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**Status of Atlantic Salmon Stocks  
of Scotia-Fundy Region, 1992**

by

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## ABSTRACT

Retained catches of small salmon in the recreational fisheries of SFAs 19, 20, and 21 in Nova Scotia were again low, i.e., 63%, 43% and 75%, respectively, of the 1987-1991 landings and 63%, 46% and 89%, respectively, of the previous 10-year mean landings (Table 9.4.1). Released catches of large salmon in SFAs 19, 20 and 21 were also low, i.e., 77%, 49%, and 66%, respectively, of the mean number released, 1987-1991. All rivers of inner Bay of Fundy (portions of SFAs 22 and 23) were closed to any exploitation. The retained catch of small salmon in the outer Fundy portion of SFA 23 was 180% of that of 1991, 115% and 109% of the previous 5- and 10-year means, respectively.

Counts of wild adult salmon at counting facilities in SFAs 19 and 20 were down from the low values of 1991; counts of 1SW fish in SFA 21 increased four-fold over 1991 while MSW salmon counts in SFA 23 were similar to those of 1991 (Table 9.4.2). Wild 1SW counts in the Liscomb (SFA 20), LaHave (SFA 21) and Saint John (SFA 23) rivers were 17%, 101% and 86% respectively, of the 1987-1991 means. Wild MSW counts were 42%, 52%, and 112% of the 1987-1991 means. Counts of 1SW and MSW salmon on the Magaguadavic in SFA 23 (about one-third of aquaculture origin) were down 6% and 59% respectively, from the mean of four annual counts in the 1980s. Fewer than a dozen salmon were counted at the Causeway on the Petitcodiac (SFA 23); more were known to have bypassed the fishway. In-river counts of salmon in the Middle (SFA 19) and Big Salmon (SFA 23) rivers were lower than those of 1991.

The percentage return of 1SW fish from hatchery smolts to the Liscomb River counting facilities was the second lowest of record; the return of 1SW fish to the LaHave was 148% of that of 1991 but the fourth lowest of that 14-year record. Survival of Saint John River smolts increased slightly over the previous year but was the fourth lowest of the 17-year record. Hatchery MSW return rates on the Saint John and Liscomb rivers remained among the lowest of the series; the return rate for the LaHave River doubled over that of 1991 and approximated the mean value, 1987-1991.

Forecasts indicate that wild MSW salmon returns to Liscomb Falls in 1993 will be about 47% of the 1987-1991 mean count; returns to Morgan Falls on the LaHave River will be about the same as the 1987-1991 count. Neither forecast accounts for the possible impacts of the moratorium in 1992 on the insular Newfoundland commercial salmon fisheries. The estimated return of wild MSW salmon destined for Mactaquac on the Saint John River is expected to be 100% or 115% (depending on method) of the 1987-1991 mean estimated returns to Mactaquac. Wild 1SW returns to Mactaquac in 1992 are projected to be 81% or 91% (depending on method) of the 1987-1991 mean return. Zero to 15% of the forecast MSW returns to Mactaquac could be composed of 2SW salmon that were affected by the moratorium on the Newfoundland commercial fishery.

## RÉSUMÉ

Les prises de petit saumon conservées dans les ZPS 19, 20 et 21 en Nouvelle-Écosse ont à nouveau été faibles, représentant respectivement 63 p. 100, 43 p. 100 et 75 p. 100 de la moyenne de 1987-1991 et 63 p. 100, 46 p. 100 et 89 p. 100 de la moyenne des dix années antérieures (tableau 9.4.1.). Les prises de gros saumon remises à l'eau dans les ZPS 19, 20 et 21 ont aussi été basses, s'établissant respectivement à 77 p. 100, 49 p. 100 et 66 p. 100 par rapport à la moyenne de 1987-1991. La pêche est restée interdite dans toutes les rivières de l'arrière-baie de Fundy (parties des ZPS 22 et 23). Dans partie de la zone 23 qui se trouve dans l'avant-baie de Fundy, les prises de petit saumon conservées représentaient 180 p. 100 de celles de 1991 et respectivement 115 p. 100 et 109 p. 100 des moyennes des cinq et des dix dernières années.

Les résultats obtenus dans des installations de dénombrement des ZPS 19 et 20 en ce qui concerne le saumon sauvage adulte étaient inférieurs à ceux de 1991, pourtant déjà faibles; en revanche, dans la ZPS 21, le nombre d'unibermarins était quatre fois plus élevé que celui de 1991, tandis que dans la ZPS 23, le nombre de pluribermarins était comparable à celui de 1991 (tableau 9.4.2.). Les dénombrements d'unibermarins sauvages effectués dans les rivières Liscomb (ZPS 20) et LaHave (ZPS 21) ainsi que dans le fleuve Saint-Jean (ZPS 23) représentaient respectivement 17 p. 100, 101 p. 100 et 86 p. 100 des moyennes de 1987-1991. Les dénombrements de pluibermarins sauvages se chiffraient respectivement à 42 p. 100, 52 p. 100 et 112 p. 100 de ces moyennes. Les dénombrements d'unibermarins et de pluribermarins sur la Magaguadavic, dans la ZPS 23 (environ un tiers d'origine aquicole), étaient inférieurs de 6 p. 100 et 59 p. 100 respectivement à la moyenne de quatre dénombrements annuels effectués dans les années quatre-vingt. On a dénombré moins d'une douzaine de saumons à la chaussée de la Petitcodiac (ZPS 23), mais on sait qu'un certain nombre de saumons a contourné l'installation de dénombrement. Les dénombrements directs dans les rivières Middle (ZPS 19) et Big Salmon (ZPS 23) étaient inférieurs à ceux de 1991.

À l'installation de dénombrement de la Liscomb, les taux de remontée des saumoneaux d'écloserie parvenus au stade d'unibermarin s'inscrivaient au deuxième rang des taux les plus bas à ce jour. Les remontées d'unibermarins dans la rivière LaHave représentaient 148 p. 100 des remontées de 1991, mais se situaient au quatrième rang des plus basses de la période 1987-1991. Pour ce qui est du fleuve Saint-Jean, le taux de survie des saumoneaux a augmenté légèrement par rapport à l'année antérieure, mais il se situait néanmoins lui aussi au quatrième rang des taux les plus bas des dix-sept dernières années. Quant aux taux de remontée des pluribermarins provenant initialement d'écloserie dans le Saint-Jean et la Liscomb, ils demeuraient parmi les plus bas de la série. Dans la rivière LaHave, le taux de remontée a doublé par rapport à celui-ci de 1991, pour atteindre à peu près la moyenne de 1987-1991.

D'après les prévisions, les remontées de pluribermarins aux chutes Liscomb s'établiront en 1993 à environ 47 p. 100 de la moyenne de 1987-1991; aux chutes Morgan et dans la rivière LaHave, les remontées seront à peu près équivalentes à celles de 1987-1991. Ces prévisions ne tiennent pas compte des effets possibles du moratoire sur les pêches commerciales insulaires de Terre-Neuve imposé en 1992. On s'attend à ce que les remontées estimées de pluribermarins sauvages à Mactaquac, sur le Saint-Jean, s'établissent à 100 ou 115 p. 100 (selon la méthode d'estimation) de la moyenne des retours estimés à Mactaquac pour la période 1987-1991. Quant aux remontées d'unibermarins sauvages à Mactaquac, on prévoit qu'elles se chiffreront à 81 ou 91 p. 100 (selon la méthode d'estimation) de la moyenne des remontées de 1987-1991. De zéro à 15 p. 100 des remontées à Mactaquac pourraient se composer de saumons de deux hivers en mer, résultant du moratoire sur la pêche commerciale à Terre-Neuve.

## INTRODUCTION

This document presents a review, similar to those of 1987 to 1991 (Marshall et al. 1988, Amiro et al. 1989, O'Neil et al. 1989, Amiro et al. 1991, Amiro et al. 1992), of the status of Atlantic salmon stocks of the five Salmon Fishing Areas (SFAs 19 to 23) of Scotia-Fundy Region and, as such, documents sport landings, fishway counts, diver counts and electrofishing results for specific rivers in 1992 and provides, where possible, forecasts of returns in 1993. Summary sheets are provided for the Grand, Liscomb, LaHave and Saint John rivers.

## METHODS

Sport fishery data for 1991 in SFAs 19 to 22 (Nova Scotia) were derived from an analysis of Nova Scotia salmon license stubs. Recreational catches, 1974-1986, for all SFAs of Scotia-Fundy Region appear in the "Redbook" series (DFO, Halifax) and O'Neil et al. (1985, 1986, 1987, 1989a, 1989b, 1991). Sport landings for SFAs 19-22, 1974-1983, were adjusted upward to a Nova Scotia license stub equivalency (1984-1991) based on a ratio of (Department of Fisheries and Oceans district officer reports) DFO to license stub comparison in 1983 which indicated that DFO catch estimates were lower. It was assumed that DFO catches for that pre-1983 period were also underestimated. Sport fishery data for 1991, 1992 and 1987-1991 mean catches and effort for individual rivers appear in Appendix 1. Catch data for outer Bay of Fundy rivers in SFA 23 were obtained from New Brunswick Dept. of Natural Resources and Energy and DFO field personnel (Atlantic salmon harvest was prohibited in inner Bay of Fundy rivers of SFAs 22 and 23).

