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STATUS OF ATLANTIC SALMON (*SALMO SALAR*) IN THE BUCTOUCHE RIVER IN 1996

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TABLE OF CONTENTS

ABSTRACT

Angling effort on the Buctouche River is low and in most years insufficient to estimate catches. Data from the New Brunswick Department of Natural Resources were not available for 1996. A telephone survey of anglers indicated that at least 21 large salmon were released, 19 small salmon were retained, and 2 were released. First Nation catches were four large and 25 small salmon. Unrecorded catch (poaching) was estimated at 10 large and 10 small salmon. A mark-recapture experiment was the basis for estimating returns: tags were applied at one estuarial trapnet and recovered at a counting fence in freshwater. Large salmon total returns were estimated at 134 and small salmon total returns at 127. Respective spawning escapements were 124 and 78. Total egg deposition was a minimum of 46% of the conservation requirement, since some fish (mostly small salmon) ascended prior to installation of counting facilities. This represents a decline of 21%, relative to 1995. Juvenile densities at the sites surveyed were somewhat higher than previous years but still well below optimum, confirming that spawning in recent years has been inadequate. At present, sufficient information on stock status has not been accumulated to forecast returns, but with four consecutive years well below requirements (mean: 53%) it is unlikely that conservation requirements will be met on the Buctouche River in 1997. In this event there will be no harvestable surplus of large or small salmon.

RÉSUMÉ

L'effort de pêche sportive sur la rivière Buctouche est faible et, la plupart des années, il est insuffisant pour estimer les prises. Les données du ministère des Ressources naturelles du Nouveau-Brunswick n'étaient pas disponibles en 1996. Un sondage mené par téléphone auprès des pêcheurs sportifs a indiqué qu'au moins 21 gros saumons ont été remis à l'eau, 19 petits ont été gardés et deux petits ont été remis à l'eau. Les pêcheurs des premières nations ont pour leur part capturé quatre gros et 25 petits saumons. On a estimé les prises non déclarées (braconnage) à 10 gros et 10 petits saumons. Pour estimer la remonte, on a utilisé la méthode de marquage et recapture : les saumons étaient étiquetés à un filet-trappe dans un estuaire et recapturés à une barrière de dénombrement en eau douce. On a estimé la remonte totale à 134 gros saumons et à 127 petits. Le nombre respectif de saumons qui ont atteint les frayères était de 124 et de 78. Dans l'ensemble, la ponte n'a atteint que 46 % de l'objectif de conservation puisque certains poissons (la plupart des petits saumons) sont remontés avant l'installation du matériel de dénombrement. Cette proportion représente une baisse de 21 % par rapport à 1995. Les jeunes saumoneaux étaient légèrement plus nombreux que les années précédentes aux sites d'enquête, mais toujours bien au-dessous du nombre optimal, confirmant le fait que le frai des dernières années est insuffisant. On ne dispose pas à l'heure actuelle de suffisamment de données sur l'état des stocks pour prévoir la remonte, mais comme les données disponibles pendant quatre années consécutives démontrent une moyenne bien au-dessous (53 %) de l'objectif de conservation, il est peu probable que cet objectif sur la rivière Buctouche soit atteint en 1997, ou qu'il y ait un surplus de gros et de petits saumons exploitables.

SUMMARY SHEET

STOCK: Buctouche River (SFA 16)
CONSERVATION REQUIREMENT: 1.587 million eggs (281 large salmon, 172 small salmon)

	1991	1992	1993	1994	1995	1996	MIN[1]	MAX[1]	MEAN[1]
Angling catch									
Large (Released)			35	20	0	na(21)	0	52	
Small (Rel + Kept)			64	7	33	na(21)	7	64	
Aboriginal Community Harvest									
Large		12	0	12	0	4			
Small		0	0	11	15	25			
Broodstock removals									
Large					7	5			
Small					8	5			
Spawning escapement									
Large			94	212	147	124			
Small			21	59	67	78			
Total returns									
Large			95	225	154	134			
Small			78	77	98	127			
% Requirement met									
Large			34	72	55	45			
All spawners			35	72	58	46			

[1]Angling catch min, max are for years 1984 to 1995. The mean was not calculated because angling catches are not estimated on a consistent basis.

__Recreational catches__: Catch statistics from the New Brunswick Department of Natural Resources and Energy were not available for 1996. A telephone survey indicated that a minimum of 21 large salmon were released, 19 small salmon were retained and 2 were released. These totals appear above in parentheses.

__Data and assessment__: Returns of large salmon to the Buctouche River in 1996 were estimated from tags applied at an estuarial trapnet and recaptured at a counting fence. Returns of small salmon were calculated based on the proportion observed at the counting facilities. Spawners were estimated as returns minus known removals.

