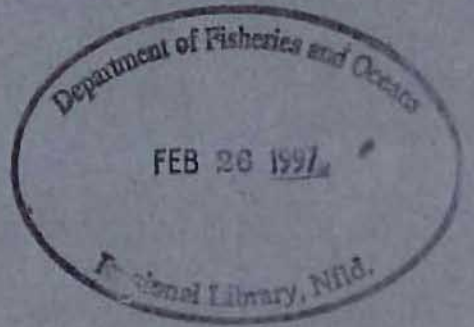


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# Proceedings of the 1996 Newfoundland Region Salmonid Stock Assessment Meeting

M. F. O'Connell (editor)



Science Branch  
Department of Fisheries and Oceans  
P.O. Box 5667  
St. John's, Newfoundland A1C 5X1

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Salmonid Stock Assessment Meeting**

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M. F. O'Connell (editor)

Science Branch  
Department of Fisheries and Oceans  
P.O. Box 5667  
St. John's, Newfoundland A1C 5X1

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### **Abstract**

O'Connell, M. F. (ed.). 1997. Proceedings of the 1996 Newfoundland Region salmonid stock assessment meeting. Can. MS Rep. Fish.Aquat. Sci. 2385: iv + 47 p, 5 appendices.

The third annual Newfoundland Region Salmonid Stock Assessment Meeting was held in St. John's on February 26 - March 1, 1996. The status of Atlantic salmon in general and for 21 individual rivers in 1995 was examined. An overview of landings in the Arctic charr commercial fishery in Labrador in 1995 was also reviewed. Data and analyses involved in status of stock determinations were contained in 16 working papers. For Atlantic salmon, information obtained from a series of public meetings held in Newfoundland and Labrador in the fall of 1995 were incorporated into the assessment process. This report presents summaries of each of the working papers, stock status summary sheets for individual rivers, minutes of the public meetings, and a discussion of issues related to the data used in stock assessments.

### **Résumé**

O'Connell, M. F. (ed.). 1997. Proceedings of the 1996 Newfoundland Region salmonid stock assessment meeting. Can. MS Rep. Fish.Aquat. Sci. 2385: iv + 47 p, 5 appendices.

La troisième Réunion annuelle d'évaluation des stocks de salmonidés de la Région de Terre-Neuve a eu lieu à St. John's du 26 février au 1<sup>er</sup> mars 1996. On a examiné la situation du saumon de l'Atlantique en général et dans 21 rivières en 1995. On a aussi étudié un compte-rendu des débarquements de la pêche commerciale de l'omble arctique pratiquée au Labrador en 1995. Seize documents de travail contenant des données et des analyses associées à la détermination de l'état des stocks ont été présentés. Dans le cas du saumon de l'Atlantique, les informations tirées d'une série d'assemblées publiques tenues à Terre-Neuve et au Labrador durant l'automne 1995 ont été intégrées au processus d'évaluation. Le présent rapport fournit un résumé de chacun des documents de travail, des feuilles de résumé sur l'état des stocks dans diverses rivières, les procès-verbaux des assemblées publiques et un examen des facteurs associés aux données qu'on emploie pour évaluer les stocks.

## INTRODUCTION

The third annual Newfoundland Region Salmonid Stock Assessment Meeting was held on February 26 - March 1 at the Northwest Atlantic Fisheries Centre in St. John's. In addition to Department of Fisheries and Oceans (DFO) scientific and resource management staff, the meeting was attended by representatives of the Government of Newfoundland and Labrador, Parks Canada, and Memorial University of Newfoundland. Working papers containing information and analyses related to status of stocks, estimates of population size, and future abundance were presented and discussed. The assessment process incorporated information obtained from a series of public meetings on science issues that were held throughout the region in the fall of 1995.

This report contains a summary of each of the working papers presented and associated discussion. Complete details of the data and methodologies used in the assessments will be published in the DFO Atlantic Fisheries Research Document series. Additional summaries, environmental considerations, future prospects, and management issues are presented in Anon. (1996)<sup>1</sup>. A copy of the agenda is shown in Appendix 1, the list of participants in Appendix 2, the list of working papers in Appendix 3, and minutes of the public consultations in Appendix 4.

## SUMMARIES OF PRESENTATIONS

A total of 16 working papers was presented, 15 on Atlantic salmon and 1 on Arctic charr. One paper provided a general overview of the status of Atlantic salmon at the SFA, sub-regional, and regional levels. Trends in recreational fishery catch and effort data, commercial fishery data (Labrador only), and counts at counting facilities were examined in relation to the 1995 Management Plan and the moratorium on the Atlantic salmon commercial fishery, which was implemented in 1992 and entered its fourth year in 1995. Papers were presented that examined the status of Atlantic salmon in relation to target spawning requirement for 21 rivers and also compared total river escapements, spawning escapements, and estimates of total population size (certain rivers) prior to and during the commercial fishery moratorium. A prognosis of anticipated returns for 1996 was presented for certain stocks. Elements of the results of these analyses for individual rivers are shown in the attached Summary Sheets (Appendix 5). A map showing the Salmon Fishing Areas (SFAs) of the Newfoundland Region, the individual rivers assessed, and percent of target egg deposition requirement achieved for each river in 1995 is provided in Fig. 1. A paper was presented that provided a preliminary analysis of information obtained from the first year of the implementation of the Atlantic salmon angler license stub return system in the Newfoundland Region. The paper on Arctic charr presented information on commercial fishery landings for 1995 as well as historical landings, quotas, and the results of an in-river experimental fishery .

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<sup>1</sup>Report on the status of Atlantic salmon stocks in eastern Canada in 1995. DFO Atlantic Fisheries Stock Status Report 96/80.

**Status of Atlantic salmon (*Salmo salar* L.) stocks of the Newfoundland Region, 1995** by M. F. O'Connell, J. B. Dempson, C. C. Mullins, D. G. Reddin, N. M. Cochrane, and D. Caines

The five-year moratorium on the commercial Atlantic salmon fishery in insular Newfoundland entered its fourth year in 1995. There were further reductions in commercial quotas in Labrador and the opening of the commercial fishery was delayed from June 5 to July 3. The objective of the delayed season was to allow a greater escapement of large salmon into rivers in Labrador. The moratorium placed on the Northern Cod Fishery in 1992, which should have eliminated by-catch of Atlantic salmon in cod fishing gear in Salmon Fishing Areas (SFAs) 1-9, continued in 1995. The moratorium on cod fishing introduced in SFAs 11-14A in August 1993 also continued in 1995. Commercial salmon fishery quotas were not caught in any of the SFAs of Labrador in 1995.

While the total catch (retained plus released fish) of small salmon in the recreational fishery for all of Labrador in 1995 was similar to 1994, the catch of large salmon increased. A similar pattern was noted for retained small and large salmon catches; CPUE in 1995 was the highest in recent years. Recreational catches of small and large salmon in SFA 14B, an area of concern in 1994, improved in 1995. Estimated total population sizes (before any fisheries) of small (1SW) and large (2SW) salmon for Labrador in recent years were low compared to the late 1970s and early 1980s. In spite of continued restrictions on fisheries, compared to 1992-95, estimated spawning escapements of 1SW salmon in Labrador have been as high or higher in the past. Estimated spawning escapements of 2SW salmon however, have increased since the low observed in 1991, with the highest on record being achieved in 1995. The continued increase in spawning escapements of 2SW salmon in the face of declining total population sizes is consistent with the intent of management measures. However, spawning escapements of 2SW salmon in recent years, including 1995, remained below target requirement. Below average spawning escapements in 1990 and 1991 could contribute to lower future returns relative to 1995, should natural survival remain the same.

In insular Newfoundland, many rivers, particularly in SFAs 6-10, were closed to angling for 1-2 weeks in July; other closures of similar duration occurred in mid-late August. In SFA 13, seven rivers were closed to angling on July 10 or 17 for the remainder of the season after an in-season review indicated total returns for 1995 would be less than 50% of target requirement. In spite of the closures, effort expenditure overall in 1995 for insular Newfoundland was the highest recorded, slightly above that of 1994; however, overall CPUE was below the mean for 1992-94 and comparable to the 1984-89 and 1986-91 means. Total returns of small and large salmon in the moratorium years 1992-95 improved significantly over the 1986-91 mean for rivers on the western Northern Peninsula and along northeast and east coasts, but many rivers along the south coast and particularly those in Bay St. George did not improve. Levels of recreational catch and returns to counting facilities, in the absence of commercial fisheries, suggest the overall total population sizes of small salmon for insular Newfoundland in 1992-95 were low relative to pre-salmon moratorium years. An analysis of trends in estimated total population sizes of small salmon for Gander River (SFA 4), Middle Brook (SFA 5), Biscay Bay River (SFA 9), Humber River (SFA 13), and Western Arm Brook (SFA 14A) for the period 1974-95, supports this conclusion. Spawning escapements for these rivers in 1991 were among the lowest on record; also, angling data overall and counts of small salmon at several counting



facilities indicate that in general spawning escapements were among the lowest on record in 1991. This suggests that returns to Northern Peninsula East and Eastern (SFAs 3-8) and Northern Peninsula West (SFA 14A) rivers in 1996 could be lower than observed during the moratorium to date and returns to South (SFAs 9-11) and Southwest (SFAs 12-13) rivers could continue at the low levels similar to those of the past few years, if natural survival rates remain low.

**The status of the Atlantic salmon stock on the Humber River, 1995 by C. C. Mullins and D. G. Reddin**

Based on the angling exploitation rate derived by the mark-recapture method, 129% of the target spawning requirement was achieved in 1995. This was the highest estimated spawning escapement in 20 years.

The Petersen single census and Darroch stratified estimates of small salmon returns to the Humber River in 1995 were almost identical. While, there was some variation in recapture probabilities among the two recapture strata of the Darroch, the mean of the Darroch recapture probabilities (0.19) was very similar to the overall angling exploitation rate (0.18). It was noted that this was the result of pooling of several of the initial strata which was necessary for the Darroch estimator as a result of low numbers of tag recaptures in some strata. If the number of recaptures had been large enough to maintain the initial number of strata, the Darroch stratified estimate of small salmon returns would probably have been a more appropriate estimator than the single census estimate in 1995.

An increase in total spawning escapement in the Humber River in 1995 compared to 1994 was anticipated as a result of the increased spawning escapement in 1990 compared to 1989. However, the magnitude of the increase was much greater than the maximum value anticipated. The increase may be a function of variability in the recruit to spawner relationship.

The current assessment of the status of the Humber River salmon stock is based on returns to the river in June-August. While returns in June-August represent by far the majority, there is anecdotal evidence that a run of large salmon enters the river in the fall. There has been some discussion among angling organizations in recent months about a fall fishery on this stock component given that the status of the Humber stock in general appears to have improved. The following points need to be kept in mind in this discussion:

1. Small salmon recruits from the first post-moratorium year-class (1992) will not return to the Humber River until 1997 and 1998 based on the smolt-age distribution observed in 1995 and large salmon recruits will not return until 1998 and 1999. Therefore, if the fall run is comprised mainly of large salmon as suggested, they should not be exploited until they have had the full benefit of the commercial fishery moratorium, similar to the small salmon component.
2. We have little or no information on either the abundance or the biology of salmon entering the Humber River in the fall. If the popular assumption is correct that these fish are primarily virgin large

salmon, then they are indeed a unique stock component because large salmon that enter the Humber River in June-August are primarily repeat spawners.

3. The recreational catch of small salmon in the Humber River increased in 1995 compared to the catch in 1994 but not compared to the 1992-94 mean or to years prior to the commercial moratorium. In contrast, it is apparent from stock assessments conducted in 1992-94 that total returns to the river have increased since the commercial salmon fishery moratorium but remain below historical levels.