Monitoring of upstream-migrating wild and hatchery-origin adult salmon was conducted at seven counting facilities in Scotia-Fundy Region: 1) Grand River in SFA 19, 2) Liscomb River in SFA 20, 3) LaHave River in SFA 21, 4) Petitcodiac, 5) Saint John and 6) Magaguadavic rivers in SFA 23 and 7) Stewiacke River SFA 22. Counts of returning hatchery-origin fish from the Liscomb, LaHave and Saint John fishways and the number of smolts from which they originated are provided as an index of marine survival in 1975-1992. Counts of seaward-migrating smolts are available at Little River, a tributary of the Stewiacke River for 1990, 1991 and 1992.

Estimates of adult salmon populations above the fishway on Grand River (SFA 19) were made by use of counts at the fishway and estimates of fishway by-pass rates. Rates were established in 1989 (9% for fish <63cm and 43% for larger fish) and again in 1991 (43% for grilse and salmon). An estimate of removals by the angling fishery above the Grand River fishway was based on the 1991 sport catch and a 1990 phone survey that indicated 31% of the 1990 Grand River sport catch occurred above the fishway.

Indices of river escapements were derived from counts of adult salmon by divers in the Big Salmon (St. John Co.) and Middle (Victoria Co.) rivers.

Juvenile densities were determined by electrofishing in the Stewiacke River in SFA 22 and in Big Salmon River in SFA 23. Densities in the Big Salmon River were determined by

the removal method from within barriered sites. Densities of age 1+ and older parr in the Stewiacke River were determined by mark-recapture methods in unbarriered sites. Age-0+ parr densities for the Stewiacke River were estimated by dividing the count of the 'mark-run', by the capture efficiency estimated for the age-1+ parr population estimate. Tests for differences in juvenile salmon densities were conducted using ANCOVA models as reported in Amiro (1992).

Forecasts of wild multi-sea-winter (MSW) returns for 1993 (unadjusted for potential fish benefits from the Newfoundland commercial fishery moratorium in 1992) were based on regressions of wild MSW counts on wild one sea-winter (1SW) counts of the same smolt class at the Liscomb and LaHave river facilities. The MSW run destined to Mactaquac Dam, Saint John River (adjusted for potential benefits of the 1992 moratorium in Newfoundland on returning 2SW fish) was forecasted by parametric and nonparametric regression methods from total returns of wild 1SW salmon (and their fork length) destined for Mactaquac in 1992 (Marshall, 1993). The 1993 potential run of wild 1SW fish to Mactaquac was estimated using parametric and nonparametric regressions of 1SW returns on egg depositions four and five years previous.

## **RESULTS and DISCUSSION**

### **SFA 19 (Cape Breton East)**

Reported effort in the 1992 sport fishery totaled 6,616 rod days or 77% of the 1987-1991 and 65% of the 1982-1991 mean rod-day effort (Table 1). The 1992 estimated sport catch of small salmon is 475 or 63% of the 1987-1991 and 1982-1991 means. Sixty-six percent of the total SFA catch was taken from the Grand and North rivers (Appendix 1). An estimated 1,033 MSW salmon was reported released in the 1992 sport fishery which is 77% of the 1987-1991 mean.

The count of wild salmon in 1992 at the Grand River fishway, Richmond County, was 71 fish <63cm, and 12 fish  $\geq$ 63cm (Table 2, Appendix 2). The count of wild 1SW salmon was 51% of that of 1991 and 26% of that of 1990; the count of salmon  $\geq$ 63cm was 84% of the 1990 and 22% of 1991 counts. The 1992 count of 41 1SW, 5 2SW and 3 repeat-spawning hatchery fish was 37% of the count at the fishway. Counts at the fishway are known to underestimate the population above the falls because some fish ascend the falls adjacent to the fishway. Previous adjustments for by-pass were 9% for fish <63cm and 43% for fish greater than 63cm. Broodstock collected above the fishway on October 17, 1991, indicated 43% of the fish less than 63cm had not passed through the trap at the fishway. Because no adjustment figure was available in 1992 an average of the 1989 and 1991 by-pass rates for fish <63 cm was used to estimate the population above the fishway. A population of 154 fish <63cm and 32 fish >63cm was estimated above the fishway before removals. Because few salmon larger than 63cm were observed at the fishway or in the broodstock collections, salmon  $\geq$ 63cm were adjusted using the 1989 rate. Spawning escapement for the entire river is unknown because of the location of the fishway 10.2 km above the mouth of the river. Native food fishery removals below or above the fishway are unknown. Recreational fishery

retained catch above the fishway of 43 fish <63 cm was estimated using the 1990 follow-up phone survey which indicated 31% of the retained grilse was caught above the fishway. The estimated spawning escapement above the fishway was 143 fish or 26% of the required escapement for the entire river.

Underwater counts of adult salmon were conducted in four sections (Fig. 1 in Amiro et al. 1991) or 96.2% of the adult salmon potential holding areas of the Middle River (SFA 19) on October 22, 1992. Counts totalled 56 small salmon thought to be 1SW and 212 large salmon thought to be MSW fish of which one was of hatchery origin. In-river native food fisheries reportedly removed 23 salmon after the count had taken place. Estimated escapement was 46% of the MSW required spawning escapement.

### **SFA 20 (Eastern Shore)**

The 1992 estimated retained catch of 930 small salmon is 43% of the 1987-1991 and 34% of the 1982-1991 mean (Table 1). An estimated 413 MSW salmon was reported released in 1992 (49% of the 1987-1991 mean).

The retained angling catch of 300 small salmon on the St. Mary's River was 32% of the average retained catch, 1987-1991. Release of 164 MSW fish was 41% of that of the past five-year mean (Appendix 1). Angling catches of small and MSW fish on most other rivers of SFA 20 were lower, often substantially lower, than in 1991 while releases of MSW fish were either similar to or lower than in 1991. Exceptions include the Salmon River, Guysborough, the Ecum Secum River, and East River, Sheet Harbour. Effort was not uniformly changed across the zone so could not be considered a principal factor affecting the apparent change in catch levels.

The count of 145 wild 1SW fish at the Liscomb Falls fishway was the lowest since 1984 (Semple and Cameron 1990) and only 25% of the 546 fish recorded in 1991 and 17% of the 1987-1991 mean (Table 2, Appendix 3). The count of 27 wild salmon was the lowest since 1983. The return rate to the fishway of hatchery-origin 1SW fish was 0.50% (Table 3) which is the second lowest return rate noted since the fish trap was constructed and only a fraction of the 1987-91 mean of 1.42%. Counts of wild (Table 1) and hatchery adults (Table 2) in 1992 totalled 309 fish or about 10% of river targets of 1,908 1SW and 280 MSW fish (Semple and Cameron 1990) estimated without consideration for habitat adversely impacted by acidification. Revised spawning targets are being considered.

The equation used to predict a return of 53 MSW salmon (90% CI 34-72) to the Liscomb River in 1992 (as compared with an observed return of 27 MSW salmon) from 1SW returns in 1991, was updated in 1992 to  $Y = 0.048X + 22.74$  ( $n=13$ ,  $r^2=0.29$ ,  $p = 0.06$ ). The return of MSW salmon to the Liscomb River in 1992 is predicted to be 30 fish (90% CI 0-94).

### **SFA 21 (Southwest N.S.)**

The preliminary estimate of the angling catch of small salmon in SFA 21 is 2,310 or 415% of the 1991 catch and 75% of the 1987-1991 mean (Table 1). Similarly an estimated 351 MSW salmon was reported released in 1992, 112% of the 1987-1991 mean.

A count of 1,915 wild 1SW fish at the Morgan Falls fishway, LaHave River, was 386% of the 1991 count, 101% of the 1987-1991 mean count, and 143% of the mean count of the past sixteen years at this salmon development project. The estimated recreational catch of small salmon in the LaHave River was 1,058, 454% of the 1991 catch and 60% of the 1987-1991 mean (Appendices 1 and 4). The return rate for 1SW fish from  $43.9 \times 10^3$  hatchery smolts stocked above Morgan Falls in 1991 was 1.29% which is 69% of the prior 13-year annual mean return rate (Table 3, Appendix 4).

A total of 215 wild MSW salmon was counted at Morgan Falls during 1992, which is 52% of the 1987-1991 mean count of 413 MSW salmon (Table 2). The return rate for 2SW salmon from  $12.5 \times 10^3$  hatchery smolts stocked above Morgan Falls in 1990 was 0.46% which compares favorably with the 0.4% average rate observed in the prior twelve years.

