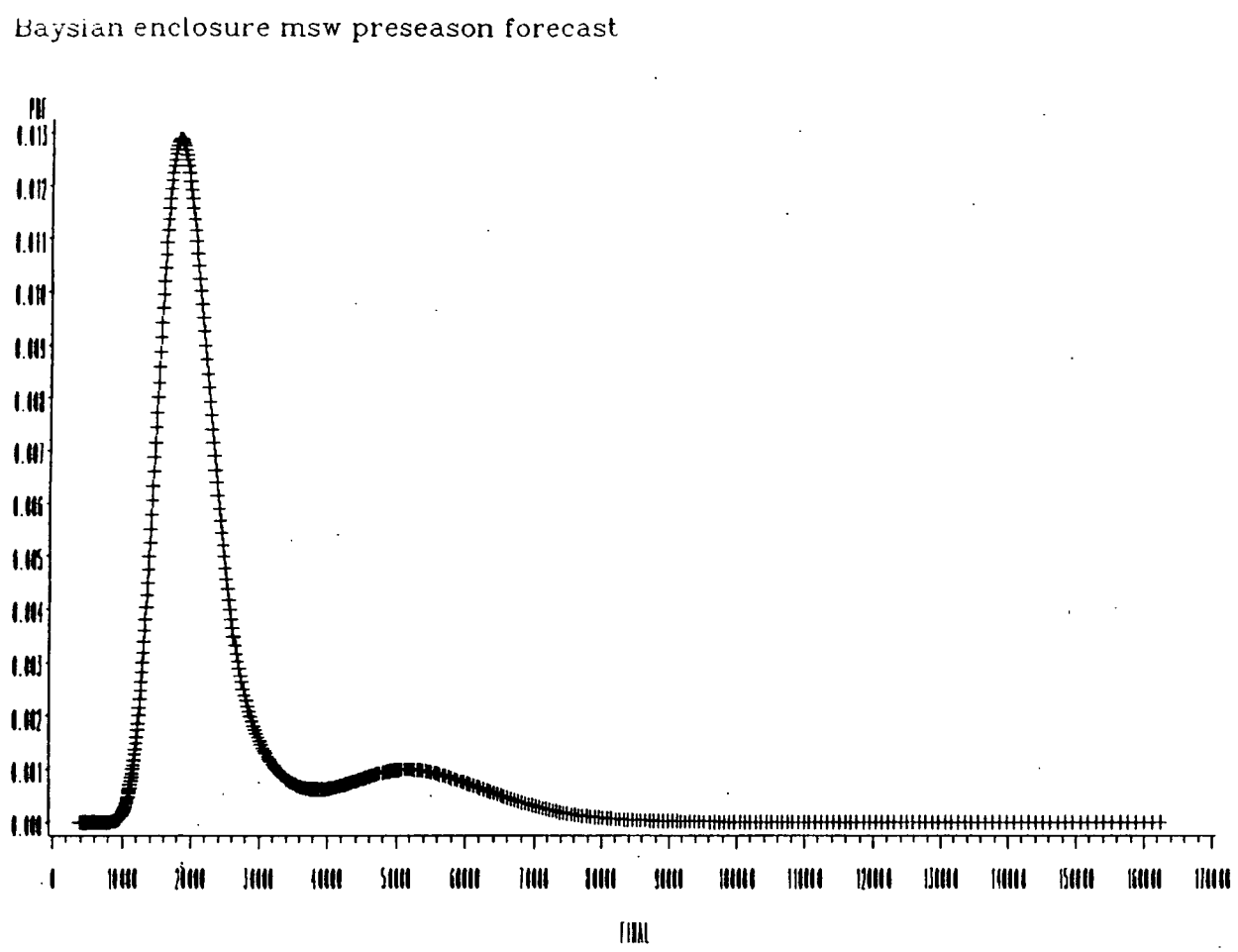


Figure 14. Forecasted large salmon returns for 1993 using 152,647 small salmon returns for 1992 (Bayesian estimate from Enclosure tagging). Most probable value = 18,315.