The interpretation of trends in annual recreational catch and effort data is confounded by the unknown effect of the various catch and effort controls which have been implemented in the recreational fishery in recent years and have succeeded in keeping catches at a low level compared to historical levels. In addition, discrepancies exist between catch data reported by DFO at Big Falls on the Humber River and those based on creel survey results which suggest that total catches may be underestimated in the DFO catch statistics by as much as 50%. This is not surprising given that the proportion of catches and effort actually observed, as opposed to estimated, by the DFO river guardians in recent years has declined. In 1995, actual observed catches and effort accounted for only 35% of the total (observed + estimated) catches and effort. This compares with the 30% of catches observed in 1994 but both the 1995 and 1994 values are much lower than the 80% of catches observed in years prior to 1990. In 1991 and 1994, when catches in the Humber River were at their lowest level in recent years, there was little difference between the DFO Guardian and creel survey results. In contrast, it appears that in 1992, 1993 and 1995, when angling catches were higher, the greatest discrepancy occurred between the two estimates of catch at Big Falls. It appears that it is more difficult to obtain accurate catch data by the traditional methods when catches are high. If this is true for other rivers then population sizes derived from catch statistics will be underestimated on these rivers.

The high effort on the Lower segment of the Humber River in 1995 and 1994 compared to the 1992-93 mean was probably due to the increase in catches of large salmon on this section of the river, indicating an increase in the abundance of large salmon.

The anticipated spawning escapement for 1996 based on trend analysis is below the target spawning requirement. However, the variability in recruitment must be kept in mind with respect to estimates of anticipated returns.

In a stock with a healthy spawning population it is suggested that points in the spawner-recruit relationship should fall above and below the line in a 50:50 distribution. Also, the points should fall above the target spawning line which in the case of the Humber occurred in three years of four years (1992, 1993, and 1995) since the closure of the commercial salmon fishery. We conclude from this that the Humber River salmon stock, while being below target spawning in some years, is now in a position to increase in size.

**Status of Atlantic salmon (*Salmo salar* L.) in Gander River, Notre Dame Bay (SFA 4), Newfoundland Region, 1995 by M. F. O'Connell, D. G. Reddin, and E.G.M. Ash**

The status of Atlantic salmon in Gander River in 1995 was determined using counts of small and large salmon from a counting fence located on the main stem just above head of tide, recreational fishery data, and biological characteristics information. The assessment was conducted in relation to the five-year moratorium on the commercial Atlantic salmon fishery, which entered its fourth year in 1995. The proportion of target egg deposition requirement achieved in 1995 was 93% which compares to 112% in 1992, 135% in 1993, 89% in 1994, and 33-36% for the pre-moratorium period 1989-91. Numbers of small salmon spawning during 1989-91 were the lowest recorded since 1974. There was a significant decline in estimated total population sizes of small salmon during the period 1974-95. Recruitment during 1989-95 was among the lowest in the time series. The number of recruits per spawner for 1995 was the highest since 1988, probably the result of increased sea survival. Anticipated returns of small salmon in 1996 will be below target requirement, without a recreational fishery. For the period June 17 - July 5, of the small and large salmon examined, 16.9% and 46.1% possessed net marks.

In 1995, for the first time, there was a fall hook-and-release fishery in the main stem of Gander River below Gander Lake, from September 9 to October 8. During this period, 30 small and 9 large salmon were caught; effort expended was 158 rod days.

**Ratio of adults to experimental ponds area juveniles in a prediction of Atlantic salmon (*Salmo salar* L.) returns to the Gander River, Newfoundland in 1996 by P. M. Ryan, R. Knoechel, M. F. O'Connell, and E.G.M. Ash**

Spring population sizes of juvenile Atlantic salmon were determined by Schnabel multiple, mark-recapture methods in two Experimental Ponds Area (EPA) lakes at the headwaters of the Gander River from 1979-95. Juvenile abundance in 1995 was considerably higher than expected as indicated by a previously derived stock-recruit relationship between juvenile abundance and adults returning to the Salmon Brook fishway on a lower river tributary four years earlier.

Total river adult (small salmon <63 cm) returns were obtained over the period 1989-95 at the counting fence near the mouth of the river and the fish angled downstream of the fence. Changes in the ratios of returning small salmon to the EPA juvenile abundance one year earlier were indicative of a more than fourfold (4.8 X) increase in the average marine survival of Gander River salmon following closure of the commercial fishery in 1992. Total river adult returns in 1996 were projected from 1995 juvenile abundance and the post-commercial fishery ratio of returning small salmon to the juvenile abundance one year earlier. Projections indicate that 37,014 small salmon will return to the Gander River to spawn in 1996 and will exceed the estimated spawning requirement in 1996.

Use of this method (ratio of adults to EPA juveniles) to predict the adult returns to the Gander River one year in advance has previously resulted in a conservative projection. The difference between the observed returns in 1995 and the returns projected from the juvenile 1994 data

represents 16% of the actual 1995 count, indicative of a slightly faster stock recovery than previously anticipated.

**Status of the Exploits River stock of Atlantic salmon (*Salmo salar* L.) in 1995 by C. E. Bourgeois, J. Murray, and V. Mercer**

The Exploits River was the site of an Atlantic salmon colonization program from 1957 to 1993. The 1995 count at the Bishop's Falls fishway of 16,655 (15,723 small and 941 large) adults was 97% of 1994 count. The 1995 total escapement to the Exploits (17090) was 93% of the 1992-94 mean, 213% of the 1987-91 mean, and 136% of the 1984-89 mean. In 1995 the lower, middle and upper Exploits received 99, 24, and 12% of the required egg deposition, respectively. Concern was noted with respect to the low egg deposition in the upper Exploits, which was adjusted to account for 1,000 adults transferred from Grand Falls to Red Indian Lake in 1995. In 1995 the Exploits River had a recreational fishery quota which yielded a catch (retained) of 1,336 fish which was below the 1990-94 mean of 1,619 fish and 43.5% of the 1994 catch.

**Stock status of Atlantic salmon from Conne River, SFA 11, Newfoundland, 1995 by J. B. Dempson and G. Furey**

Results obtained from a fish counting fence provided the basis for the assessment of the Conne River Atlantic salmon stock in 1995. Returns to home waters (river and estuary) were 3502 salmon < 63 cm in length (small) and 110 salmon ≥ 63 cm (large) in size. This represented an increase of 128% for small salmon in comparison with 1994 and was the highest return since 1990. Large salmon returns increased by 10% from 1994. Sea survival increased to the highest level since 1989-90 (5.8%). Egg deposition from small salmon contributed 76% of the target requirement. With the added contribution from large salmon, it was estimated that 81% of the required target egg deposition was achieved.

An enhancement project, initiated at Conne River in 1994, resulted in the stocking of about 128,000 fry in 1995. A mark-recapture study suggested a smolt run in 1995 of 62,749 (55,300-70,197). With survival similar to that of 1994-95, over 3,300 fish would be expected to return in 1996. A sea survival of about 7% will be needed in order for total returns to homewaters to meet or exceed 4,000 adult salmon.

Test fisheries were carried out in Bay d'Espoir to obtain information on relative abundance of escaped rainbow trout. While few trout were captured during the spring fishery, results during the fall would indicate rainbow trout are quite abundant in Bay d'Espoir. No evidence for predation on salmon was found.

Concern was expressed over the escapement of approximately 100,000 Atlantic salmon parr (30-35 g) from a local sea cage operation. These fish were of similar size to the wild Conne River smolts but are of Saint John River, New Brunswick, origin. Even at moderately low sea survival rates, the potential exists for large numbers of these fish to return as adults in 1997 and 1998.

**Status of Atlantic salmon (*Salmo salar* L.) in Northwest River, Bonavista Bay (SFA 5), Newfoundland, 1995** by B. J. Linehan and M. F. O'Connell

Prior to 1988, Northwest River was managed entirely by the Department of Fisheries and Oceans. In 1988, the lower 2.5 km of the river were gazetted into Terra Nova National Park by revisions to the National Parks Act. In 1989, the Park began to manage this section of the river using the National Park license and tagging system. A counting fence was operated in Northwest River for the first time in 1995. The fence was located 0.6 km upstream from the mouth of the river and operated from June 6 to November 1. During this period, 498 small and 135 large salmon were enumerated. Northwest River achieved 40% of target egg deposition requirement in 1995. It is anticipated that returns of small salmon in 1996 will be less than 50% of requirement.

**Status of the Atlantic salmon stock on Harry's River/Pinchgut Brook, 1995** by C. C. Mullins, D. Caines, F. F. Downer, and S. L. Lowe

Harry's River in SFA 13 is potentially the largest Atlantic salmon producing river in Bay St. George. However, the stock has been declining since the 1970s. A number of fisheries management measures have been put in place to stop the decline, including recreational quotas, complete closure of the commercial fishery in 1992, and in-season review of stock abundance. Thus far these measures do not appear to have resulted in significant improvements to the overall status of the stock on Harry's River. A maximum of 49% of the spawning target was achieved in 1992-95. However, potential egg depositions increased in 1992-95 on the Pinchgut Brook tributary system which is the main salmon spawning area of the Harry's River. The recreational fishery on Harry's River is currently controlled by an in-season review and a 350 fish river quota, but other factors such as severe poaching are believed to be contributing to the low spawning escapements.

The Pinchgut Brook tributary system is the uppermost headwater of Harry's River and based on the 1995 spawning survey, it is the primary spawning area for the system. Pinchgut Brook contains the largest proportion of the spawning habitat and the largest spawning escapement of any of the other thirteen major tributaries. Angling catches on the Pinchgut Brook system and other tributaries flowing into Georges Lake represented only 7.2% of the Harry's River catch in 1984-89. Considering that the stock is still at an extremely low level, it would be to the long term benefit of the salmon stock and to the fishery if this area were closed completely to angling in 1996 in order to preserve it as a spawning area.

Spawning escapements and egg deposition appear to have increased on both Harry's River and Pinchgut Brook in the last four years. However, spawning on Harry's River as a whole has been at most 49% of the target requirement based on this assessment. This is consistent with estimates of the stock status based on angling exploitation rates derived during the in-season review in 1994 and 1995. It is also consistent with the view of anglers expressed during public consultations in 1995 that Bay St. George rivers, with the exception of Grand Codroy and Little Codroy, have generally experienced poor returns in recent years. Severe poaching has also been identified as a long standing problem on Harry's River by both anglers and DFO guardians. It was suggested that mortalities

within the river could be as high as 50% of the run. If this is true, the target spawning requirements could be achieved by addressing this problem alone.

**Status of Atlantic salmon (*Salmo salar*) in the Highlands River, St. George's Bay (SFA 13), Newfoundland, 1995** by R. J. Gibson, K. G. Hillier, and R. R. Whalen

The smolt trap was operated from May 14 to June 8, at which time high water washed out the counting fence. The total smolt count was 9,009, but by using the proportion of the run that emigrated in the previous two years after June 8, the total smolt yield was estimated to be 10,000. About 2% of the smolts were sampled (178) through the run. Most smolts were 3+ (51%) and 4+ (42%), with smaller proportions of 2+ (4%) and 5+ (3%). The adult trap operated from June 12 to October 25, and 172 small salmon and 120 large salmon were enumerated. There is a substantial fall run. The potential egg deposition was estimated to be 68% of the target egg deposition. This was lower than that of the previous year (77%), but higher than that estimated in other years, 1980-82 (26-34%) and in 1993 (47%). Sea survival from the 1993 smolts of large and small salmon was 2.65%, which is low, but is more than double that of the smolt run in 1980 (1.21%). Estimates of juvenile salmon showed that the 0+ densities were higher than in previous years. Estimates of older juveniles was equivocal, possibly related to studies being undertaken later in the year than usual, when water levels were higher. A number of beaver dams on small tributaries were removed to allow access to adult salmon. Improperly placed culverts on some tributaries are barriers to migration to adult and juvenile fish. Sedimentation from logging roads and erosion may have negative effects on production.

**Status of Atlantic Salmon (*Salmo salar* L.) in eleven rivers of Bay St. George (SFA 13), Newfoundland** by D. G. Reddin and C. C. Mullins

This paper provides details on the status of salmon stocks in 11 rivers of Bay St. George, Newfoundland. Bay St. George rivers have in the past been high producers of multi-year salmon or salmon that spend multiple years at sea. Estimates of available parr-rearing habitat in each river including stream and some pond habitat are used to provide target egg deposition rates consistent with biological conservation. Angling catches and exploitation rates, developed from rivers in Bay St. George with counting facilities and adjusted for run timing, are used to estimate total river returns for rivers without counting facilities. Stock status is provided in terms of achievement of target egg deposition rates. The results indicate that with the exception of Little and Grand Codroy rivers, no rivers in Bay St. George have achieved target egg deposition in recent years. Total recruits for Bay St. George salmon stocks have declined in recent years from higher numbers of recruits in the early 1960s and 1970s. Consistent with anglers observations, the numbers of salmon in freshwater have increased in 1992-94 compared to previous years.