Estimated egg deposition in 1992 was 3.38 million eggs ( $4.93 \text{ eggs}^{-1}\text{m}^2$ , without adjustment for poaching or angling removals and disease). This estimate compares with the 1.65 million eggs required by the interim  $2.4 \text{ eggs}/\text{m}^2$  standard for non-acid-impacted rivers, though the LaHave is acid-impacted. The regression equation  $Y = 0.187X + 65.189$  ( $n = 18$ ;  $r^2 = 0.63$ ;  $p < 0.01$ ) and the 1,915 wild 1SW fish count in 1992 forecasts a count in 1993 of 423 (90% CI 191-655) MSW salmon, 197% of the 1992 count and 102% of the 1987-1991 mean count.

### **Inner Bay of Fundy (Portions of SFA 22 and SFA 23 )**

A continuation of the 1989 management measure to close all inner Bay of Fundy rivers until 700 fish are determined to enter Big Salmon River, New Brunswick, remained in place in 1992. Counts of salmon in Big Salmon River in 1992 did not reach sufficient numbers to open inner Bay of Fundy rivers to Native food or recreational fishing.

Counts of salmon from stream bank observation and by divers in the Big Salmon River on August 21 and September 29, 1992, indicated approximately 150 salmon of which 45% was classed as <63 cm length or 21% of the target required for spawning. Age-1+ parr densities for four of six sites on the Big Salmon River in 1992 were similar to values obtained 1989-1991 (Figure 1).

Count of salmon returning to the Petitcodiac River fishway in 1992 was thought to have been affected by increased numbers of fish using the by-pass notch in the tidal gate and therefore not consistent with previous counts at the fishway.

The count of smolts at Little River (a tributary of Stewiacke River) was 1,959 in 1992

or about 62% of the 1991, and 55% of the 1990, count.

A total of 54 fish <63cm and 123 fish  $\geq$ 63cm was counted at the Stewiacke River counting fence from October 5 to November 21, 1992. The combined catch by electrofishing boat above the fence on November 3<sup>rd</sup> and November 16<sup>th</sup> indicated 7 out of 8 salmon ( $\geq$  63cm) were tail punched and 2 out of 4 grilse (< 63cm) were previously counted at the fence. These data indicate approximately 87 fish < 63cm and 137 fish > 63cm entered Stewiacke River prior to November 16, 1992. These 224 fish plus the five salmon and one grilse released at the fence after November 16 indicate approximately 21% of the target spawning escapement of 1,100 fish (Amiro 1990) was reached.

Mean density  $100^{-1} \text{ m}^2$  at 31 sites in the Stewiacke River, 1992, was 14.9 age-0+, 15.0 age-1+ and 2.0 age-2+ parr (Figure 2). Post-hypothesis comparison of annual mean density, adjusted for habitat and distance above tide head, indicated a significant ( $p=0.027$  for age-0+,  $p=0.008$  for age-1+ and  $p=0.0001$  for age-2+ parr) difference between 1992 and 1984 to 1991 means. A paired comparison of adjusted means indicated significant ( $p=0.002$ ) lower mean density of fry in 1992 compared to 1984 ( $p<0.001$ ) and to 1986 ( $p=0.007$ ). Age-1+ parr density in 1992 was significantly less than in 1985 ( $p=0.001$ ) and in 1987 ( $p=0.004$ ) by the same test procedure.

### SFA 23 (South Western N.B.)

Fishing effort (25,600+ rod-days) and landings of salmon (3,452 small salmon) in SFA 23 were up 80% from 1991 and 15% and 9% from the respective 5- and 10-year means (Table 1). Inner Fundy rivers which were closed to angling in 1992, accounted for only 6% of the mean retained catch in SFA 23, 1984-1989.

Counts of salmon by the Atlantic Salmon Federation at the St George fishway on the Magaguadavic River numbered 250 1SW and 193 MSW fish of which 37% and 29%, respectively, were estimated to be of aquaculture origins (Anderson, pers comm.). Counts made previously by DFO, but without distinction as to fish origin, were as follows:

<u>Year</u>	<u>1SW</u>	<u>MSW</u>
1983	303	637
1984	249	534
1986	169	466
<u>1988</u>	<u>291</u>	<u>398</u>
Mean	253	509

Counts of salmon were temporarily discontinued at the Milltown fishway on the St. Croix River, 1992. The count of wild 1SW fish at Mactaquac, Saint John River, in 1992 was similar to that of 1991 and 86% and 95% of the previous 5- and 10- year mean counts (Table 2). Mean daily river discharges at Mactaquac, June through August, rebounded from a 26-



year low in 1991 to a 26-year high in 1992 (Marshall 1993). Return of hatchery 1SW fish originating from smolts released at Mactaquac was 0.71% (Table 3), a value which is about 85% of the 1985-1991 mean return rate for largely 1-year smolts.

A count of 3,522 wild MSW salmon at Mactaquac in 1992 was virtually the same as the 1991 count and 96% and 112% of the respective 5- and 10- year mean counts (Table 2). The estimated total wild MSW return of 4,104 fish (fishway count comprised 86% of the estimated number of fish destined for Mactaquac) was within 4% of the 1992 pre-season forecast (Marshall 1993).

Spawning requirement above Mactaquac is 4,400 MSW fish. The estimated escapement of 3,269 wild and hatchery MSW spawners (unadjusted for losses to poaching and disease) is 74% of the requirement. Egg depositions by 1SW fish were about 1.8 million eggs; about 6% of the 2.4 eggs m<sup>2</sup> requirement.

Forecasts of wild 1SW fish returning to the Saint John River in 1993 and destined for Mactaquac are 6,100 or 7,500 fish, depending on forecast method (Appendix 5 and Marshall 1993). Forecasts of wild MSW returns to Mactaquac in 1993 (inc. those 2SW fish affected by the moratorium on commercial fishing in Newfoundland) are 3,800 MSW fish by the parametric method or 4,400 MSW fish by the non-parametric technique.

Forecasts of hatchery-origin 1SW fish returning in 1993 are 1,900 fish (Appendix 5 and Marshall 1993) about 85% of the number estimated to have returned in 1992. Hatchery MSW returns are expected to number 1,000 fish, about 20% more than were estimated to have returned in 1992. A total return of either 4,800 or 5,400 MSW salmon in 1993 would result in a potential surplus to spawning escapement of either 400 or 1,000 salmon. A total return of either 8,000 or 9,400 1SW returns will exceed spawning requirements by 4,800 or 6,200 fish.

## SUMMARY/SYNOPSIS

Retained catches of small salmon in the recreational fisheries of SFAs 19, 20, and 21 in Nova Scotia were again low, i.e., 63%, 43% and 75%, respectively, of the 1987-1991 landings and 63%, 46% and 89%, respectively, of the previous 10-year mean landings. Released catches of large salmon in SFAs 19, 20 and 21 were also low, i.e., 77%, 49%, and 66%, respectively, of the mean number released, 1987-1991. Effort in SFAs 19, 20 and 21 was 77%, 70% and 90% respectively, of the 1987-1991 mean effort and again may be attributable to poor angling conditions, particularly low river discharges and warm water temperatures much of the angling season. Catch per unit effort for retained small salmon was 82%, 61% and 87% of the 1987-1991 mean in SFAs 19, 20 and 21, respectively. All rivers of inner Bay of Fundy (portions of SFAs 22 and 23) were closed to any exploitation.

The retained catch of small salmon in the outer Fundy portion of SFA 23 was 180% of that of 1991, 115% and 109% of the previous 5- and 10-year means respectively. Fishing effort was 200% of that in 1991 and 112% of the 1987-1991 mean, in all probability because

of generally good angling conditions. The catch per unit effort was 103% of the previous 5-year mean.

Counts of wild MSW salmon at counting facilities in SFAs 19 and 20 were down from the low values of 1991; counts of 1SW fish in SFA 21 increased four-fold over 1991 while MSW salmon counts in SFA 23 were similar to those of 1991. Wild 1SW counts in the Liscomb (SFA 20), LaHave (SFA 21) and Saint John (SFA 23) rivers were 17%, 101% and 86% respectively, of the 1987-1991 means. Wild MSW counts were 42%, 52%, and 112% of the 1987-1991 means. Counts of 1SW and MSW salmon on the Magaguadavic in SFA 23 (about one-third of aquaculture origin) were down 6% and 59% respectively, from the mean of four annual counts in the 1980s. Fewer than a dozen salmon were counted at the causeway on the Petitcodiac (SFA 23); more were known to have bypassed the fishway. In-river counts of salmon in the Middle (SFA 19) and Big Salmon (SFA 23) rivers were down from those of 1991.

Estimated returns of wild MSW salmon to Mactaquac on the Saint John River, 1992, was 116% of the parametric forecast; counts of MSW salmon on the Liscomb and LaHave rivers were 51% and 141% of their respective pre-season forecasts.

The percentage return of 1SW fish from hatchery smolts to the Liscomb River counting facilities was the second lowest of record; the return of 1SW fish to the LaHave was 148% of that of 1991 but the fourth lowest of that 14-year record. Survival of Saint John River smolts increased slightly over the previous year but was the fourth lowest of the 17-year record. Hatchery MSW return rates on the Saint John and Liscomb rivers remained among the lowest of the series; the return rate for the LaHave River doubled over that of 1991 and approximated the mean value, 1987-1991.