__State of the stock__: Spawning escapement was not met for either large or small salmon in 1996. Total egg deposition was estimated at 46% the conservation requirement. This can be considered as a minimum level since some fish had ascended prior to installation of counting facilities.

__Forecast for 1997__: Because 1996 is only the fourth year of data on returns, no quantitative forecast can be made for 1997. However, given four consecutive years with well below required egg depositions, it is unlikely that the conservation requirement will be met in 1997.

__Management Considerations__: There will probably not be an harvestable surplus of either large or small salmon from the Buctouche River in 1997.

Introduction

The Buctouche River (also spelled Bouctouche) is situated in Kent County, southeast New Brunswick and flows in an easterly direction to Northumberland Strait in Fisheries Statistical District 77, Salmon Fishing Area 16 (Fig.1). The system is small and has no man-made barriers to ascending fish. A spawning run of Atlantic salmon, composed of approximately two thirds multi-seawinter fish, enters the river during September and October. The resource is harvested for food by Buctouche First Nation and by public recreational angling. Information on stock status is required to manage salmon harvest on the Buctouche, and ensure that adequate spawning escapement occurs on a sustainable basis. This is of particular concern on smaller rivers where the potential to overexploit remaining wild stocks is high.

The stock on this river has been assessed previously in 1993, 1994, and 1995 (Atkinson and Claytor MS1994, Atkinson *et al.* MS1995, Atkinson and Chaput MS1996). Under the Aboriginal Fisheries Strategy (AFS) agreements the Department of Fisheries and Oceans (DFO) provides funding and training to First Nations in the interest of developing a co-management approach to the resource. These assessments were accomplished through mark-recapture experiments in which tags were applied in the estuary at Buctouche First Nation trapnets and recovered in the recreational fishery or at a counting fence upriver. In 1996, tags were again applied in the estuary, but only one trapnet was operated. Recaptures were obtained from a counting fence in the freshwater portion of the river operated by the Southeastern Anglers Association, and from anglers.

Results of electroseining at twelve sites during the summer of 1996 have been included in the current assessment, along with juvenile density data from previous surveys for purposes of comparison.

Description of Fisheries

Commercial

Commercial harvesting of Atlantic salmon ceased in 1984. The harvest from 1967 to 1983 in SFA 16 was presented in Atkinson and Claytor (MS1994).

First Nation

Beginning in 1992, Buctouche First Nation has harvested salmon from research trapnet(s) in the Buctouche River estuary during September and October (Table 1). Prior to 1992, this was a sporadic gillnet fishery and numbers taken were not recorded. In 1996, four large (63 cm or more) and 25 small (less than 63 cm) salmon were removed for food. Allocations to Buctouche First Nation under the AFS agreement in 1996 were 36 large and 56 small salmon (Table 1).

Recreational

Recreational angling occurs upstream from the head of tide. There is no leased water on the system. Prior to 1996, black salmon could be angled from April 15 through May 15, bright salmon from June 8 through the end of the season. The bright season was extended in 1993 from October 15 through the end of the month, downstream from the Route 490 bridge. In 1996 the angling season for black or bright salmon was continuous from April 15 through October 31. Prior to 1984 all salmon could be retained. In 1984 large black salmon could be kept but all large bright salmon had to be released. Beginning in 1985, regulations have required that all large salmon (brights and blacks) be released, and only small salmon be retained. In 1992, the season limit for small salmon was reduced from ten to eight, and this regulation remains in effect to date. Little effort is devoted to angling black salmon, and almost all angling for bright salmon occurs from late September to the end of the season.

Recreational catches have been estimated by the New Brunswick Department of Natural Resources and Energy (DNRE) based on random surveys representing 20 to 40 percent of license purchasers. For small rivers such as the Buctouche , the rate of survey return was usually not high enough to estimate catch accurately (Table 2). The survey was not done in 1996.

A telephone survey was therefore conducted of 35 anglers known to fish the Buctouche River. The list was compiled from personal contact on the river, from names provided by local angling associations, and from anglers who have returned tags. Only 21 anglers on the list fished the Buctouche in 1996 and of these, only 16 caught salmon. Results indicated that 21 large salmon were caught and released, 19 small salmon were retained, and 2 were released. It is not known precisely what proportion of all angling effort the survey represented, but is thought to include about 75% of the catch. For the purpose of this assessment, removals have been calculated as retained fish plus a 3% mortality on released fish. However, it is unlikely that losses due to angling significantly affect large salmon spawning escapement; in 1996 one fish was considered to have been removed.