**Assessment of the Atlantic salmon population of Sand Hill River, Labrador, 1995** by D. G. Reddin, P. B. Short, M. F. O'Connell, and A. D. Walsh

The status of Atlantic salmon in 1995 was determined for Sand Hill River, Labrador which

is located in Salmon Fishing Area (SFA ) 2. Assessments were conducted in relation to reduced Atlantic salmon commercial fisheries in Labrador due to quota restrictions and the five-year moratorium on the commercial salmon fishery in insular Newfoundland, which entered its fourth year in 1995. Target spawning requirements were derived using a habitat weighted model which utilizes separate conservation target egg deposition values for fluvial and lacustrine habitats. In 1995, an aerial habitat survey was done and a new target was established. The new egg deposition target is  $23.544 \times 10^6$  which translates into 4,211 small and 1,805 large salmon, based on the average biological characteristics in 1994-95. Total returns to Sand Hill River adjusted for lateness of installation of the counting fence were 2,781 small and 559 large salmon. In 1995, the proportion of egg deposition requirement achieved was 43.7%, an increase from the 39.1% achieved in 1994. While target egg deposition achieved in 1994-95 has increased relative to the 1970-73 period, it remains below 50%. The increased spawning escapements in 1994-95 relative to earlier years were directly attributable to the Salmon Management Plan that reduced commercial fishing exploitation by closing the commercial salmon fishery in insular Newfoundland, reductions in fishing effort in Labrador due to license buy-outs, and the delay in the opening date to 3 July in 1995.

The review committee expressed concern over the missing data caused by high water but concluded that the adjusted counts provided an accurate estimate of the number of salmon entering Sand Hill River in 1995. Of more concern are the continuing declines in the total population including salmon caught in the commercial fishery, which have declined from a mean of 6,000 small and 6,806 large salmon in the period 1970-73 to 2,821 small and 1,225 large in 1994-95. The decline in large salmon is especially significant due to their economic importance and contribution to the egg deposition. Future management plans should take into consideration the current reduced population size and continue with efforts to maintain exploitation as low as possible.

#### **Status of the Atlantic salmon stock on Forteau River, 1995 by S. L. Lowe and C. C. Mullins**

For the 1995 assessment, the counting fence location was changed from the previous year in order to eliminate the problem of high angling exploitation on fish holding up below the fence. A habitat survey was also completed in 1995 which indicated that a total of 551,500 m<sup>2</sup> of fluvial area and 896 ha of lacustrine area were available to salmon for rearing in the river. Based on the available habitat, the target spawning requirement for the Forteau River was estimated at 1,417,680 eggs. It was recommended by the review committee that the biological characteristics of female salmon since 1992 be used when expressing the spawning target in terms of fish. Seventy-four percent of the target egg deposition was achieved in 1995 compared to 46% in 1994.

The method used to calculate the target spawning requirement for the Forteau River has a number of limitations which are difficult to quantify. The stream survey completed in 1995 may have underestimated the amount of juvenile rearing habitat available in the Forteau River because habitat varies with water level. In addition, the stream survey on individual tributaries ended when a complete obstruction was encountered. During the 1995 survey, salmon parr were found above several obstructions which had been judged in the past to be impassable to migrating salmon. Habitat preference by juvenile salmon, the atresia of eggs in the ovary, the degree of dispersion of juveniles

from the spawning grounds, and the possible interaction of anadromous and landlocked forms are also potential limitations to full utilization and seeding of the available habitat. However, the method used was accepted as a reasonable standard for the evaluation of stock status.

The main limitations on using the angling exploitation rate from 1995 to retrospectively estimate returns to the river prior to 1994, when there was no counting fence in place, is that it does not account for annual variability in angling pressure which would normally occur as a result of changes in run-timing, water levels on the river, and management restrictions.

It was noted that the return of small salmon to the Forteau River in 1995 was the same as in 1994 but the return of large salmon was 91% above the return in 1994. The return of small salmon in 1995 and 1994 was lower than the pre-moratorium mean for 1987-91. The return of large salmon in 1995 was higher than the 1987-91 mean while the return in 1994 was similar to the mean.

In the recreational fishery, the retained catch of small salmon in 1995 was below the catch in 1994 and below the 1987-91 mean, but the catch of large salmon in 1995 was the second highest since 1989. It was noted that the reduction of the recreational bag limit of large salmon from two in 1994 to one in 1995 would have contributed to lower angling catches of large salmon in 1995 but that the practice of "high-grading" (releasing grilse to keep large salmon) would have increased the catch of large salmon. The closure of the estuary to angling with spinning gear in 1995 would have also had a positive impact on small and large salmon returns by increasing the survival of kelts returning to the river as consecutive spawners.

**Status of five enhanced Atlantic salmon (*Salmo salar*L.) stocks of the Newfoundland Region in 1995** by C. E. Bourgeois, J. P. Davis, J. Murray, and V. Mercer

The status of Atlantic salmon was determined for four systems, namely Rocky River, Piper's Hole River, Little River, and Flat Bay Brook, which are presently undergoing salmon enhancement activities. The systems are located in Salmon Fishing Areas (SFAs) 9, 10, 11, and 13 respectively. Egg deposition for each watershed was 33.0, 22.0, 21.7, and 28.8% respectively of the target egg deposition requirement. Of these systems only Little River would have benefited in 1995 from previous stocking activities. Rocky River has never been open for salmon angling, Little River has been closed since 1987, and Flat Bay Brook was closed in 1995. The target egg deposition achieved in 1995 for Piper's Hole River may be an underestimate due to a fence washout. Romaines River, an unscheduled river in SFA 13, was stocked for the first time in 1995 with 39,577 unfed fry. Total returns for the system were unavailable in 1995.

**Status of Atlantic salmon (*Salmo salar* L.) in eight rivers in the Newfoundland Region, 1995** by M. F. O'Connell, D. G. Reddin, and C. C. Mullins

The status of Atlantic salmon in 1995 was determined for Campbellton River located in Salmon Fishing Area (SFA) 4, Middle Brook and Terra Nova River in SFA 5, Biscay Bay River in SFA 9, Northeast River in SFA 10, and Lomond River, Torrent River, and Western Arm Brook in



SFA 14A. Assessments were conducted in relation to the five-year moratorium on the commercial Atlantic salmon fishery, which entered its fourth year in 1995. Target spawning requirement was not met in Terra Nova River and Biscay Bay River; target was exceeded in all the remaining rivers. Compared to the late 1970s and early 1980s, since 1989, estimated total population sizes of small salmon for Middle Brook, Biscay Bay River, and Western Arm Brook have been quite low. Estimated total river returns of small salmon for Middle Brook and Western Arm Brook in 1996 are expected to exceed target requirement; returns to Biscay Bay River are expected to be below target. An estimated 5.0% of Atlantic salmon entering Campbellton River in 1995 possessed net marks, compared to 6.2% in 1994; these are minimum estimates.

**Preliminary results of the license stub return system in the Newfoundland Region, 1994 by M. F. O'Connell, E.G.M. Ash, and N. M. Cochrane**

A license stub return system was implemented in the Newfoundland and Labrador Atlantic salmon recreational fishery in 1994. Of a total of 22,596 licenses sold, overall response rate after a voluntary period and three post prompts was 55%. Response rates for residents and non-residents were similar. Catch and participation rates for anglers returning stubs voluntarily were higher than for anglers who had to be prompted. Estimates of effort expenditure from the stub return system were generally lower than reported by Department of Fisheries and Oceans (DFO) River Guardians while the reverse was true for catches of small and large salmon, in both the kept and released categories. The difference in estimates of catch between methods was greater for released fish than for kept fish. In the present analysis, extrapolation of reported catch and effort to the entire population did not account for non-response bias and recall bias, which could be sources of substantial error. In future it is imperative that resources for a formal investigation of potential bias be incorporated into the system.

**Northern Labrador Arctic charr: catch and effort update for 1995 by M. Shears and J. B. Dempson**

Northern Labrador Arctic charr landings in 1995 totalled 30 t, and were similar to 1994 but 65% below the previous ten year (1985-94) mean of 86 t. Charr landings from the Nain Fishing Region were 25 t or 85% of the northern Labrador total. Most of this (73%) originated from subareas north of Black Island. Over 10 t of charr were caught at Okak Bay. Effort was the lowest recorded in 22 years and is largely related to the licence buy-out program. Catch rates in the Okak stock unit remained high. Atlantic salmon landings were summarized for the period 1977-95. Salmon landings in 1995 remained low.

An experimental in-river harvest for Arctic charr at Southwest Arm Brook, Saglek Fiord, caught 8,815 charr. Of this, 1,534 fish were removed for commercial harvest. Aerial surveys of rivers in the Voisey's Bay area identified large concentrations of charr (> 200 fish/pool) in Ikadlivik Brook. Smaller concentrations (< 50 charr/pool) were observed in the Kogluktokoluk and Reid brook systems.

## GENERAL DISCUSSION

Unrecorded mortality in freshwater in relation to estimates of spawning escapement and egg deposition continues to be an issue. Potential sources of unrecorded mortality include poaching activity, hook-and-release fishing, and natural causes. The target egg deposition rate for fluvial habitat currently used throughout Atlantic Canada for Atlantic salmon is 240 eggs/100 m<sup>2</sup>. Removals due to poaching and disease have been incorporated into this value. In insular Newfoundland however, a substantial proportion of production also comes from lacustrine habitat. The target egg deposition rate for lacustrine habitat is 368 eggs/ha, but there is no allowance for removals due to factors such as poaching and disease. There have been no definitive studies on the magnitude of mortality from hook-and-release fishing in Newfoundland and Labrador. An opinion expressed at public meetings was that if the recommended hook-and-release protocols were strictly adhered to, mortality would be minimal. In light of the uncertainties surrounding unrecorded mortalities, estimates of egg deposition should be regarded as 'potential'.

For the past several years, there have been concerns that continual management changes in the recreational fishery have seriously eroded the usefulness of angling data for historical comparisons, especially in terms of abundance indices. The accuracy of angling data provided by DFO River Guardians continues to be questioned, which has implications for the calculation of egg deposition. Independent creel surveys for Big Falls, Humber River have shown that DFO Guardians have underestimated catches by as much as 50%. Estimates of catch by DFO River Guardians were also generally lower than determined from the angler license stub return system in 1994 while estimates of effort expenditure were higher. These discrepancies could also be due in part to failure to account for non-response bias and recall bias in the stub system.

Most information on the amount and type of fluvial Atlantic salmon habitat in insular Newfoundland and Labrador comes from river surveys conducted from helicopter, with minimal groundtruthing. Subsequent measurements obtained by ground surveys for several of these rivers varied by as much as plus or minus 50% of the earlier helicopter based estimates. In insular Newfoundland, helicopter surveys utilized 1:50,000 topographical maps. In Labrador however, surveys were based on 1:250,000 topographical maps, which eliminated the inclusion of substantial amounts of habitat contained in smaller tributaries. Surveys to refine estimates for Sand Hill and Forteau rivers in Labrador were conducted in 1995. Efforts are continuing to determine the amount of lacustrine habitat available for rivers in several SFAs.