The Middle (SFA 19) and the Saint John River above Mactaquac (SFA 23) did not achieve target spawning requirements. Escapements to Big Salmon and Stewiacke rivers, two index rivers for inner Bay of Fundy were similar at about 21% of requirement.

The estimated egg deposition above Liscomb Falls on the Liscomb River (SFA 20) was 0.4 eggs  $m^{-2}$ ; the potential egg deposition above Morgan Falls on the LaHave River (SFA 21) was 4.9 eggs  $m^{-2}$ , up considerably from the 15+ year low in 1991. Target spawning requirements for the Liscomb and LaHave rivers remain to be established because these rivers are acid-impacted.

Hatchery fish contributed 25% and 16% of the 1SW and MSW potential spawning escapement above Mactaquac on the Saint John River, 46% and 31% of 1SW and MSW fish above Liscomb Falls on the Liscomb River, 23% and 21% of 1SW and MSW salmon above Morgan Falls on the LaHave River and 37% of all salmon above Grand River Falls on Grand River.

Forecasts indicate that wild MSW salmon returns in 1993 will be about the same as the 1992 count at Liscomb Falls and for Morgan Falls on the LaHave River, the forecast returns are 197% of the 1992 count. Both forecasts are less certain than those of previous

years because data do not take into account possible impacts of the moratorium in 1992 on the insular Newfoundland commercial salmon fisheries. The estimated return of wild MSW salmon destined for Mactaquac on the Saint John River (adjusted for the Newfoundland closure) is expected to be 92% or 106% (depending on method) of the 1992 return. Wild 1SW returns to Mactaquac in 1992 are projected to be 91% or 112% (depending on method) of the 1992 return. Zero to 15% of the forecast MSW returns to Mactaquac could be composed of 2SW salmon that were affected by the moratorium on the Newfoundland commercial fishery.

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Table 1. Numbers of 1SW salmon retained, MSW salmon retained and released, and effort, by SFA, in the sport fisheries of Scotia-Fundy Region, 1974-1992.\*

Year	SFA 19			SFA 20			SFA 21			SFA 22**			SFA 23		
	1SW Catch	MSW Catch	Effort in rod-days	1SW Catch	MSW Catch	Effort in rod-days	1SW Catch	MSW Catch	Effort in rod-days	1SW Catch	MSW Catch	Effort in rod-days	1SW Catch	MSW Catch	Effort in rod-days
1974	416	588	7,229	3,462	434	24,977	2,462	397	13,236	2,004	714	7,418	1,312	1,798	16,897
1975	117	213	2,157	694	94	8,455	1,416	656	8,286	818	293	3,662	1,888	1,691	17,078
1976	278	445	4,209	2,652	219	18,530	2,474	321	16,026	1,931	537	8,815	3,150	2,498	20,511
1977	768	561	6,703	1,639	422	14,364	3,434	643	20,278	296	898	9,267	2,040	2,553	22,792
1978	257	456	10,780	396	272	12,403	460	481	9,748	1,681	334	6,078	843	924	17,128
1979	281	304	16,761	2,178	267	22,312	2,969	374	14,834	1,258	490	13,030	3,034	927	21,420
1980	997	795	30,143	3,483	469	25,458	2,773	1,104	25,682	151	526	6,408	2,734	2,860	28,947
1981	1,265	496	9,365	2,556	581	30,840	4,342	1,284	38,111	1,045	379	6,887	1,963	1,473	30,423
1982	857	523	18,661	1,657	201	28,187	1,847	494	28,351	983	444	8,717	3,129	2,361	45,520
1983	240	269	15,322	1,336	401	37,352	471	409	13,743	2,402	386	16,764	2,210	1,103	40,311
1984	821	108	8,759	1,744	128	14,426	2,159	232	18,868	966	29	10,226	2,891	0	28,912
1985	1,015	0	833	2,555	0	1,713	2,790	0	1,567	1,634	0	578	4,485	0	38,716
1986	804	0	1,976	1,771	0	1,622	3,110	0	1,583	830	0	843	4,033	0	33,555
1987	890	0	1,390	1,711	0	886	4,395	0	799	24,593	255	0	3,870	0	26,870
1988	873	0	1,580	2,758	0	1,280	3,022	0	846	27,222	574	0	2,991	0	26,627
1989	675	0	1,247	1,884	0	940	4,016	0	1,150	27,981	1,755	0	3,590	0	26,354
1990	865	0	1,370	3,029	0	696	17,787	3,497	933	29,029	274	0	2,613	0	21,915
1991	452	0	1,076	1,392	0	604	13,133	557	0	13,411	9	0	1,915	0	12,635
1992	475	0	1,093	929	0	413	11,746	2,310	0	21,949	18	0	3,452	N/A	25,555
Means															
1977-91	737		11,729	2,043		20,439	2,656		22,264	941		8,724	2,823		28,142
1982-91	749		10,219	2,039		20,121	2,596		22,530	968		8,919	3,173		30,142
1987-91	751	1,333	8,559	2,167	841	16,703	3,097	808	24,447	573	198	6,030	2,996		22,880

\* SFA's 19-22 based on DFO estimates 1974-1983 adjusted by differential between DFO and Nova Scotia license stub returns, 1983; i.e., 1.52, 1.32, 1.36, and 1.04 and license stub returns since 1983. SFA 23 based on DFO estimates.

\*\* SFA 22 data for 1983 are based on Nova Scotia license stub data, not converted DFO figures. Most area 22 rivers were closed to fishing in 1991 and 1992.

Table 2. Counts of wild Atlantic salmon from fishway traps in SFAs 19, 20, 21 and 23, Scotia-Fundy Region.

Year	SFA 19 Grand (a)		SFA 20 Liscomb		SFA 21 LaHave		SFA 23 Saint John	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
1974					29	2	3,389	4,775
1975					38	5	5,725	6,200
1976					178	23	6,797	5,511
1977					292	25	3,504	7,247
1978					275	67	1,584	3,034
1979			60		856	67	6,234	1,993
1980			111	0	1,637	288	7,555	8,157
1981			76	6	1,866	366	4,571	2,441
1982			252	10	799	256	3,932	2,262
1983			520	15	1,129	213	3,623	1,712
1984			606	48	2,043	384	7,353	7,011
1985			507	87	1,343	638	5,331	6,391
1986			736	117	1,579	584	6,347	3,656
1987			1,614	88	2,529	532	5,097	3,088
1988	553	25	477	76	2,464	390	8,062	1,930
1989	490	50	532	75	2,087	511	8,417	3,854
1990	269	50	955	44	1,880	396	6,486	3,163
1991	139	13	586	38	495	236	5,415	3,639
1992	71	11	145	27	1,915	215	5,729	3,522
Means:								
1987-91	N/A	N/A	833	64	1,891	413	6,695	3,135
1982-91	N/A	N/A	679	60	1,635	414	6,006	3,671
1992 as %								
1987-91	N/A	N/A	17%	42%	101%	52%	86%	112%
1982-91	N/A	N/A	21%	45%	117%	52%	95%	96%

a. By-pass rate may vary annually.

Table 3. Estimated numbers of 1SW and 2SW returns from hatchery-reared smolts released at or above counting facilities on Scotia-Fundy rivers, 1975-1991.