Other

Estimates of unrecorded catch are obtained from fishery officers and represent known or suspected removals in the estuary or freshwater due to by-catch in commercial fishing gear or poaching. A survey of by-catch in the Buctouche estuary from gaspareau traps in June, conducted by the Southeastern Anglers Association, found one small salmon kelt on the few dates when gear was checked. Poaching in the freshwater portion of the river has been considered a problem in past years, but DFO and DNRE fishery officers felt that it was minimal in 1996. No apprehensions were made and patrols found no evidence of poaching activity. It was suggested that between by-catch in smelt traps and poaching in freshwater, 10 each of large and small bright salmon may have been removed.

An enhancement initiative for the Buctouche River, under the auspices of DFO and the Southeastern Anglers Association, resulted in the collection of 5 large and 5 small salmon for broodstock production. These fish were returned to the river following artificial spawning at the DFO Miramichi hatchery. The progeny of these fish will be stocked in the Buctouche as fall fingerlings in 1997 and subsequently monitored for in-river survival.

Summary of Removals, 1996

Location	Large	Small
First Nation Food (traps)	4	25
Angling (freshwater)	1	19
Broodstock (counting fence)	5	5
Unrecorded	10	10
Total	20	59

Conservation Requirement

The calculation of the conservation requirement for the Buctouche River is detailed in Table 3, using Method 2 recommended by Randall (MS1985) for the Miramichi River. The number of spawners needed to meet egg deposition requirements was calculated assuming all egg deposition came from large salmon. The number of small salmon required was calculated assuming that at least one male spawner was needed for each female large salmon. Fecundity was considered to be equivalent to Miramichi stock, based on river proximity. Also, the Buctouche was stocked in 1978-79 with 37,000 juvenile salmon from the Miramichi River (Newbould 1983) (Table 4, Fig. 1). Stock characteristics used were the means of values observed from 1993-95. Sex determination was done using external characters, with sex ratios derived accordingly. The 2SW component of total large salmon requirements was calculated using the mean proportion from aged samples (1992-94).

Egg Requirement: 1.587 million eggs
Large Spawners: 281 (2SW component: 244)
Small Spawners: 172

Research Data

Mark/Recapture

In co-operation with Buctouche First Nation, one trapnet was operated in the tidal portion of the river to mark salmon. This was situated 5 km upriver (west) of the Route 11 bridge in Buctouche, and corresponded to the site of the upper, or recapture trap, operated in former years (Fig. 1). The box portion of the trap measured 3.7 m (12') wide by 18.3 m (60') long and was constructed with 5.7 cm (2.25") mesh knotless nylon. A single leader of approximately 60 m (200'), extending from shore into a door in the middle of the long side of the box, was made from 11.4 cm (5.5") mesh polypropylene. The trap was configured to fish in an upstream direction. Salmon caught were measured for fork length, sexed using external characters, and scale sampled. They were then marked with small blue Carlin tags attached with a single wire through the back behind the first ray of the dorsal fin, and released. Only large salmon were tagged; all small salmon were retained for food.

The trap was operated from September 17 to October 28. Captures of both large and small salmon peaked between September 20 and 27 (Weeks 38-39). This timing was approximately two weeks earlier than 1995, and the earliest observed to date. Total catch was 26 large and 25 small salmon, exclusive of recaptures (Table 5, Fig. 2). Relative to 1995, catch for the same site and period declined by 26% for large salmon and 29% for small. However, it was likely that some fish had moved up the estuary prior to the beginning of trap operation and hence were not available for capture.

A counting fence was installed on the main stem of the river 2.75 km upstream from the head of tide, just below the confluence of the South Branch (Fig. 1). The fence, consisting of a trapnet about 6m (20') long by 3m (9') wide and connected to the shore by two downstream-angled leaders, trapped fish moving upstream only. The trap and leaders were constructed with 5.7 cm (2.25") knotless nylon mesh, held in place with steel rods driven into the stream bed. The fence was operated from October 9 to November 3 by the Southeastern Anglers Association. Each fish was measured, sexed and a scale sample was taken for ageing. All untagged fish released upstream were marked by punching a 5mm (1/4') hole in the caudal fin. Water levels prior to fence installation were adequate for fish to ascend. Some (mainly small salmon) had already been caught by anglers in the pool immediately above the fence site. Salmon were caught at the fence immediately after installation and up to November 3. However, due to persistent heavy rain and high water conditions the facility was only partially operating much of the time. Hence, a total count of fish ascending past the site was not possible for 1996. Peak catches occurred during Week 43 for large salmon and Week 41 for small. Timing was the same for large but two weeks earlier for small fish, relative to 1995. Total catch was 53 large and 35 small salmon (Table 5, Fig. 2).