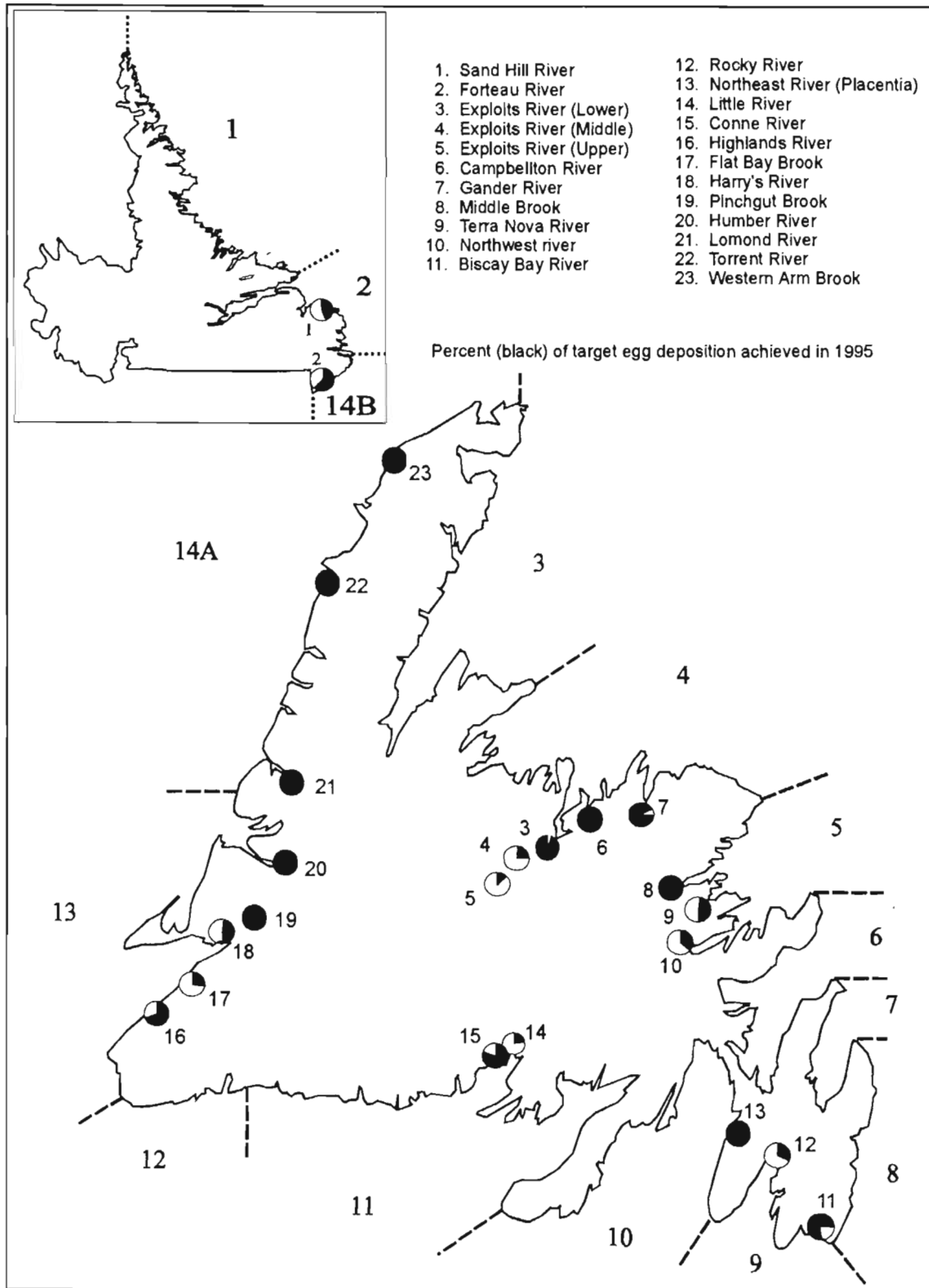


Fig. 1. Map showing the Salmon Fishing Areas of Newfoundland and Labrador, the locations of rivers assessed, and percent (black) of target egg deposition achieved in 1995.

**APPENDIX 1**

**Newfoundland Region Salmonid Stock Assessment Meeting  
February 26 - March 1, 1996  
A. T. Pinhorn Boardroom  
Northwest Atlantic Fisheries Centre, St. John's**

AGENDA

The meeting is scheduled to start on Monday, February 26 at 0900 hrs and to end on Friday, March 1 at 1200 hrs. The following is an outline of the topics slated for discussion and an order of presentation of working papers.

**Monday**

- (0900-1200) 1. Call to order (0900 hrs)
2. Finalization of agenda
3. The Newfoundland Region stock assessment and documentation process - summary and discussion; format and contributors to the Zonal/Interregional Report
4. Newfoundland Region Atlantic salmon general stock status report
5. Atlantic salmon license stub return results - a first look (could run into afternoon session)
- (1230-1700) 6. Atlantic salmon river-specific stock assessments
- 6.1 Humber River
- 6.2 Gander River
- 6.3 Gander River - juvenile production and predicted adult returns

**Tuesday**

- (0900-1200) 6.4 Exploits River
- 6.5 Conne River
- 6.6 Northwest River, Terra Nova National Park
- (1230-1700) 6.7 Harry's/Pinchgut
- 6.8 Highlands River
- 6.9 Bay St. George general status

**Wednesday**

- (0900-1200) 6.10 Sandhill River  
 6.11 Forteau River  
 6.12 Romaines River  
 6.13 Flat Bay Brook  
 6.14 Little River  
 6.15 Rocky River  
 6.16 Piper's Hole River
- (1230-1700) 6.17 LomondRiver  
 6.18 Torrent River  
 6.19 Western Arm Brook  
 6.20 Campbellton River  
 6.21 Middle Brook  
 6.22 Terra Nova River  
 6.23 Biscay Bay River  
 6.24 Northeast River, Placentia

**Thursday**

- (0900-1200) 7. Arctic Charr and trout
- (1230-1700) 8. Other business
- Material for Halifax Workshop, March 11-17

**Friday**

- (0900-1200) 10. Review of Newfoundland Region contribution to the Zonal/Interregional Report

**APPENDIX 2****List of Participants**

C. Bourgeois	DFO, Science, St. John's NF
G. Chaput	DFO, Science, Moncton NB
B. Dempson	DFO, Science, St. John's NF
D. Downer	Sir Wilfred Grenfell College, Corner Brook NF
D. Fong	Department of Natural Resources Government of Newfoundland and Labrador, Clarenville NF
G. Furey	DFO, Science, St. John's NF
R. Hinks	Conne River Band Council, Conne River, Bay D'Espoir NF
G. Kelland	DFO, Area Office - Eastern, St. John's NF
R. Knoechel	Department of Biology, Memorial University of Newfoundland St. John's NF
B. Linehan	Terra Nova National Park, Glovertown NF
D. Meerburg	DFO, Science, Ottawa ON
C. Mullins	DFO, Science, Corner Brook NF
M. O'Connell (Chair)	DFO, Science, St. John's NF
K. Pelley	DFO, Area Office - Eastern, Glovertown NF
R. Porter	DFO, Science, St. John's NF
D. Reddin	DFO, Science, St. John's NF
P. Ryan	DFO, Science, St. John's NF
B. Slade	DFO, Resource Management, St. John's NF
R. Whalen	DFO, Science, St. John's NF

**APPENDIX 3****List of Working Papers**

- Bourgeois, C. E., J. P. Davis, J. Murray, and V. Mercer. Status of five enhanced Atlantic salmon (*Salmo salar*L.) stocks of the Newfoundland Region in 1995.
- Bourgeois, C. E., J. Murray, and V. Mercer. Status of the Exploits River stock of Atlantic salmon (*Salmo salar* L.) in 1995.
- Dempson, J. B., and G. Furey. Stock status of Atlantic salmon from Conne River, SFA 11, Newfoundland, 1995.
- Gibson, R. J., K. G. Hillier, and R. R. Whalen. Status of Atlantic salmon (*Salmo salar*) in the Highlands River, St. George's Bay (SFA 13), Newfoundland, 1995.
- Linehan, B. J., and M. F. O'Connell. Status of Atlantic salmon (*Salmo salar* L.) in Northwest River, Bonavista Bay (SFA 5), Newfoundland, 1995.
- Lowe, S. L., and C. C. Mullins. Status of the Atlantic salmon stock on Forteau River, 1995.
- Mullins, C. C., D. Caines, F. F. Downer, and S. L. Lowe. Status of the Atlantic salmon stock on Harry's River/Pinchgut Brook, 1995.
- Mullins, C. C., and D. G. Reddin. The status of the Atlantic salmon stock on the Humber River, 1995.
- O'Connell, M. F., E.G.M. Ash, and N. M. Cochrane. Preliminary results of the license stub return system in the Newfoundland Region, 1994.
- O'Connell, M. F., J. B. Dempson, C. C. Mullins, D. G. Reddin, N. M. Cochrane, and D. Caines. Status of Atlantic salmon (*Salmo salar* L.) stocks of the Newfoundland Region, 1995.
- O'Connell, M. F., D. G. Reddin, and E.G.M. Ash. Status of Atlantic salmon (*Salmo salar* L.) in Gander River, Notre Dame Bay (SFA 4), Newfoundland Region, 1995.
- O'Connell, M. F., D. G. Reddin, and C. C. Mullins. Status of Atlantic salmon (*Salmo salar* L.) in eight rivers in the Newfoundland Region, 1995.
- Reddin, D. G., and C. C. Mullins. Status of Atlantic Salmon (*Salmo salar* L.) in eleven rivers of Bay St. George (SFA 13), Newfoundland.

Reddin, D. G., P. B. Short, M. F. O'Connell, and A. D. Walsh. Assessment of the Atlantic salmon population of Sand Hill River, Labrador, 1995.

Ryan, P. M., R. Knoechel, M. F. O'Connell, and E.G.M. Ash. Ratio of adults to experimental ponds area juveniles in a prediction of Atlantic salmon (*Salmo salar* L.) returns to the Gander River, Newfoundland in 1996.

Shears, M., and J. B. Dempson. Northern Labrador Arctic charr: catch and effort update for 1995.



**APPENDIX 4**

**The Results of  
DFO Public Meetings on  
1995 Atlantic Salmon Stock Assessments in  
Newfoundland and Labrador**

**Purpose:** to allow the public to have input into the stock assessment process.

**Background:** As in 1994, Science Branch augmented 1995 stock assessments by incorporating the knowledge of anglers and fishers through a series of public meetings which provided the opportunity for public input. This process provided fishers the opportunity to review the information available to assess the status of salmon stocks in 1995 and to provide information to scientists on their observations regarding the state of the resource. Each meeting began with a brief presentation by DFO scientists showing information on catch statistics and counts at enumeration facilities in the local area; then the proceedings were opened for public comment and input.

**Information requested from fishers included:**

- evidence of unrecorded mortalities (due to poaching, hook-and-release fishing, and natural causes, etc.) in inland waters
- effects of water levels and water temperatures on angling success
- perceptions of abundance of salmon in 1995
- how the 1995 management plan affected angling effort and success
- information on long-term population size in the local area.
- stock status of Little and Grand Codroy rivers versus other rivers in Bay St. George  
(SPECIAL QUESTION FOR SOUTH BRANCH)

**Public meeting locations and attendance, 1995:**

LOCATION	DATE	DFO	ANGLERS & ANGLER REPRESENTATIVES	TOTAL
Placentia	Oct. 24	5	13	18
Grand Falls	Nov. 1	5	8	13
South Branch	Nov. 6	2	6	8
Deer Lake	Nov. 8	4	24	28

## PLACENTIA, OCTOBER 24, 1995

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### 1. Evidence of unrecorded mortalities in inland waters.

#### *General*

- It was felt that poaching was a problem in the area. There were concerns over mortality of parr, smolts, and kelts by trout fishers. All felt that recorded catches of retained salmon should be adjusted upwards to offset unrecorded mortalities. An overall adjustment of 5-10% was suggested and accepted by attendees.

#### *Specific*

- Poaching is considered to be a serious problem in Northeast River. Poachers were apprehended this past summer at the pool immediately below the fishway. Poaching also occurs in the Junction Pond area of Northeast River.

### 2. Effect of 1995 water levels and water temperatures on angling success.

- Many Avalon Peninsula rivers were closed to angling in July and August due to low water levels and high water temperatures. One person felt that the decision to close Southeast River was not justified and questioned the criteria for determining closures. Others in attendance seemed to understand and support closures for low water levels and high water temperatures.

### 3. Perceptions of abundance of salmon in 1995.

- An increase in abundance of large salmon was noted for Southeast River (Placentia) in 1994 and 1995.
- Some anglers reported that a number of small salmon, smaller than the usual grilse size, were caught in Northeast and Southeast rivers.
- Several anglers stated that salmon are easier to catch in Northeast River than in Southeast River. The reason given for this was that the water is clear in Northeast but dark in Southeast, which makes salmon more visible in Northeast. Also the pools on the mainstem of the river are deeper in Southeast than Northeast. The overall conclusion was that exploitation as a percent of total returns will be higher in Northeast than in Southeast.