Sea-age	River	Smolt year i																	
		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
1SW	LaHave	Smolts (1000's)																	
		Returns	83.9	21.9	61.4	29.0	29.0	2.0	19.6	7.2	5.6	23.4	26.9	21.4	33.2	12.5	43.9		
		Smolts a. Ret. (+1) %	1,064 1.27	396 1.54	1,181 1.92	621 2.14	621 2.14	27 1.32	27 1.32	250 1.27	102 1.42	135 2.42	573 2.45	1,056 3.92	405 1.89	573 1.72	109 0.87	567 1.29	
Tusket		Smolts																	
		Ret. (+1) %	11.3 110 0.97	29.4 108 0.37	15.8 102+ 0.64+	52.1 41+ 0.08+	10.0 51+ 0.51+	22.6 71 0.31	55.7 735 1.32	30.3 348+ 1.15+	48.1 314 0.65	32.4 323 1.00	36.7 -	36.7 -					
		Smolts	47.4	57.5	26.9	42.4	43.8	58.2	50.0	29.6	19.0	31.3	48.4	28.0	22.4	25.1			
Liscomb		Smolts	485	931	241	827	594	331	175	766	523	431	288	438	178	125			
		Ret. (+1) %	1.02	1.61	0.90	1.95	1.35	0.57	0.35	2.59	2.75	1.38	0.60	1.56	0.79	0.50			
		Smolts b. Ret. (+1) %	324.2 9,074 2.80	297.4 6,992 2.35	293.1 3,044 1.04	293.1 3,044 1.04	196.2 3,827 1.95	244.0 10,793 4.42	244.0 10,793 4.42	232.3 5,627 2.42	189.1 3,038 1.61	172.2 1,564 0.91	144.5 1,410 0.97	206.5 1,899 0.92	89.1 773 0.87	191.5 3,006 1.57	113.4 762 0.67	238.2 1,085 0.76	241.1 1,610 0.67
MSW	LaHave	Smolts a. Ret. (+2) %	83.9	21.9	61.4	29.0	29.0	2.0	19.6	7.2	5.6	23.4	26.9	21.4	33.2	12.5			
		Smolts	385	116	102	64	64	0	63	49	54	54	164	83	72	58			
		Ret. (+2) %	0.46	0.53	0.17	0.22	0.00	0.00	0.32	0.68	0.97	0.23	0.61	0.39	0.22	0.46			
Tusket		Smolts																	
		Ret. (+2) %	11.3 12 0.11	29.4 16+ 0.05+	15.8 6+ 0.04+	52.1 17+ 0.03+	10.0 8 0.08	22.6 11 0.05	55.7 59+ 0.11+	30.3 65 0.21	48.1 44 0.09	32.4 -	32.4 -						
		Smolts	47.4	57.7	26.9	42.4	43.8	58.2	50.0	29.6	19.0	31.3	48.4	28.0	22.4	22.4			
Liscomb		Smolts	51	49	41	63	42	49	108	54	44	71	22	22	12				
		Ret. (+2) %	0.11	0.08	0.15	0.15	0.10	0.08	0.22	0.18	0.23	0.23	0.05	0.08	0.05				
		Smolts b. Ret. (+2) c. %	324.2 2,725 0.84	297.4 2,534 0.85	293.1 1,188 0.40	293.1 1,188 0.40	196.2 2,992 1.52	244.0 2,728 1.12	244.0 2,728 1.12	232.3 1,769 0.76	189.1 1,104 0.58	172.2 963 0.56	144.5 799 0.55	206.5 714 0.35	89.1 403 0.45	191.5 678 0.35	113.4 374 0.33	238.2 443 0.19	241.1 636 0.26

a. Estimated "good quality" smolts.

b. Smolts > 12 cm; return years 1981-'83 adjusted (Marshall, 1992).

c. Incl. some repeat spawners.

+ Potentially higher.

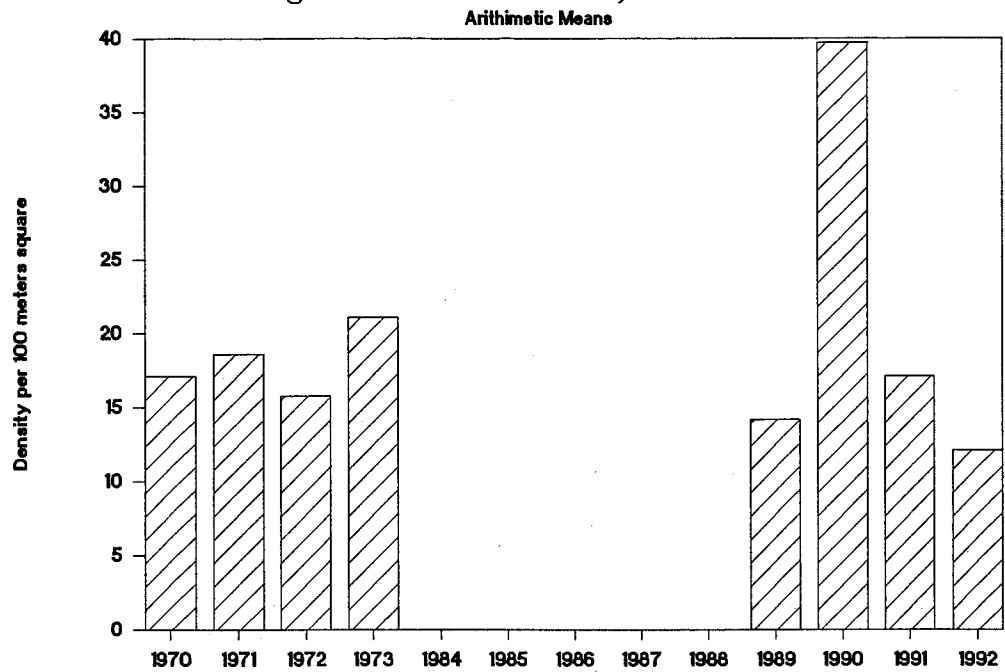
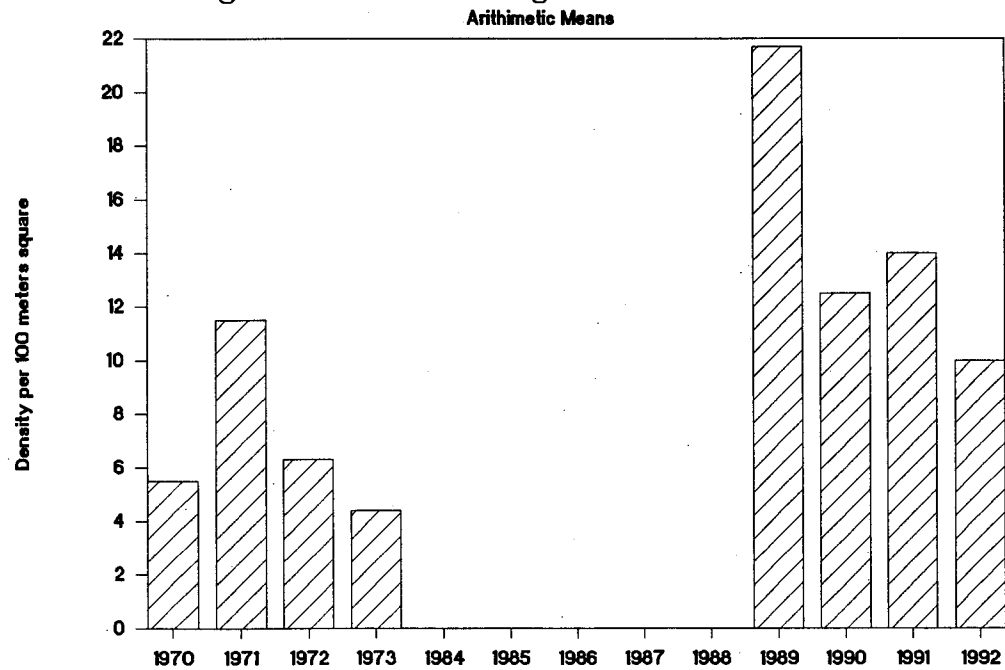
*Big Salmon River Fry Densities**Big Salmon River Age-1 Parr Densities*

FIG. 1. Mean annual Atlantic salmon fry (upper) and parr (lower) densities at 11-3 sites in the Big Salmon River, 1970-1992.