APPENDIX A. SALMON ANGLING SEASON DATES IN 1992

SFA16: June 8 - October 7, with the following exceptions:

Bartibog River:	June 1 - October 15
<u>Southwest Miramichi</u>	
Main, from head of tide to Cains R.	June 8 - October 15
Main, from Burnt Land Brook up to fork of the N. & S. branches	June 8 - September 30
N.& S. branches	June 8 - September 15
Cains River:	June 8 - October 15
Dungarvon River:	June 8 - September 15
Renous River:	June 8 - September 15
Trib. above Cains R. except Rocky Brook	June 8 - September 15
Rocky Brook	June 1 - August 31
<u>Northwest Miramichi</u>	
Main & tribs. upstream of Little R.	June 8 - August 31
Little Southwest Mir. R. above Catamaran Brook	June 8 - September 15
Sevogle R.	June 8 - September 15

APPENDIX B. CONTRIBUTION OF HATCHERY FISH

Eighteen adipose-clipped grilse were caught at Millbank trap for a proportion of fish examined of 2.4%, higher than the previous 3 year average of 1.6% (Table B1). As in previous years, most (89%) of adipose-clipped fish were caught before September 1 (June 11 - August 4, mean: June 25, SD: 13d). Tags from 3 of these "early run" grilse were subsequently recovered by anglers in the Southwest Miramichi (Table B2). Assuming a 50% tag reporting rate and no tag loss or mortality, this implies an angling exploitation rate of 37.5% on early run hatchery fish.

No adipose-clipped MSW salmon were caught at Millbank trap in 1992, in contrast to the previous 3 years when 1 - 4 such fish were observed (0.3 - 1.3% of fish observed).

The Southwest Enclosure trap caught 22 adipose-clipped grilse (1.5% of grilse examined), 21 (96%) before September 1. Tags from 4 of the 21 early run fish were recovered by anglers (3 in the Southwest Miramichi, 1 in the Sevogle), implying an exploitation rate of 38.1% on early run hatchery fish (Table B2).

The Northwest Eel Ground trap caught 19 adipose-clipped grilse (1.9% of grilse examined), 16 (84%) before September 1. A tag from one of these early run fish was recovered by an angler in the Sevogle River, implying an exploitation rate of 12.5% (Table B2).

The Northwest Eel Ground trap also caught 3 adipose-clipped MSW salmon (0.95% or MSW examined), 3 (75%) of which were caught by June 15.

The Red Bank traps caught only one adipose-clipped grilse out of 352 grilse (0.3%) and 243 MSW examined. These traps did not begin fishing until mid-July by which time other traps had caught the majority of their hatchery fish.

These numbers represent minimum estimates of the contribution of hatchery fish to the Miramichi River because not all hatchery fish are adipose-clipped.

Table B1. Adipose-clipped salmon observed at Millbank Index Trap.

1SW

YEAR	EXAMINED AT MILLBANK	ADIPOSE-CLIPPED		CAUGHT < SEPT.1	
		NUMBER	%	NUMBER	%
1989	834	11	1.3	11	100
1990	1029	22	2.1	22	100
1991	563	8	1.4	6	75
1992	755	18	2.4	16	89
WEIGHTED MEAN			1.9		93

MSW

YEAR	EXAMINED AT MILLBANK	ADIPOSE-CLIPPED		CAUGHT < SEPT.1	
		NUMBER	%	NUMBER	%
1989	295	2	0.7	2	100
1990	393	1	0.3	0	0
1991	320	4	1.3	4	100
1992	191	0	0.0	-	-
WEIGHTED MEAN			0.6		86

Table B2. Angler recoveries of tags from adipose-clipped grilse.

LOCATION		JULIAN DATE		
TAGGED	RECOVERED	TAGGED(T)	RECOVERED(R)	(T-R)
Millbank	Southwest Miramichi	181	-	-
Millbank	Southwest Miramichi	189	215	26
Millbank	Southwest Miramichi	169	201	32
SW Encl.	Southwest Miramichi	198	230	32
SW Encl.	Southwest Miramichi	189	193	4
SW Encl.	Southwest Miramichi	191	-	-
SW Encl.	Sevogle River	171	183	12
NW Encl.	Sevogle River	164	221	57
AVERAGE		182 (30 JUNE)	207 (25 JULY)	27