### 4. Effect of the 1995 management plan on angling effort and success.

- One person suggested that since very few salmon have been caught traditionally in August, the 3:3 seasonal bag limit split (3 fish prior to and after July 31) should be abandoned in

favour of a total season limit of 4 fish, with no split. This met with a lot of objections from people who felt that with a greater expenditure of effort, it is possible to retain the 3 fish in August.

#### **5. Information on long-term population size in the local area.**

- One person stated that while escapements appear to have improved in recent years in Southeast River, they are lower than in the 1940s. Higher populations of salmon in freshwater were also noted in scientific assessments for Biscay Bay River on the southern Avalon.

#### **6. Other**

- A counting fence was requested for Southeast River (Placentia) in order to determine the population size. It would be best if electronic counters could be used in both Northeast and Southeast rivers.

## **GRAND FALLS, NOVEMBER 1, 1995**

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#### **1. Evidence of unrecorded mortalities in inland waters.**

- There were opinions that poaching activity was down in 1995 compared to 1994 in both the freshwater and marine environments.
- People in attendance had no problem with hook-and-release fishing as long as it was done properly. Dead fish were seen in certain rivers in 1995, but it was not possible to attribute the cause to hook-and-release fishing.
- While it was felt that recorded catches of retained salmon should be adjusted upwards to offset unrecorded mortalities, an appropriate factor was not put forward.
- One person suggested that opening rivers to just retention during periods of higher water temperatures (i.e., below the temperature at which rivers are closed to angling) would eliminate potential mortality due to hook-and-release fishing, which most likely would increase with temperature.

#### **2. Effect of 1995 water levels and water temperatures on angling success.**

- Angling success for Campbellton River and Gander River (in August) appeared to be down this year due to warm water conditions, which prevailed at both low and high water levels. Anglers had to fish longer to catch fish.

### **3. Perceptions of abundance of salmon in 1995.**

- Fishing was poor in Campbellton River, and if data were not available from the counting fence, an erroneous conclusion of low abundance could be drawn.
- Rivers in the vicinity of Exploits River and on the western side of Notre Dame Bay (except for Point Leamington River) appear to have done well.

### **4. Effect of the 1995 management plan on angling effort and success.**

- Anglers indicated that the 3:3 bag limit split made it difficult to retain the 3 fish in August due to lack of fish entering rivers during that month. More effort was expended in August in an attempt to retain the 3 fish.

### **5. Information on long-term population size in the local area.**

- No information forthcoming.

### **6. Other.**

- There may be straying from Exploits to Charles Brook, Peters River, Northern Arm Brook, and Jumpers Brook.
- About 300 salmon were seen in Greenwood Brook by a Fishery Officer.
- An angler suggested that salmon be allowed to jump the dam at Bishops Falls and fish be counted while jumping.
- One angler was opposed to the transfer of salmon from the Bishops Falls fishway to the Grand Falls fishway.

## **SOUTH BRANCH (CODROY VALLEY), NOVEMBER 6, 1995**

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Due to the recommendations of the Bay St. George Working Group a series of special questions were posed at this meeting. The objective of the special questions was to obtain information on the stock status of Little and Grand Codroy rivers.

### **1. Stock status of Little and Grand Codroy rivers.**

- Local anglers agreed that the stock status of Little and Grand Codroy rivers were considerably better than rivers in Bay St. George, which in recent years have generally experienced poor returns.

It was felt that DFO estimates of large salmon were reasonable but that estimates of small salmon may be a little too high. One reason given for the better stock status of Little and Grand Codroy rivers compared to Bay St. George rivers may be in their geographic location.

## **2. Evidence of unrecorded mortalities in inland waters.**

- There were opinions that poaching activity was low in 1995 compared to earlier years in both the freshwater and marine environments.
- People in attendance had no problem with hook-and-release fishing as long as it was done properly. A few dead fish were seen in Little and Grand Codroy rivers and the fact that most dead salmon were large suggests hook-and-release mortality as the probable cause.
- It was felt that recorded catches of retained salmon should be adjusted upwards to offset unrecorded mortalities by a factor of 10-15%.

## **3. Perceptions of abundance of salmon in 1995.**

- Abundance of large salmon in 1995 was good and better than small salmon. The numbers of small salmon in both rivers have declined the last four years.
- In Bay St. George rivers, the runs generally drop off in late August and at the same time angling conditions are not very good due to high temperature and low water. Because of this Bay St. George rivers could be closed on August 15.

## **4. Information on long-term population size in the local area.**

- Long-term salmon populations in Little and Grand Codroy rivers have declined since the 1950s and 1960s.
- Runs to Burnt Island River seem to be improving.
- Local anglers agreed with population trends from Little and Grand Codroy rivers.

# **DEER LAKE, NOVEMBER 8, 1995**

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## **1. Evidence of unrecorded mortalities in inland waters.**

- Most of the anglers in attendance had no problem with hook-and-release fishing as long as it was done properly. Dead fish were seen on certain rivers in 1995 that may have been due to hook-and-release fishing. The number of dead salmon seen ranged from 0 to 3. A couple

of anglers did not like hook and release because of concerns for excessive mortalities. However, when questioned they were not able to provide evidence of high numbers of mortalities.

- Anglers thought that unrecorded mortalities were occurring from inaccuracies in angling stats, poaching, disease, and hook and release. When lacking specific information for a particular river they recommended an adjustment of 15% should be applied to the river escapement. One angler suggested 50% for Harry's River. It was also suggested that Science Branch should be directly investigating these factors.

## **2. Effect of 1995 water levels and water temperatures on angling success.**

- Water levels were high all summer in Crabbes, Southwest, and Humber rivers. Anglers did not express an opinion on how these high water levels may have influenced angling success but noted that they felt angling conditions were good all summer.

## **3. Perceptions of abundance of salmon in 1995.**

- Salmon were abundant in Humber River.
- Salmon were abundant in Trout River in 1995 and have increased considerably with the commercial fishing moratorium. Rainbow trout are still being observed in Trout River and it is possible that they have established a resident population.

## **4. Effect of the 1995 management plan on angling effort and success.**

- Anglers indicated that the 3:3 bag limit split made it difficult to retain the 3 fish in August.

## **5. Information on long-term population size in the local area.**

- There was general agreement with the trends shown and that stocks in the 1960s and early 1970s were higher than at present.

**APPENDIX 5**

**SUMMARY SHEETS FOR INDIVIDUAL RIVERS**

**STOCK:** Sandhill River, SFA 2  
**TARGET:** 23.544 million eggs.

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational catch</b>									
Small	372	197	448	258	279	289	100	702	372
Large	38	18	25	12	29	28	2	94	25
<b>Adult counts<sup>2</sup></b>									
Small					2159	2781	2038	4761	
Large					730	559	138	730	
<b>% Target eggs met (small +large)</b>					39%	44%			
<sup>1</sup> Recreational catch is for the period 1974 to 1991. Catches for 1992-1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Catches prior to 1992 and for 1994 are for retained fish for the entire angling season. <sup>2</sup> Counts are for the period 1970-1973 and 1994-1995. Values in this table have been updated from 1994									

**Recreational catches:** Catches have ranged from 122 to 785 during the period 1974-95. The number of small salmon retained in 1995 was 289 and 340 were released. The number of large salmon retained was 28 and 14 were released.

**Data and assessment:** Complete counts of smolt and adult salmon (1970 - 3600 small, 138 large; 1971 - 3484 small, 266 large; 1972 - 1901 small, 168 large; 1973 - 4584 small, 491 large) migrations were obtained from portable fish counting fences in 1970-73 and a complete count of adults was done in 1994-95.

**State of the stock:** Egg deposition in 1995 was 10.3 million eggs which was below target requirements.

**Accessible habitat:** A new calculation of available habitat was done to include data collected during an aerial survey of the system.

Target: Fluvial = 9.428 million m<sup>2</sup>; Lacustrine = 8730 ha



**STOCK:** Forteau River (SFA 14B)

**TARGET:** 1.4 million eggs (~ 361small and 140 large salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	MEAN <sup>1</sup>
<b>Returns to counting fence</b>									
Small	.	.	.	.	228	315	.	.	.
Large	.	.	.	.	74	136	.	.	.
<b>Angling catch below fence</b>									
Small	.	.	.	.	230	146	.	.	.
Large	.	.	.	.	3	11	.	.	.
<b>Total returns to river<sup>2</sup></b>									
Small	532	336	397	760	458	461	269	1342	706
Large	43	18	55	288	77	147	18	196	107
<b>Spawning escapement</b>									
Small	208	131	178	375	149	212	131	524	275
Large	36	15	46	245	73	127	15	164	89
<b>% of Target eggs met (small + large)<sup>3</sup></b>									
	34%	20%	40%	143%	46%	74%	20%	96%	59%

<sup>1</sup> MIN., MAX., MEAN are for 1974-1991  
<sup>2</sup> Total returns to river for 1974-1993 estimated from 1995 ER of 0.6095 for small and 0.1633 for large retained and released salmon.  
<sup>3</sup> Values in this table are updated from previous reports based on revised habitat parameter values. Available rearing area was measured from a stream survey in 1995 and from a 1:50,000 scale topographical map on GIS.

**Methodology:** Fluvial habitat includes 515,500 m<sup>2</sup> and lacustrine habitat includes 896 ha of standing water. Target egg deposition is based on 2.4 eggs per m<sup>2</sup> fluvial area and 105 eggs per ha of lacustrine area. Target eggs are to come from large and small salmon.

**Recreational fishery:** The recreational effort and retained catch of small salmon in 1995 were below the recreational effort and retained catch of small salmon in 1994. The 1995 retained catch of large salmon was above 1994. In the recreational fishery only one large salmon per licence was allowed to be retained as opposed to two in 1994. The angling pool directly below the counting fence was closed to angling (retained and release) for the entire fishing season.

**Commercial fishery:** The opening date of the SFA 14(B) commercial fishery in 1995 was July 3 as opposed to the June 6 opening in 1994. Only 1.6t of the 6.5t quota was caught in 1995, but the commercial licenced effort remained the same as in 1994.

**Data and assessment:** An adult salmon counting fence was operated in 1994 and 1995. The total returns of small salmon to the Forteau River in 1995 were similar to the total returns of small salmon in 1994 but the returns of large salmon in 1995 were 91% above the total return in 1994.

**State of the stock:** The target egg deposition for the Forteau River is 1,417,680 eggs. Potential egg depositions were 46% of this target in 1994 and 74% in 1995. The percent of target achieved in 1994 was 22% below the 1974-1991 mean but the percent achieved 1995 was 20% above the 1974-1991.

**Forecast:** Based on similar spawning escapements in 1989 and 1990 and assuming that the smolt-age distribution and smolt-adult survival of small salmon remain similar to previous year, the returns of small salmon in 1996 are not expected to be higher than in 1995.

**STOCK:** Exploits River (SFA 4)  
**TARGET:** 95.9 million eggs (equivalent to 56,670 small salmon)  
 Lower Exploits 16.4 million eggs  
 Middle Exploits 64.2 million eggs  
 Upper Exploits 15.4 million eggs

Year	1990	1991	1992	1993	1994	1995	MIN	MAX	Mean <sup>4</sup>
<b>Recreational harvest<sup>1</sup> (retained only)</b>									
Small	917	1045	1408	1655	3072	1302	577	2998	1660
<b>Broodstock removals<sup>2</sup></b>									
	3869	1408	1078	0	0	0	31	5111	3371
<b>Returns<sup>1</sup></b>									
Total	7117	5758	13818	22777	18472	17090	3845	19557	8966
Small	6995	5659	13504	22150	17556	16149	4740	19205	8785
Large	122	99	314	627	916	941	343	352	180
<b>% Target eggs met<sup>3</sup>:</b>									
Lower	47%	35%	79%	109%	124%	99%	35%	127%	51%
Middle	12%	14%	20%	23%	27%	24%	8%	21%	12%
Upper	88%	0%	2%	6%	7%	12%	0%	125%	66%
<sup>1</sup> MIN, MAX period from 1974-1991.									
<sup>2</sup> MIN, MAX period from 1974-1992.									
<sup>3</sup> MIN, MAX period from 1987-1991.									
<sup>4</sup> MEAN period from 1987-1991.									