## Stewiacke River parr densities

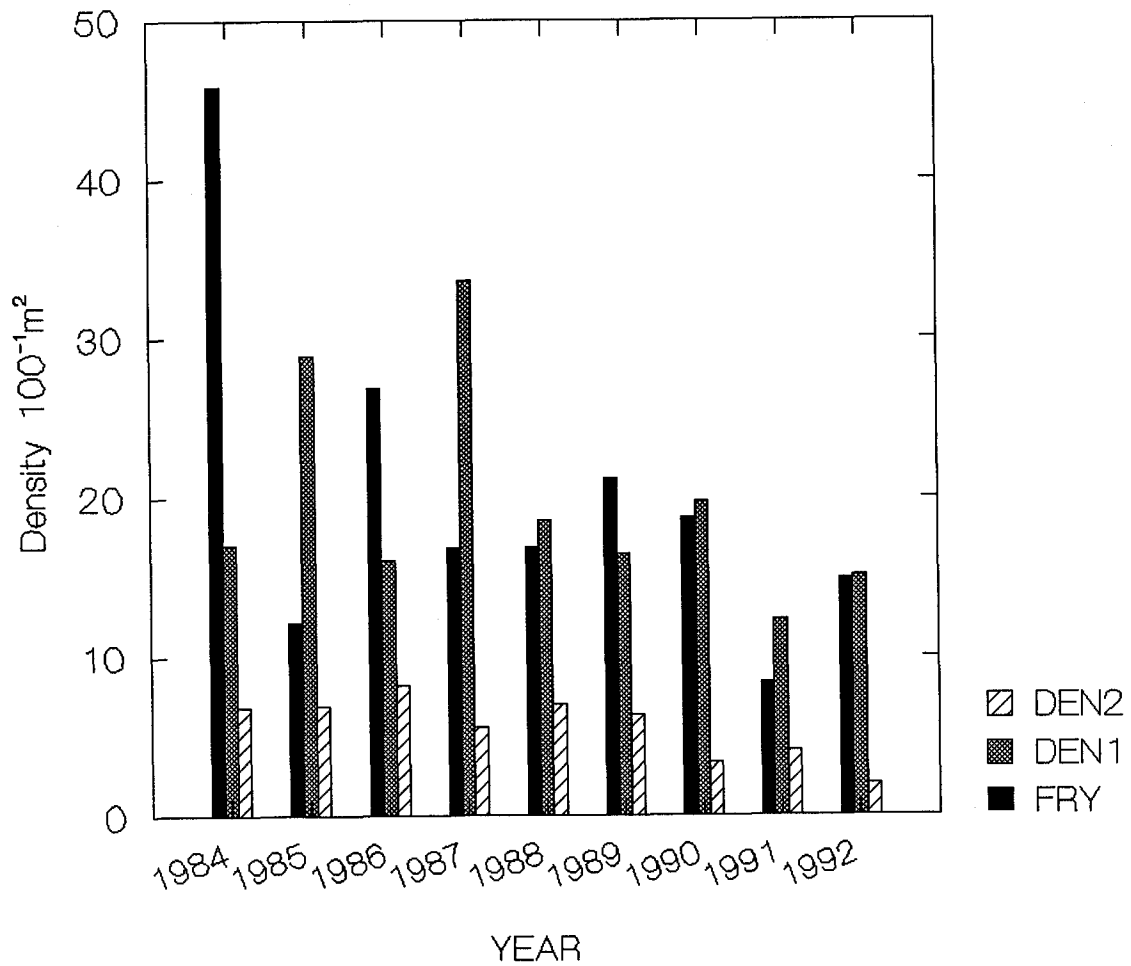


FIG. 2. Mean annual Atlantic salmon parr (fry, age 1+, age 2+) densities determined by electrofishing 29-44 sites in the Stewiacke River, 1984-1992.

Appendix 1. Atlantic salmon sportcatch and effort for Scotia-Fundy Region rivers, 1991 and 1992, contrasted with mean catches, 1987-91.

River	1992				1991				1987-91 means							
	Grilse		Salmon		Grilse		Salmon		Grilse		Salmon		Effort			
	retained	released	retained	released	retained	released	retained	released	retained	released	95% C.I.	released	95% C.I.	roddays	95% C.I.	
Salmon Fishing Area 19																
Aconi Brook	4	4	9	29	8	0	8	41	5.8	4.70	0.2	0.39	4.8	5.79	50.6	42.93
Baddeck	53	7	176	690	28	23	213	640	24.6	10.44	19.2	6.72	189.8	35.45	517.8	78.25
Barachois	1	0	5	71	4	3	22	110	6.2	2.98	4.0	2.56	20.4	11.06	78.2	22.88
Catalone	8	1	3	210	5	1	3	225	46.0	31.57	6.0	5.33	30.8	23.79	625.4	308.50
Clyburne					4	0	4	38	1.6	1.92	0.0	0.00	5.0	5.75	31.8	19.89
Framboise	15	3	5	295	24	5	22	283	58.8	24.69	6.6	1.33	41.8	15.33	457.6	105.40
Gaspeau: Cape Breton Co.	0	0	0	13	1	0	1	52	0.8	0.73	0.0	0.00	0.4	0.48	28.0	15.27
Gerratt	0	0	0	6	1	1	37	1.8	1.44	2.2	2.35	0.2	0.39	27.4	14.30	
Grand	139	12	46	1955	115	13	18	1985	268.2	76.67	33.2	22.83	79.8	32.17	2587.6	486.96
Indian Brook	0	0	0	21	3	8	26	89	2.2	1.14	2.6	2.74	15.4	9.53	44.4	24.36
Ingonish	0	1	1	49	10	1	4	103	7.4	2.20	2.2	2.35	18.4	8.35	77.6	39.47
Inhabitants	30	0	148	457	38	6	139	367	36.8	6.66	5.4	3.75	135.4	42.76	380.2	61.95
Little Lorraine	12	3	9	67	0	3	0	58	17.6	11.47	1.6	0.78	5.0	3.10	173.4	66.54
Lorraine Brook									0.2	N/A	1.2	N/A	1.8	N/A	13.0	N/A
MacAskill's Brook	9	3	5	134	1	0	0	24	13.6	8.10	1.4	1.71	2.2	2.00	71.4	28.43
Marie Joseph	7	4	32	198	18	9	186	856	46.0	20.30	13.0	7.91	184.2	52.77	834.0	104.07
Middle: Victoria Co.	3	4	1	102	21	1	9	219	14.8	6.66	0.6	0.48	10.8	4.97	213.4	60.19
Mira	1	0	23	92	9	1	35	99	5.6	3.90	1.6	1.33	37.8	20.55	99.2	26.94
North Aspy									0.2	0.39	0.0	0.00	2.0	3.92	18.0	17.34
Northwest Brook (River Ryan)	173	41	537	1793	148	38	355	1391	154.4	33.06	42.2	16.26	483.2	98.18	1565.6	180.52
North: Victoria Co.	1	0	1	7												
River Bennett	1	0	3	11	0	0	0	3	1.8	3.53	0.4	0.78	1.2	2.35	2.2	2.59
River Denny's	5	1	5	55	5	4	15	72	13.0	7.09	2.8	2.09	21.8	16.85	106.2	32.05
River Tillard	1	0	0	25	0	0	0	3	2.6	4.14	0.0	0.00	2.0	2.97	23.2	29.98
Saint Esprit	7	1	7	289	8	5	9	339	15.4	9.12	2.2	1.90	18.8	8.11	432.4	144.73
Salmon: Cape Breton Co.																
Skye	3	1	9	38	0	0	9	4	0.0	0.00	0.2	0.39	4.6	4.86	9.8	9.87
Sydney																
Totals	475	86	1033	6616	451	122	1078	7078	740.0	148.6	1322.8	84.18.6				

Appendix 1. (Continued)

River	1992				1991				1987-91 means				Effort				
	Grilse		Salmon		Grilse		Salmon		Grilse		Salmon		95% C.I.		roddays	95% C.I.	
	retained	released	released	released	retained	released	retained	released	retained	released	retained	released	95% C.I.	95% C.I.			
Salmon Fishing Area 20																	
Clam Harbour	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.8	
Cole Harbour	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.4	
Country Harbour	4	0	0	0	10	40	1	13	175	3.2	7.72	3.92	9.6	3.65	185.6	31.61	
East Sheet Harbour	30	0	7	1	252	15	1	97	64.6	42.25	14.8	16.29	11.2	8.66	385.2	255.63	
Ecum Secum	68	0	11	0	527	19	0	1	417	75.8	30.95	4.61	11.8	7.50	650.8	180.94	
Gaspereau Brook	1	0	0	0	35	0	0	0	3	4.6	4.41	0.2	0.39	0.2	0.39	35.8	19.54
Guyaborough	0	0	0	0	3	1	0	4	13	2.8	2.09	0.0	2.8	2.35	25.6	13.90	
Halfway Brook	0	0	0	0	3	1	0	0	5	0.6	0.78	0.0	0.00	0.0	0.0	4.6	4.14
Isaac's Harbour	8	0	0	0	74	4	0	0	68	24.2	10.43	0.4	0.48	2.29	124.6	38.25	
Kirby	1	0	0	0	27	1	0	0	29	4.6	3.65	0.2	0.39	1.6	3.14	28.4	9.61
Larry's	0	0	0	0	6	4	3	0	49	2.2	2.00	1.2	1.44	0.2	0.39	20.6	19.59
Lawrencetown Lake	19	1	0	0	650	46	18	5	513	132.6	80.87	17.2	11.62	9.20	814.6	194.10	
Liscomb																	
Little Salmon																	
Moser	80	0	4	0	1087	106	26	12	633	186.0	50.96	21.2	8.80	6.56	1048.0	289.37	
Musquodoboit	57	7	19	0	700	106	26	144	2142	209.2	57.41	77.0	32.55	49.25	3167.6	696.26	
Necum Teuch																	
New Harbour	20	7	1	0	449	23	0	1	335	37.2	31.27	0.8	1.57	1.07	351.4	144.22	
Port Dufferin	1	0	0	0	78	5	0	0	119	22.8	14.83	1.8	2.18	3.06	164.8	57.06	
Porters Lake (East Brook)																	
Quoddy	0	0	0	0	10	0	0	0	17	0.2	N/A	0.0	0.0	0.0	0.8	N/A	
Rocky Run Porters Lake																	
Saint Francis																	
Saint Mary's	300	34	164	0	4419	744	231	264	5486	932.4	408.63	215.8	132.06	157.74	6168.6	1272.56	
Salmon: Guysborough Co.	286	37	203	0	1972	190	23	148	1809	223.8	37.65	16.2	10.65	60.93	1571.4	295.93	
Salmon: Halifax Co.	0	0	0	0	14	3	0	0	30	9.0	7.31	1.6	1.92	1.86	84.8	39.35	
Ship Harbour Lake Charlotte	0	0	0	0	236	5	0	0	264	30.4	16.80	0.4	0.78	2.20	353.8	106.73	
Tangier	0	0	0	0	3	0	0	0	17	0.0	0.00	0.0	0.00	0.00	12.6	5.32	
West Sheet Harbour	54	1	4	0	1103	67	9	8	864	148.4	66.35	13.6	15.68	7.82	1251.0	419.89	
<b>Totals</b>	<b>929</b>	<b>87</b>	<b>413</b>	<b>0</b>	<b>11746</b>	<b>1390</b>	<b>338</b>	<b>605</b>	<b>13130</b>	<b>2148.4</b>	<b>397.2</b>	<b>831.4</b>	<b>16506.6</b>	<b>16506.6</b>	<b>16506.6</b>	<b>16506.6</b>	

Appendix 1. (Continued)

River	1987 - 91 means											
	1992			1991			1990			1989		
	Grilse retained	Salmon released	Effort	Grilse retained	Salmon released	Effort	Grilse retained	Salmon released	Effort	Grilse retained	Salmon released	Effort
Salmon fishing area 21												
Broad	114	9	16	763	15	0	0	0	355	0.0	N/A	0.0
Clyde	0	0	0	8	0	0	0	0	11	0.0	41.37	12.6
East: Lunenburg Co.	185	9	30	1934	51	4	26	1087	266.0	136.23	35.4	0.6
Gold	7	1	0	80	3	1	0	68	3.4	2.02	2.2	0.4
Ingram	1058	77	184	9046	233	44	142	4359	1757.6	832.91	268.6	146.69
Lal-Have												
Martins	493	41	45	4838	47	3	47	2637	525.8	258.22	31.2	15.93
Medway	47	3	1	1734	65	8	21	2251	99.8	29.47	11.0	4.34
Mersey	0	0	0	3	1	0	0	5	1.4	1.33	2.8	1.69
Middle: Lunenburg Co	19	3	4	94	10	0	0	37	32.0	16.27	1.6	1.71
Mushamush												
Nine Mile												
Petite Riviere	198	18	12	1240	35	1	6	546	112.2	47.44	11.6	8.35
Sackville	26	42	14	479	19	8	13	397	20.6	13.07	7.8	6.33
Salmon: Digby Co.	32	3	3	316	18	4	8	350	60.6	23.35	8.6	5.53
Tusket	131	24	42	1414	58	10	50	1302	165.0	101.05	19.0	9.66
Totals	2310	230	351	21949	555	83	313	19405	3096.6	413.0	805.6	24221.6

Appendix 1. (continued)

River	1987-91 means													
	1992			1991			1990			1989				
	Grilse retained	Salmon released	Effort	Grilse retained	Salmon released	Effort	Grilse retained	Salmon released	Effort	Grilse retained	Salmon released	Effort		
Salmon fishing area 22														
Annapolis	0	0	0	0	0	5	2.4	1.92	0.0	0.00	0.6	0.78	38.0	22.97
Apple							2.2	2.59	0.2	0.39	0.4	0.48	29.0	17.46
Bass														
Chiganois														
Cornwallis	0	0	0	0	0	21	1.0	1.07	0.8	1.57	0.8	0.73	66.0	33.56
Debert							12.0	13.31	1.2	2.35	2.4	2.53	126.6	77.91
Diligent							0.0	N/A	0.0	N/A	0.0	N/A	2.2	N/A
East Colchester							0.6	1.18	0.0	0.00	0.8	1.57	4.4	6.75
Economy							3.4	3.75	0.2	0.39	2.0	1.64	82.8	68.40
Folly							16.8	15.76	3.4	3.01	2.8	3.36	118.6	83.19
Gaspereau: Kings Co.	18	24	7	504	1	26	33.2	16.38	2.2	3.36	31.0	11.51	576.2	70.96
Great Village							4.6	7.58	1.4	2.74	0.6	0.48	18.4	16.16
Harrington							0.0	N/A	0.2	N/A	0.8	N/A	5.0	N/A
Kennetcook							0.0	0.00	0.0	0.00	0.0	0.00	9.6	10.80
Lequille							0.0	N/A	0.0	N/A	0.0	N/A	8.0	N/A
Maccan	0	0	0	17	0	0	40.0	45.00	4.6	4.19	9.0	12.87	521.2	339.46
Meander (Avon)							0.0	N/A	0.0	N/A	0.0	N/A	6.6	N/A
Nappan							0.0	N/A	0.0	N/A	0.0	N/A	8.6	N/A
Nictaux							0.0	N/A	0.0	N/A	0.0	N/A	2.0	N/A
North : Colchester	0	4	0	7	0	4	47.8	49.04	5.0	5.65	5.8	5.76	262.8	187.78
Portapique							6.2	5.59	2.2	1.69	0.8	0.73	29.6	18.15
Ramshead (Ramsey)							19.8	29.16	1.6	3.14	2.0	2.56	194.8	124.07
River Hebert							0.0	N/A	0.0	N/A	0.0	N/A	0.2	N/A
Round Hill							8.8	10.72	3.8	7.45	0.0	0.00	136.0	132.28
Saint Croix							28.4	34.65	11.8	18.82	10.6	8.33	215.4	140.46
Salmon: Colchester							32.6	20.90	3.2	4.04	15.2	11.72	404.0	251.47
Shubenacadie							308.2	380.70	67.0	84.83	110.0	85.89	3074.4	1865.77
Stewiacke	0	1	0	4	0	23								
<b>Totals</b>	<b>18</b>	<b>29</b>	<b>7</b>	<b>583</b>	<b>9</b>	<b>840</b>	<b>568.0</b>	<b>108.8</b>	<b>108.8</b>	<b>195.6</b>	<b>5973.0</b>			

Appendix 1. (continued)

River	1992			1991			1987 - 91 means			
	Grilse	Salmon	Salmon	Grilse	Salmon	Salmon	Grilse	Salmon	Salmon	
	retained	released	released	retained	released	released	95% C.I.	released	95% C.I.	Effort
		Effort	retained	released	released	95% C.I.	released	95% C.I.	95% C.I.	roddays
Salmon fishing area 23										
Alma						5.4	7.32		0.4	38.8
Big Salmon						51.2	50.50		0.0	488.6
Caran		10	130			6.2	N/A		0.0	34.4
Dennis Stream	15			7	2	2.6	N/A		0.4	16.6
Digdegwash				5	1	12.4	5.24		2.8	92.8
Gaspereau	30	20	250			88.4	64.77		0.0	570.4
Hammond	120	120	2100			73.8	43.85		4.0	704.0
Kennebecasis	200	150	3000							
Keswick	22		75							
Magaguadavic				67	46	83.6	51.18		24.0	465.4
Nashwaak	900	900	5520	186	77	356.2	215.70		115.6	3255.6
Nerepis				4	0	7.0	4.47		1.0	178.8
New				0	10	0.8	N/A		2.0	3.6
Oromocto	1		13							
St. Croix				4	5	11.0	6.93		7.6	246.4
Saint John	1211	527	5334	805	275	916.8	116.98		225.6	6856.4
Salmon: Queens Co.	60	40	500			38.4	32.92		1.6	214.4
Salmon: Victoria Co.	60	40		130		N/A	N/A		46.0	774.0
Tobique	833		8633	704	0	825.4	215.60		0.0	8142.8
Waweig				3	1	6.0	3.87		3.2	86.2
Totals	3452	1807	25555	1915	417	12635	2655.2	434.2		22149.2

\* Confidence limits were not calculated on SFA 23 released fish or effort because of the number of missing values.

U Unknown

## Appendix 2

**STOCK:** Grand River, SFA 19.  
**TARGET:** 1.1 million eggs

Year	1987	1988	1989 <sup>1</sup>	1990	1991 <sup>1</sup>	1992	MIN <sup>2</sup>	MAX <sup>2</sup>	MEAN <sup>2</sup>
<b>Native fisheries</b>				24	39	UK			
<b>Recreational catch</b>									
Grilse	342	338	307	416	115	139	115	416	313
Salmon	107	105	74	98	15	46	15	194	99
Broodstock		33	25	18	19	10			
<b>Count at fishway</b>									
Grilse		554	512	527	234	114			
Salmon		31	25	27	18	18			
<b>% Hatchery</b>		NA	NA	43	45	38			
<b>Correction for by-pass</b>									
Grilse		55	51	52	176 <sup>5</sup>	40			
Salmon		54	19	20	14	14			
<b>Total above fishway</b>		694	607	626	442	186			
<b>Population below fishway (estimate)</b>		143	UK	UK	UK	UK			
<b>% Angled above</b>		UK <sup>6</sup>	42 <sup>3</sup>	31 <sup>3</sup>	31 <sup>3</sup>	31 <sup>3</sup>			
<b>Required spawning escapement</b>		539	545	545	545	545			
<b>Estimated escapement<sup>4</sup></b>		736	453	442	348	143			
<b>% of Adults required</b>		136	83	83	64	26			
<sup>1</sup> In-season variation closures. <sup>2</sup> For the period 1986-1991; not shown where only 1988-1991 data are available. <sup>3</sup> Determined from post-season phone survey. <sup>4</sup> Above fishway in relation to entire river. <sup>5</sup> 1991 by-pass rate for fish <63cm. <sup>6</sup> 20% Assumed angled above fishway.									