**Methodologies:** Fluvial habitat includes 35 million m<sup>2</sup> and lacustrine habitat includes 34,000 ha. Target egg requirements are to come from small salmon. Previous fry releases are backcalculated to eggs for % of target egg deposition achieved in areas stocked. Total returns to the river are based on the count at Bishop Falls fishway plus angling below the fishway. Spawning escapements for the tributaries of the Lower Exploits except for Great Rartling Brook are derived from spawning surveys in 1992 and 1993.

**Broodstock requirements:** None at present.

**Recreational catches:** The 1995 recreational fishery on the Exploits was restricted by quota of 1330 small salmon retained.

**State of the stock:** The egg requirement for the Middle Exploits includes the main stem of the river which at present is not producing adults. If this habitat is removed, then the Middle Exploits in 1995 achieved 81% of its target. The low returns to the Upper Exploits is cause for concern and every effort should be made to reduce mortality on these returning adults.

**STOCK:** Campbellton River (SFA 4)  
**TARGET:** 2.916 million eggs (1480 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational harvest (small salmon)<sup>2</sup></b>	106	126	311	316	340	393	23	1547	626
<b>Smolt counts</b>				31577	41633	39715	31577	41633	37642
<b>Smolt to 1SW sea survival (%)</b>				7.2%	6.2%				
<b>Adult Counts</b>									
Small				4001	2857	3035			
Large				145	191	218			
<b>% of egg target met (small + large)</b>				320%	245%	294%			

<sup>1</sup> Recreational harvest is for the period 1974 to 1991.

<sup>2</sup> Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Harvests prior to 1992 are for retained fish for the entire angling season. Harvests for 1979 and 1987 were not included in the mean since in that year the river was closed for most of the angling season due to drought conditions. Harvests for 1994 are retained small salmon.

Note: any changes from previous years were due to updating preliminary data and biological characteristics information.

**Recreational catches:** Harvests have ranged from 23 to 1547 during the period 1974-95. Harvests declined during 1981-91 before the salmon moratorium. Effort has remained relatively steady until 1992. The number of small salmon retained in 1995 was 393 and 47 were released.

**Data and assessment:** Complete counts of smolt and adult salmon migrations were obtained from portable fish counting fences in 1993-95.

**State of the stock:** Egg deposition in 1995 was 8.57 million eggs which was in excess of target requirement.

**Accessible habitat:**

Fluvial = 596,000 m<sup>2</sup>; Lacustrine = 4037.3 ha.

**STOCK:** Gander River (SFA 4)

**TARGET:** 46.211 million eggs (~21,828 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	MEAN <sup>1</sup>
<b>Recreational harvest (small salmon)<sup>1</sup></b>	1155	1180	1268	1271	2122	2598	1155	4575	2459
<b>Counts<sup>2</sup></b>									
Small	7520	6445	18179 <sup>3</sup>	25905	18080	22002	6445	7743	7236
Large	508	670	4162 <sup>3</sup>	1734	1072	1121	473	670	550
<b>% egg target met<sup>2</sup></b>	36%	33%	112%	135%	89%	93%	33%	36%	35%

<sup>1</sup> Recreational fishery data are for the period 1974 to 1991. Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and excludes hook-and-release fish. Data prior to 1992 and for 1994-1995 are retained fish for the entire angling season. Data for 1987 are omitted from the calculations of min., max., and mean due to closure of parts of the river resulting from drought conditions.

<sup>2</sup> Summaries for counts and target egg deposition are for 1989-1991. Target egg deposition represents the contribution of both small and large salmon.

<sup>3</sup> Counts for 1992 were adjusted.

Note: any changes from previous years were due to updating of preliminary data and biological characteristics information.

**Recreational catches:** Catches have ranged from 1,155 to 4,575 small salmon during the period 1974-91. Catches declined during 1981-91, before the salmon moratorium. Effort has remained relatively steady. The number of small salmon retained in 1995 was 2598 (an increase of 22% over 1994) and the number released was 612 compared to 448 in 1994.

**Data and assessment:** Complete counts of salmon were obtained at a fish counting fence during 1989-95, and have historically been counted at a fishway located on a tributary, Salmon Brook.

**State of the stock:** Target egg deposition was not achieved in 1995 (-7%). The relative contribution of large salmon to total egg deposition was 13%, which was the same as for 1994, but represented a substantial decline from 40% observed in 1992 and was also below the average for 1989-91 (17%). Except for 1993, target spawning requirement in terms of small salmon (after angling removals) was not met in 1992 (-21%), 1994 (-26%), and 1995 (-10%). Using Salmon Brook as an indicator of returns to the entire river, it is likely that returns of small salmon of a magnitude similar to or greater than those in 1992-95 occurred in pre-salmon moratorium years. Total population sizes of small salmon and spawning escapements for pre-salmon moratorium years 1989-91 were the lowest for the period 1974-91. Increased returns arising from the closure of the commercial fishery in 1992 are not expected until 1997 or 1998. Counts of large salmon at Salmon Brook in 1992-95 were the highest on record.

**Forecast:** Based on a retrospective analysis of total population size and ratio of small salmon produced per spawner, returns in 1995 were anticipated to be below target requirement, without a recreational fishery. Actual returns were 37% higher, possibly related to increased natural survival. If survival remains the same as for 1995 then anticipated returns in 1996 could be similar to actual returns in 1995. An alternate prediction based on juvenile population estimates as indices of abundance indicates target requirement will be exceeded in 1996.

**STOCK:** Middle Brook (SFA 5)  
**TARGET:** 2.3 millions eggs (~1012 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational harvest (small salmon)<sup>2</sup></b>									
	349	278	423	299	409	402	165	708	461
<b>Fishway counts<sup>3</sup></b>									
Small	745	562	1168	1859	1513	1139	496	2414	1118
Large	13	14	43	87	90	168	13	91	34
<b>% of Target eggs met<sup>4</sup></b>									
	75%	51%	145%	222%	175%	120%	51%	134%	80%

<sup>1</sup>Recreational harvest is for the period 1974 to 1991.  
<sup>2</sup>Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994-1995 are retained fish for the entire angling season. The years 1979 and 1987 are omitted from calculations of min, max, and mean due to river closures resulting from drought conditions.  
<sup>3</sup>Means for fishway counts are from 1980 to 1991.  
<sup>4</sup>Summary for target egg deposition applies from 1984 to 1991 and represents the contribution of both small and large salmon.  
Note: any changes from previous years were due to updating preliminary data and biological characteristics information.

**Recreational catches:** For the period 1974-91, harvests ranged from 165 to 789 small salmon. Rod-days of effort peaked during the mid-1980s but declined substantially in recent years. A total of 402 small salmon was retained in 1995 and 82 were released.

**Data and assessment:** Complete counts are available from a fishway located on the lower river.

**State of the stock:** Target egg deposition requirement was exceeded in 1992-95. Egg deposition was below target requirement for pre-salmon moratorium years 1985-91. Higher counts of both small and large salmon occurred in pre-salmon moratorium years than were observed in 1992-94. Total population size of small salmon during the moratorium years was substantially lower than in the late 1970s and early 1980s.

**Forecast:** Based on a retrospective analysis of total population size and the number of small salmon produced per spawner, returns in 1996 are anticipated to be in excess of the target requirement.

**STOCK:** Terra Nova River (SFA 5)  
**TARGET:** 14.30 million eggs (~7094 small fish)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational harvest (small salmon)<sup>2</sup></b>									
	624	448	409	484	822	696	243	850	559
<b>Fishway counts</b>									
Small	1149	873	1443	2713	1571	2258	569	1737	1087
Large	144	114	270	470	242	634	19	206	101
<b>% of target eggs met (small + large)<sup>4</sup></b>									
	20%	16%	31%	56%	29%	49%	15%	30%	20%
<sup>1</sup> Recreational harvests are for the period 1974 to 1991. <sup>2</sup> Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994-1995 are retained fish for the entire angling season. <sup>3</sup> Means for fishway counts are from 1979 to 1991. <sup>4</sup> Summary for targets applies from 1984 to 1991. Note: any changes from previous years were due to updating preliminary data and biological characteristics information.									

**Recreational catches:** For the period 1974-91, harvests ranged from 243 to 850 small salmon. Harvests in pre-salmon moratorium years 1989-91 were low relative to those of the late 1970s and early 1980s. Rod days of effort have generally increased over time. A total of 696 small salmon was retained in 1995 and 132 were released.

**Data and assessment:** Counts are available from a fishway located on the lower river. Counts of small and large salmon for 1993 are incomplete. In 1994 and 1995, a number of adults were removed as broodstock for an incubation facility for subsequent fry stocking back to Terra Nova River; these adults were deducted from spawning escapements in the calculation of percent of target met presented above.

**State of the stock:** The count of small salmon in 1995 was the second highest on record and that of large salmon the highest. The proportion of target egg deposition achieved in 1995 was 49%, the second highest on record.

**STOCK:** Northwest River (SFA 5)  
**TARGET:** 4.1 millions eggs (~1726 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational harvest (small salmon)<sup>2</sup></b>									
	64	30	148	164	167	97	30	336	174
<b>Counts</b>									
Small						498			
Large						135			
<b>% of target eggs met</b>						40%			
<sup>1</sup> Recreational catch is for the period 1974 to 1991. <sup>2</sup> Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994-1995 are retained fish for the entire angling season. The years 1979 and 1987 are omitted from calculations of min, max, and mean due to river closures resulting from drought conditions.									

**Recreational catches:** For the period 1974-91, harvests ranged from 30 to 336 small salmon. Rod-days of effort peaked during the late 1970s and reached lowest levels in the early 1990s; effort in 1994 however was among the highest recorded. In 1988, the portion of the lower river within the boundaries of Terra Nova National Park came under park management, using the National Park license and tagging system. Outside of park boundaries, the river was managed according to regulations in place for the remaining rivers in insular Newfoundland.

**Data and assessment:** A count was obtained at a counting fence installed in the lower river in 1995. The fence was operated by Terra Nova National Park personnel.

**State of the stock:** The river received 40% of target egg deposition requirement in 1995.

**STOCK:** Biscay Bay River (SFA 9)

**TARGET:** 2.9 million eggs (~1134 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational harvest (small salmon)</b>									
	232	10	75	299	214	386	10	424	234
<b>Counts<sup>2</sup></b>									
Small	1657	394	1442	1107	1592	1071	394	2516	1656
Large	73	35	51	120	68	56	35	101	75
<b>% of target eggs met<sup>2</sup></b>									
	128%	39%	132%	91%	134%	77%	39%	208%	130%
<sup>1</sup> Recreational harvest is for the period 1974 to 1991. Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994-1995 are retained fish for the entire angling season. Data for 1987 are omitted from the calculation of the mean due to river closure resulting from drought conditions.									
<sup>2</sup> Summaries for fence counts are from 1983 to 1991 and for percent of target from 1984 to 1991. Percentage of target met since 1984 reflects the contribution of both small and large salmon. Counts for 1985, 1989, 1992, and 1993 were adjusted to total counts.									
Note: any changes from previous years are due to updating count and catch data and biological characteristics information.									

**Recreational catches:** For the period 1974-91, harvests have ranged from 10 to 424 small salmon. Rod-days of effort were relatively stable during the past decade. In 1995, a total of 386 small salmon was retained and 112 were released.

**Data and assessment:** Complete counts are available from a fish counting fence which has been in operation since 1983.

**State of the stock:** Since 1984, from 39 to 208% of target egg deposition was achieved. During commercial salmon fishery moratorium years, the target was exceeded in 1992 and 1994 but not in 1993. Generally, counts of small and large salmon were higher in pre-salmon moratorium years than in 1992-95; however the 1993 count of large salmon was the highest recorded. Total population size of small salmon during the moratorium years was substantially lower than in the early 1980s.

**Forecast:** Based on a retrospective analysis of total population size and the number of small salmon produced per spawner, returns in 1996 are anticipated to be below the target requirement without a recreational fishery.



**STOCK:** Rocky River (SFA 9)

**TARGET:** 3.4 million eggs (equivalent to 881 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Returns</b>									
Total	418	227	283	354	177	424	81	418	245
Small salmon	401	211	237	282	159	385	80	401	235
Large salmon	17	16	46	72	18	39	1	17	10
<b>Broodstock</b>	0	0	0	0	62	72	62	72	67
<b>Smolt</b>	8287	7732	7813	5115	9781	7786	5115	9781	7752
<b>% sea survival<sup>2</sup></b>	2.5%	3.1%	4.1%	2.4%	3.3%				
<b>%Target eggs met:<sup>3</sup></b>	40%	22%	28%	34%	25%	33% <sup>4</sup>	17%	40%	26%
<sup>1</sup> Min, Max and Mean period from 1987-1991. <sup>2</sup> % sea survival is from smolt to small salmon return. <sup>3</sup> Note: A new fecundity relationship was established in 1995 affecting previous % target achieved <sup>4</sup> 1995 egg deposition is preliminary due to artificial egg incubation.									

**Background:** Rocky River was stocked with salmon fry from 1983-1987 with the first returns to the reconstructed fishway realized in 1987.

**Methodologies:** Fluvial habitat consists of 1.08 million m<sup>2</sup> and lacustrine habitat includes 2200 ha. Target eggs are to come from small salmon. Biological characteristics used are those of the Rocky River stock. Previous fry releases are backcalculated to eggs for % of target egg achieved in areas stocked.

**Recreational fisheries:** The recreational fishery is closed on this river.

**Data and assessment:** Complete adult counts are available from a trap installed in the fishway.

**State of the stock:** On average, the watershed is achieving 30% of its required target egg deposition.

**Forecast:** Based on the 1990-1994 smolt-to-adult survival, between 189 and 323 maiden 1SW salmon are expected in 1996. As this forecast will not meet target egg deposition it is recommended that the recreational fishery remain closed.

**STOCK:** Northeast River (SFA 10)

**TARGET:** 0.72 million eggs (~224 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational harvest (small salmon)</b>									
	173	19	37	132	39	127	19	349	168
<b>Counts<sup>2</sup></b>									
Small	551	353	921	847	677	663	223	725	415
Large	25	8	46	65	70	74	0	56	29
<b>% of target eggs met<sup>3</sup></b>									
	253%	162%	497%	471%	387%	378%	152%	349%	218%
<sup>1</sup> Recreational harvest is for the period 1974 to 1991. Harvests for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994-1995 are retained fish for the entire angling season. Data for 1987 are omitted from the calculation of the mean due to river closure resulting from drought conditions.									
<sup>2</sup> Summaries for fishway counts are for the period 1976 to 1991 and for percent of target from 1984 to 1991. Percentage of target met reflects the contribution from both small and large salmon.									
<sup>3</sup> Adjusted.									
Note: any changes from previous years are due to updating count and catch data and biological characteristics information.									

**Recreational catches:** For the period 1974-91, harvests have ranged from 19 to 349 small salmon. Rod-days of effort peaked during the early 1980s but declined substantially in recent years. In 1995, a total of 127 small salmon was retained and 8 were released.

**Data and assessment:** Counts are available from a fishway.

**State of the stock:** Target egg deposition requirement has been exceeded in all years including salmon moratorium years 1992-95. The counts of small salmon in 1994 and 1995 decreased from the highs of 1992 and 1993; the count of large salmon in 1995 was the highest on record.

**STOCK:** Little River (SFA 11)

**TARGET:** 0.314 million eggs (equivalent to 230 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Recreational catch<sup>2</sup></b>	.	.	.	.	.	.	NA	NA	NA
<b>Smolt</b>			382	324	495	2712	324	495	400
<b>Total returns:</b>	173	61	125	180	88	135	61	173	95
Small	158	55	104	169	75	118	55	158	89
Large	15	6	21	11	13	17	3	15	6
<b>% Target eggs met<sup>3</sup>:</b>	105%	47%	45%	82%	38%	22% <sup>4</sup>	29%	105%	54%

<sup>1</sup> MIN, MAX, and Mean period 1987 -1991.  
<sup>2</sup> Recreational fishery closed.  
<sup>3</sup> Represents contribution from both small and large salmon..  
<sup>4</sup> 1995 egg deposition is preliminary

**Background:** Little River is the site of an enhancement project where limited fry stocking commenced in 1990 and ended in the spring of 1994. Eggs were again planted in 1995.

**Methodologies:** Target egg deposition is for accessible habitat (130800 m<sup>2</sup> of fluvial habitat). Target eggs are to come from small salmon. Biological characteristics are those of Little River and the Conne River. Current fry releases are backcalculated to eggs for % of target egg achieved in areas stocked. Total returns to the river are based on fence counts.

**Recreational fishery:** The recreational fishery closed in 1989 and the only angling statistics for the river predate 1975.

**Data and assessment:** Complete adult counts are available from a counting fence. Smolt counts are available for the period 1992 to 1995.

**State of the stock:** For 1992-1994 the stock averaged 47% of target egg requirements based on natural spawning and fry releases.

**STOCK:** Conne River (SFA 11)      **Drainage area:** 602 km<sup>2</sup>

**TARGET:** 7.8 million eggs (~4000 small salmon) calculated as fluvial area x 2.4 eggs/m<sup>2</sup> and egg/recruit applied to total population as derived from assumed commercial exploitation rates.

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>HARVEST:</b>									
<b>First Peoples' harvest</b>									
Large	11	3	5	3	0	0	0	11	3
Small	948	281	483	417	0	0	18	948	459
<b>Recreational harvest</b>									
Small	767	108	329	0	0	0	0	3302	1824
<b>Smolt count<sup>2</sup></b>	56943	74645	68208	55765	60762	62749	55765	74645	65927
<b>Sea survival<sup>3</sup></b>	4.2%	3.4%	4.0%	2.7%	5.8%		2.7%	10.2%	
<b>Returns:</b>									
Large	372	89	159	100	100	110	89	516	355
Small	5368	2411	2523	2703	1533	3502	2411	10155	6472
<b>Escapement:</b>									
Large	361	87	153	97	99	108	87	488	345
Small	3765	2062	1783	2353	1435	3376	2062	7823	4709
<b>% Target eggs met:</b>									
	112%	51%	51%	61%	40%	81%	51%	214%	131%
<sup>1</sup> Minimum, maximum and mean recreational harvest for period 1974-91; other mean data for 1986-91 to coincide with the pre-moratorium period. Angling harvests are DFO statistics. First Peoples harvest in salt water includes some salmon from other rivers. First Peoples fishery quota of 1200 fish has been in effect since 1986, but reduced to 500 fish for 1993. First Peoples fishery closed in 1994 and 1995. <sup>2</sup> Min., max. and mean for the period 1987 to 1995. <sup>3</sup> Sea survival of smolt to small salmon returns. Min. and max. are for 1987 to 1994 smolt migrations.									

**Data and methodology:** Smolts used in adult forecasts are surveyed by mark-recapture. Returning adult salmon are enumerated at a fish counting fence. A video camera system was introduced in 1993.

**State of the stock:** Target requirements were met from 1986-90. Only 40-61% of the target was achieved from 1991-1994. This increased to 81% in 1995. Sea survival increased to the highest value in five years (5.8%), but is still low relative to the 1987-90 period. An enhancement project was initiated in 1994 with approximately 128 thousand fry released in 1995. Note that these fry have not been included in terms of the percentage target achieved in the above table.

**Forecast:** Estimated smolt output in 1995 was 62,749 (55,300-70,197); similar to 1994. At 4% survival, the average recorded during 1990-92, no more than 2,500 fish would be expected to return in 1996. A sea survival of 6.4% will be needed in order for total returns to meet or exceed the 4,000 salmon necessary to reach the target egg deposition. Sea survival of 7-10% has been recorded at Conne River in past years. Survival of salmon appears to be associated with timing of the smolt run and smolt condition. At present, there is nothing to suggest that survivals approximating 7% will occur. In-season monitoring could be used to update managers on changing conditions as the 1996 run progresses.

**STOCK:** Highlands River (SFA 13)

**TARGET:** 1.55 million eggs

Year	1980	1981	1982..	1993	1994	1995	MIN	MAX	MEAN
<b>Recreational catch<sup>1</sup></b> (closed since 1978)							19	114	67
<b>Fence counts</b>									
Smolt	15130	15839	12373	9986	10503	10802 <sup>2</sup>			
Small	82	127	100	137	145	172			
Large	55	29	56	78	148	120			
<b>%Target eggs met:</b>									
(small + large)	32%	26%	34%	47%	77%	68%			
<sup>1</sup> Recreational fishery data are available for 1953-1977 only since the river was closed to angling from 1978 to present.									
<sup>2</sup> Adjusted from actual count of 9009 to account for smolt that migrated after June 8 when fence became inoperable.									
<sup>3</sup> Based on weighted average percent female of kelt sampled over all years 1980-82 and 1993-95 and mean length of kelt 1993-95 and bright salmon 1995.									

**Data and assessment:** Counts of smolt and adult salmon were obtained with a fish counting fence in 1980-82 and in 1993-95. Juvenile densities were measured at 19 stations to determine changes in juvenile salmon production. Juvenile studies at the higher egg deposition following the moratorium will give a better estimate of the potential production of different reaches and a more accurate estimation of the target egg deposition.

**State of the stock:** Egg deposition in 1995 is slightly lower than in 1994 but higher than that observed in 1993 and much higher than in 1980-82. The improved returns in 1993-95, compared to 1980-82, are attributed to the closure of the commercial fisheries. Sea survival of the 1993 smolt-class to adult salmon returns (small + large salmon) was 2.4%, which is higher than the 1.2% observed from the 1980 smolt-class. Despite closure to angling since 1978, egg deposition has remained below the reference 2.4eggs/m<sup>2</sup>. A major tributary was blocked by a collapsed bridge until recently, but has not yet naturally re-colonized. Some small tributaries are obstructed by beaver dams.

**STOCK:** Flat Bay River (SFA 13)

**TARGET:** 3.843 million eggs

Year	1990	1991	1992	1993	1994	1995	MIN	MAX	Mean
<b>Recreational catch (retained only)<sup>1</sup></b>									
Small salmon	277	251	223	173	128	0	72	609	306
Large salmon <sup>2</sup>	0	0	0	0	0	0	4	59	28
<b>Broodstock removals:</b>					43	83			
<b>Total returns:</b>					554	698			
Small Salmon					484	650			
Large Salmon					70	48			
<b>% Target eggs met:</b>					27% <sup>3</sup>	29% <sup>4</sup>			
<sup>1</sup> MIN, MAX mean period from 1974-1991. <sup>2</sup> MIN, MAX mean period from 1974-1983. <sup>3</sup> This value has been updated from the 1994 report to account for eggs distributed from broodstock removals. <sup>4</sup> Preliminary data									

**Methodologies:** Habitat area is 1.6 million m<sup>2</sup>. Target egg requirements are to come from small and large salmon. Total returns are based on a fence count and angling below the fence. The 1994 and 1995 fence counts are partial counts.

**Broodstock requirements:** 150,000 eggs.

**Recreational catches:** The Flat Bay River stock has been under quota (small salmon) since 1986, as follows: 1986 = 400, 1987-1988 = 300, and 1989-1994 = 250. The quota has only been achieved in two years. In 1995 the river was closed to recreational fishing.

**State of the stock:** The stock is severely depressed and every effort should be made to increase spawning escapement.

**STOCK:** Harry's River (SFA 13)

**TARGET:** 7.64 million eggs

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Pinchgut Brook</b>									
Returns to the fence									
Small	.	.	222	576	563	752	222	576	454
Large	.	.	5	43	47	28	5	47	32
Spawning escapement above the fence									
Small	.	.	212	548	545	749	212	548	435
Large	.	.	5	43	47	28	5	47	32
% target eggs met above fence (small + large)									
			36%	117%	145%	150%	36%	145%	99%
<b>Harrys River</b>									
Estimated spawning escapement (small + large)									
			529	1441	1444	1895	529	1444	1138
% Target eggs met (small + large) <sup>2</sup> :									
			12%	38%	48%	49%	12%	49%	32%

<sup>1</sup>MIN, MAX, MEAN are for 1992-1994.

<sup>2</sup> Target egg and spawner requirements and % of target achieved are updated from the 1994 report based on revised habitat values and biological characteristics. Target egg requirement is preliminary because it includes only lake areas >5 ha.

**Methodology:** Fluvial habitat includes 2,639,400 m<sup>2</sup> and lacustrine habitat includes 3,546 ha (preliminary - includes all lakes >5ha). Target egg deposition is based on 2.4 eggs/m<sup>2</sup> of fluvial area and 368 eggs per ha of lacustrine area. Potential egg depositions were calculated from spawning escapements based on 1,540 eggs per kg of body weight of female salmon.