**Recreational catches:** Have ranged from 422 fish in 1984 to 115 fish in 1991, the period since the Nova Scotia license-stub return system. This river is the highest or second highest producer of fish smaller than 63 cm on Cape Breton Island.

**Data and assessment:** Counts and scale samples are taken at the fishway 10.2 km above the head of tide on the main river. By-pass of fish ascending the falls was estimated in 1989 at 9% for fish less than 63 cm and 43% for fish equal to or greater than 63 cm but may have been different in 1991 when flood conditions followed a prolonged drought. The 1991 by-pass rate for grilse of 43% was estimated from broodstock collected above the fishway ( 8 of 14 grilse were marked). Numbers below the fishway were estimated from redd counts in 1988 only.

**State of the stock:** The target spawning escapement for the Grand River has not been met during the past three years, based on the number of salmon estimated to be spawning above the fishway.

## Appendix 3

**STOCK:** Liscomb River above Liscomb Falls Fishway, SFA 20  
**TARGET:** Under development for this acid-stressed river.

Year	1987	1988	1989	1990	1991	1992	MIN <sup>1</sup>	MAX <sup>1</sup>	MEAN <sup>1</sup>
<b>Recreational catch (1SW)<sup>a</sup></b>	289	138	65	177	68	19	65	289	150
<b>Counts:</b>									
Wild 1SW	1614	477	532	955	586	145	477	1614	772
Wild MSW	88	76	75	44	38	27	38	117	75
Hatchery 1SW	523	431	288	438	178	125	175	766	400
Hatchery MSW	54	44	71	22	22	12	22	108	53
Total	2279	1028	966	1459	824	309	818	2279	1300
<b>Egg deposition/m<sup>2b</sup></b>	2.5	1.2	1.2	1.6	0.9	0.4	0.9	2.5	1.5
<b>Return rate of hatchery smolts</b>									
1SW(%)	2.75	1.38	0.60	1.56	0.79	0.50	0.35	2.75	1.43
MSW(%)	0.18	0.23	0.23	0.05	0.08	0.05	0.05	0.23	0.15
<sup>1</sup> For the period 1985-1991. <sup>a</sup> below fishway <sup>b</sup> above fishway									

**Recreational catches:** No retention of MSW fish since 1984; 1SW catches (1985-1992) have ranged from 19 in 1992 to 289 in 1987.

**Data and assessment:** Counts of adult fish are obtained at Liscomb Falls fishway.

**State of the stock:** Target egg requirements according to the 2.4 eggs/m<sup>2</sup> have been met only once since 1979 (1987); a significant contribution to egg deposition comes from hatchery-origin fish of Liscomb River stock. The 1992 escapement resulted in egg deposition of approximately one-tenth of nominal target.

**Forecast for 1993:** Forecasts of 1SW returns are unavailable. An annually-updated relation between 1SW returns in year t and MSW returns in year t + 1 has become progressively less reliable over the past few years (p=0.06), and predicts a return of 30 MSW salmon (90% CI 0-94) in 1993.



## Appendix 4

**STOCK:** LaHave River above Morgan Falls Fishway, SFA 21

**TARGET:** Under development for this acid-stressed river

Year	1987	1988	1989	1990	1991	1992 <sup>1</sup>	MIN <sup>2</sup>	MAX <sup>2</sup>	MEAN <sup>2</sup>
<b>Harvest:</b>									
Recreational									
-small <sup>3</sup>	2562	1585	2411	2008	233	1058	233	2562	1760
<b>Counts:</b>									
- Wild 1SW	2529	2464	2087	1880	495	1915	495	2529	1839
- Wild MSW	532	390	511	396	236	215	236	596	441
- Hatchery 1SW <sup>4</sup>	573	1026	443	402	109	574	109	1026	448
- Hatchery MSW <sup>4</sup>	79	59	183	118	90	58	59	183	101
	3713	3939	3224	2796	930	2762	930	3939	2829
<b>Return rate of hatchery smolts:</b>									
- 1SW (%)	2.45	3.92	1.89	1.72	0.87	1.29	0.87	3.92	2.17
- MSW (%)	0.97	0.23	0.61	0.39	0.22	0.46	0.22	0.97	0.48
<sup>1</sup> Preliminary data. <sup>2</sup> For the period 1986-1991. <sup>3</sup> Retained catch taken mostly below the enumeration site. <sup>4</sup> Mostly as a result of smolt releases.									

**Recreational catches:** Catches are for the entire river rather than only those from the stock above Morgan Falls. Retention of MSW catch since 1983 has been prohibited, but large numbers have been released after hooking.

**Data and assessment:** Spawner counts are made at a fishway at a natural falls, 25.3 km above tidehead.

**State of the stock:** Target egg requirements according to the 2.4 eggs m<sup>-2</sup> (approx. 2,800 1SW and 500 MSW salmon for the entire river; 60% of the drainage is below Morgan Falls) have been exceeded except for 1991, but the adequacy of that rate under conditions of some acid stress is uncertain at this time.

**Forecast for 1993:** A significant regression of wild MSW counts at Morgan Falls on wild 1SW counts at Morgan Falls in the previous year (18 years) forecasts a count of 423 MSW salmon in 1993.

**Conditions in 1992:** River discharge during the angling season declined, but was adequate until mid-July when low flows persisted until mid-October.

## Appendix 5

**STOCK:** Saint John River, N.B. (above Mactaquac) SFA 23  
**TARGET:** 29.4 million eggs (4,400 MSW and 3,200 1SW fish)

Year	1987	1988	1989	1990	1991	1992 <sup>3</sup>	MIN	MAX	Mean
<b>Harvest:</b>									
Native									
- small	280	300	560	273	657	560	273 <sup>2</sup>	657 <sup>2</sup>	414 <sup>2</sup>
- large	1120	1200	240	247	957	748	240 <sup>2</sup>	1200 <sup>2</sup>	753 <sup>2</sup>
Recreational:									
- small	1650	1755	2304	2110	1690	2104	1151 <sup>1</sup>	3580 <sup>1</sup>	2256 <sup>1</sup>
<b>Counts:</b>									
- 1SW	7972	9191	9587	7907	7575	7664	4140 <sup>1</sup>	17314 <sup>1</sup>	8859 <sup>1</sup>
- MSW	3430	2600	4291	3919	4226	4203	2010 <sup>1</sup>	10451 <sup>1</sup>	5221 <sup>1</sup>
<b>Returns:</b>									
- 1SW	9237	10180	10861	8804	8751	8940	4946 <sup>1</sup>	19275 <sup>1</sup>	10311 <sup>1</sup>
- MSW	4832	3537	4541	4125	5215	4898	3537 <sup>1</sup>	13916 <sup>1</sup>	7501 <sup>1</sup>
<b>Spawning:</b>									
- 1SW	7020	7810	7533	6057	5721	5128	5721 <sup>2</sup>	7810 <sup>2</sup>	6828 <sup>2</sup>
- MSW	2758	1704	3491	3202	3481	3269	1704 <sup>2</sup>	3491 <sup>2</sup>	2927 <sup>2</sup>
<b>% of Target met:</b>									
- 1SW	219	244	235	189	179	160	179 <sup>2</sup>	244 <sup>2</sup>	213 <sup>2</sup>
- MSW	63	39	79	73	79	74	39 <sup>2</sup>	79 <sup>2</sup>	67 <sup>2</sup>
<sup>1</sup> For the period 1975-1991.									
<sup>2</sup> For the period 1987-1991.									
<sup>3</sup> Preliminary data.									

**Harvests:** MSW salmon have not been retained since 1984; up to 1990, 1SW landings have ranged from 311 in 1972 to 3,580 in 1976. The native fishery, lower than that of 1991, approximated the mean of the previous five years.

**Data and methodology:** Counts of fish obtained from the collection facility at Mactaquac Dam; returns to Dam equal counts plus estimates of down river removals. Spawners equal releases above Mactaquac minus estimates of upriver removals.

**State of the stock:** Target egg requirements have been met only three times in the last 15 years (1980, 1984, 1985); 1SW escapement contributed to about 6% of the target egg deposition; hatchery fish comprised 25% of 1SW and 16% of MSW returns in 1992.

**Forecast:** A relationship between egg depositions and wild 1SW returns indicates a return of 6,100 or 7,500 wild 1SW fish in 1993, depending on the forecast model. Another relationship between wild 1SW returns, their fork length and MSW returns including those predicted to have benefited by the moratorium on the Newfoundland commercial fishery, forecasts 3,800 or 4,400 wild MSW returns in 1993, depending on forecast model. The product of the numbers of hatchery releases and recent return rates suggest hatchery returns in 1993 of 1,900 1SW and 1,000 MSW salmon. Total 1SW returns could be 8,000 or 9,400 1SW fish; total MSW returns could be 4,800 or 5,400 MSW salmon. Zero to 15% of the forecast MSW returns could be the result of the 1992 moratorium on the Newfoundland commercial fishery. Target spawning requirements do not include approximately 400 MSW broodstock required to seed Mactaquac Hatchery or spawners required for salmon development in the Aroostook River or above Grand Falls.