**Recreational fishery:** In the mid-1960s, Harrys River produced the largest recreational catches of any river in Bay St. George but catches began to decline in the 1970s and 1980s. The fishery has been controlled by a river quota of 350 small salmon since 1987 and in-season reviews in 1994-1995. The retention fishery was closed in 1994-1995 as a result of the in-season review and in 1992-1993 due to quotas being reached (1992-zonal; 1993-river). Harrys River recreational catch of small salmon was 13% of the Bay St. George recreational catch in 1995 compared to 43% in 1953.

**Data and assessment:** Assessment of the stocks in Harrys River in 1992-1995, included the operation of a counting fence on Pinchgut Brook in 1992-1995; a spawning survey in November 1995; and a mark-recapture experiment in July 1995. The redds counted on Pinchgut Brook in 1995 was 41% of Harrys River. The total spawning escapements on Harrys River in 1992-1995 were estimated based on the total spawning escapement on Pinchgut Brook adjusted by the proportion of redds counted on the Pinchgut system in 1995. The returns estimate in 1995 based on tagging was similar to the estimate based on the spawning survey results. Counts in 1992 may not represent the complete run into Pinchgut Brook.

**State of the stock:** Spawning escapements on Harrys River appear to have increased slightly since 1992 but have been less than 50% of the spawning requirement based on this assessment. The percentage of the target achieved on Pinchgut Brook has also increased since the commercial salmon moratorium in 1992.

**STOCK:** Humber River (SFA 13)

**TARGET<sup>1</sup>:** 28.3 million eggs (~13,651 small and 1,326 large salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>2</sup>	MAX <sup>2</sup>	Mean <sup>2</sup>
<b>Angling catch<sup>3</sup>:</b>									
Small	3054	1431	4349	4161	2523	5150	1217	6147	3268
Large	75	11	177	112	166	233	10	303	100
<b>Returns<sup>4</sup>:</b>									
Small	12216	5724	17571	18477	7995	27898	4868	24588	13074
Large	855	401	2945	636	1030	2064	341	2945	915
<b>Estimated spawning escapement:</b>									
Small	9162	4293	13222	14316	5472	22748	3651	18441	9805
Large	855	401	2945	636	1030	2064	341	2945	850
<b>% Target eggs met (small + large):</b>									
	60%	27%	117%	96%	40%	129% <sup>5</sup>	24%	119%	63%

<sup>1</sup> The target egg deposition requirement is based on fluvial and lacustrine habitat.

<sup>2</sup> MIN, MAX, MEAN are for 1974-1991.

<sup>3</sup> Angling catch of small salmon in 1992-1995 is estimated based on a creel survey conducted at Big Falls. Catch of small is retained fish, catch of large is released fish.

<sup>4</sup> Total returns for 1974-1991 were estimated based on an angling exploitation rate of 25% adjusted for tag loss and reporting rate.

<sup>5</sup> Preliminary data based on tags returned up to January 31, 1996.

**Methodology:** Fluvial habitat includes 11.5 million m<sup>2</sup> and lacustrine habitat includes 1,751 ha (excluding Deer Lake - 5930 ha). Target egg deposition is based on 2.4 eggs /m<sup>2</sup> of fluvial area and 368 eggs per ha of lacustrine area. Biological characteristics are based on samples from the recreational fishery and from the tagging trap located in the estuary of the Humber River. Returns of small salmon are currently estimated by mark-recapture method. Returns of large salmon are assumed to equal returns of small salmon multiplied by the ratio of large to small salmon in the tagging traps. Returns of small salmon in 1992 were based on an angling exploitation rate derived from tags recovered at the Big Falls section of the river by DFO creel survey personnel. The estimate of exploitation rate reported in 1992 had not been adjusted for tag loss but the current value for 1992 includes this adjustment based on a tag loss rate of 23%.

**Recreational fishery:** The Humber River produces about 40% of the small salmon catch in SFA 13. Recreational catches estimated in 1992 and 1993 were among the highest on the river since the early 1980s. The recreational catch of small salmon (retained) in 1995 was 100% above the retained catch of small salmon in 1994.

**Data and assessment:** The 1995 assessment was the sixth assessment of Humber River salmon using the mark-recapture method.

**State of the stock:** The mean potential egg deposition in 1974-1991 represented about 63% of the target. The 1992-1994 mean was 84% of the target and 129% in 1995. The status of the stock in 1995 was the highest since the commercial salmon moratorium and since 1974.

**Forecast:** The only forecast that can be provided is based on the relationship between spawners and recruits back to the river. Based on the mean R/S ratio in 1993-1995, the anticipated total recruitment in 1996 is expected to be less than in 1995 but within the range of 1992-1995 recruits.



**STOCK:** Lomond River (above the fishway) (SFA 14A)

**TARGET:** 1.1 million eggs (~ 653 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Returns to fishway</b>									
Small	...No Counts		435	526	701	1002	1	440	224
Large	Available (90-91)		80	34	50	95	0	50	19
<b>Angling catch below fishway</b>									
Small	386	328	357	275	325	343	203	650	366
Large	17	10	56	36	58	62	2	46	18
<b>Approximate total returns<sup>2</sup></b>									
Small			792	801	1026	1345	259	986	590
Large			80	34	50	95	3	75	31
<b>Known removals above fishway</b>									
Small			16	22		20	0	0	0
Large			0	1		0	0	0	0
<b>Spawning escapement above fishway</b>									
Small			419	504	701	982	1	440	224
Large			80	33	50	95	0	50	19
<b>% of Target eggs met (small + large)<sup>3</sup></b>									
			121%	118%	143%	187%	0%	74%	37%

<sup>1</sup>MIN, MAX, MEAN are for 1974-1988.

<sup>2</sup>Approximate because of the occurrence of spawning below the fishway. Large salmon were not retained after 1984.

<sup>3</sup>Egg depositions in 1992 and 1993 are based on biological characteristics for 1993.

**Methodology:** Fluvial habitat includes 215,600 m<sup>2</sup> and lacustrine habitat includes 1,570 ha of standing water. Target egg deposition is based on 2.4 eggs/m<sup>2</sup> of fluvial area and 368 eggs per ha of lacustrine area. Target eggs are to come from small salmon. Potential egg deposition was determined from counts of small and large salmon at the fishway and biological characteristics obtained from samples at the fishway and in the recreational fishery.

**Recreational fishery:** The recreational fishery above the fishway has been closed since 1978. The recreational fishery on the Lomond River has been managed by a river quota of 350 small salmon from 1986-1994. The quota increased to 375 small salmon in 1995. The river was closed to retention angling when the quota was reached in 1995. Angling is currently not permitted above the fishway.

**Data and assessment:** Counts of salmon using the fishway on Lomond River are available from 1962-1995 with the exception of 1968-1970 and 1989-1991 when the fishway was not monitored.

**State of the stock:** The state of the stock should be assessed in terms of the whole river. The area above the fishway represents about 40% of the total river area. Potential egg depositions averaged 37% of the target above the fishway in 1974-1988 compared to 127% in 1992-1994 and 187% in 1995.

**STOCK:** Torrent River (above the fishway), (SFA 14A)

**TARGET:** 1.5 million eggs (~ 867 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Returns to fishway</b>									
Small	2296	1415	2347	4009	3592	5799	38	2815	1509
Large	82	73	169	222	331	611	3	523	113
<b>Angling catch below fishway</b>									
Small	222	150	477	179	227	331	0	340	118
Large	4	1	6	15	9	36	0	18	3
<b>Approximate total returns to river<sup>2</sup></b>									
Small	2518	1565	2824	4188	3819	6130	96	3155	1626
Large	82	73	169	222	331	611	7	525	115
<b>Total spawners above fishway</b>									
Small	2296	1415	2347	4009	3592	5799	138	2815	1533
Large	82	73	169	222	331	611	3	523	113
<b>% of Target eggs met (small + large)<sup>3</sup></b>									
	221%	176%	314%	538%	530%	1033%	17%	360%	195%

<sup>1</sup>MIN, MAX, MEAN are for 1974-1991.  
<sup>2</sup>Approximate because of the occurrence of spawning below the fishway.  
<sup>3</sup>Potential egg depositions in 1990-1993 were calculated based on the 1985-1989 female mean wt. of 1.6 kg for small and 4.13 kg for large salmon.

**Methodology:** Fluvial habitat includes 516,800 m<sup>2</sup> and lacustrine habitat includes 2,323 ha of standing water. Target egg deposition is based on 2.4 eggs/m<sup>2</sup> of fluvial area and 105 eggs per ha of lacustrine area. Target eggs are to come from small salmon. Potential egg depositions were determined from the spawning escapement of small and large salmon based on a fecundity of 1783 eggs per kg estimated for Western Arm Brook. Biological characteristics used to calculate the potential egg depositions in 1974-1984 and in 1990-93 were the mean weight and percent female of small and large salmon in 1985-1989. Potential egg depositions for all other years were based on biological characteristics of the current year. Biological characteristics were from samples collected at the fishway.

**Recreational fishery:** The river was not open to angling in 1995 until 750 salmon had passed through the fishway. The minimum in 1994 and previous years was 1000 salmon. Angling is currently not permitted above the fishway.

**Data and assessment:** The salmon stock above the fishway on Torrent River was enhanced in 1972-1976 with the transfer of over 700 adult salmon from Western Arm Brook. The numbers of small and large salmon returning to the fishway in 1995 were the highest on record and the count of large salmon in 1995 was almost twice the number in 1994.

**State of the stock:** It is estimated that the Torrent River stock has reached its target egg deposition since 1978. The percentage of the target achieved in 1995 was 90% above the 1993 and 1994 values.

**STOCK:** Western Arm Brook, (SFA 14A)  
**TARGET:** 0.91 million eggs (~ 344 small salmon)

Year	1990	1991	1992	1993	1994	1995	MIN <sup>1</sup>	MAX <sup>1</sup>	Mean <sup>1</sup>
<b>Returns to counting fence</b>									
Small	322	233	480	947	954	823	120	1578	492
Large	0	1	8	8	31	33	0	4	1
<b>Angling catch below fence:</b>									
Small							0	171	41
Large							0	2	0
<b>Total returns to river:</b>									
Small	322	233	480	947	954	823	233	1578	533
Large	0	1	8	8	31	33	0	5	2
<b>Smolt counts and sea survival<sup>2</sup></b>									
Counts	10563	13453	15405	13435	9284	15144	5735	20653	12424
%Survival	2.2%	3.6%	6.1%	7.1%	8.9%		2.2%	12.1%	4.9%
<b>Spawning escapement above fence</b>									
Small	322	233	480	947	954	789	120	1578	468
Large	0	1	8	8	31	30	0	4	1
<b>% Target eggs met (small + large)</b>									
	114%	68%	151%	288%	292%	284%	31%	287%	111%

<sup>1</sup>MIN, MAX, MEAN are for 1974-1991.  
<sup>2</sup>Sea survivals are based on smolt to small salmon returns the following year. Min. max., and mean are for the years 1971 to 1995.

**Methodology:** Fluvial habitat includes 290,000 m<sup>2</sup> and lacustrine habitat includes 2,017 ha of standing water. Target egg deposition is based on 2.4 eggs/m<sup>2</sup> of fluvial area and 105 eggs per ha of lacustrine area. Target egg requirements are to come from small salmon. Total returns to the river are based on counts at the fence and angling catches below the fence. Potential egg depositions were calculated from the total spawning escapement of small and large salmon based on 1783 eggs per kg of females and biological characteristics observed at the fence in the current year.

**Recreational fishery:** The recreational fishery on this river has been closed since 1987 because of high angling exploitation below the counting fence.

**Data and assessment:** Complete adult and smolt counts at the counting fence are available since 1971. Adults from Western Arm Brook were transferred above the fishway in Torrent River in 1972-1976. Maximum transfers in a given year were 238 fish.

**State of the stock:** Potential egg depositions in 1974-1991 averaged 111% of the target. The percentages of the target achieved in 1993-1995 were among the five highest observed since 1974.

**Forecast:** The number of smolt counted on Western Arm Brook in 1995 was 63% above the count in 1994. Therefore, assuming that the smolt-to-adult survival rate in 1996 will be similar to that of 1995, returns of small salmon in 1996 are expected to exceed target requirement.