Tags were recovered at the counting fence throughout the duration of its operation, and no tags were known to have been lost prior to possible interception at the fence. Tags were also recovered from angled fish above the fence. No tags applied in previous years were recovered in the current year. Tagging effort and recaptures in 1996 are as follows:

Tags Applied

Location	Large	Small
Marking trap	22	0

Tags Recaptured

	Large	
Location	Recap	Catch
Counting fence	9	53
Angling	2	19

Biological Characteristics

A length-frequency histogram for all salmon caught at counting facilities on the Buctouche River for 1996 indicates modal values of 78 cm and 56 cm for large and small fish, respectively (Fig. 3). The mean length of large salmon was 78.1 cm; 78% were females (mean length 77.9 cm) and 22% males. Mean length of small salmon was 55.9 cm; 3% were females (mean length 52.5 cm) and 97% males. The large salmon proportion of the catch in 1996, determined as the average of that observed at the marking trap and counting fence, was 56%. The 1996 sample has not yet been aged. Of known-age fish in 1995, 2, 3, and 4 year smolts respectively comprised 54%, 45% and 1% of the sample. Of the multi-seawinter (MSW) component in 1995, 79% were maiden two-seawinter (2SW) fish and 21% were repeat spawners. Repeat spawning one-seawinter (1SW) fish, or grilse, represented 2% of all MSW fish and 9% of all repeat spawners (Table 6).

Electroseining

In August of 1996, 12 sites were electroseined on the Buctouche River (Fig. 1). Four of these (1,2,3,6) were barriered sites, initially fished with one upstream sweep followed by three downstream sweeps, except for site 1 where all four sweeps were upstream. The other sites (4,5,7-12) were essentially spot checks. These were open and fished with one upstream sweep in the same manner as the initial sweep on closed sites, to compare catch per unit effort across all sites. Closed site populations were calculated on the three downstream sweeps (upsweeps 2,3,4 at site 1) using the Zippin procedure (1958), then the initial upsweep catch was added before calculating density. Densities of Longnose Dace, the most numerous fish at all sites, were also calculated (Table 7). Percent

Habitat Saturation (PHS) values were derived for juvenile salmonids according to Grant and Kramer (1990). A total (fry + parr) PHS value around 27 is considered a useful reference point, since above this a greater than 50% chance exists that a density dependent response will occur. Catch per unit effort for all species in 1996 (Table 8) and a comparison of wild juvenile salmon densities determined from data collected in all years (Table 9) are also presented. Densities in years prior to 1996 were calculated using the Zippin procedure, on three to five downstream sweeps of closed sites, except for sites 1 and 3 in 1994-95, which were open. Sites fished in 1974 were spot checks, and only presence or absence of juveniles was noted. In all cases, parr classes have been combined for calculating density, due to the typically low numbers sampled.

Densities of fry (2.6 - 7.2 $100m^{-2}$) and parr (8.8 - 26.0 $100m^{-2}$) at closed sites in 1996 were higher than those observed at comparable sites in all previous surveys, with the single exception of fry at site 3 (Table 9). Further, they were two to seven times higher for fry and two to eighteen times higher for parr, than either of the two previous years. This suggests either increased spawning success in 1995, higher juvenile survival rates, or both. Water levels the previous fall were high and the summer of 1996 was relatively cool and wet. Overall, however, densities were relatively very low. Elson (1967) considered "normal" densities on Miramichi River sites which were unaffected by DDT spraying to be 29 fry and 38 parr 100 m^{-2}. Site 3 on the South Branch was notable for having the highest densities of both fry (7.2 $100m^{-2}$)and parr (26 $100m^{-2}$), the latter being comparable to the highest previously observed, in 1977 and 1979. Fry were well below the highest formerly seen (1978, 1979). The total PHS at this site (20.3) was the only value approaching the reference point of 27. At all closed sites, Longnose Dace densities far exceeded those for fry and parr combined (Table 7), in most cases being about ten times higher. With mean lengths similar to salmon fry, dace may represent overwhelming competition for available food resources, particularly during low warm summer water conditions which are stressful to juvenile salmonids.

Catch per unit effort (cpue) for all sites in 1966 (Table 8) shows the highest numbers of both fry and parr in the lower main river from just above the head of tide (Site 7) to just above the Forks pool (Site 1), and in the South Branch (Sites 3, 11). The cpue and the calculated density of fry at Site 1 were probably influenced by the release of unmarked swim-up fry in June (see below). These were some of the progeny of broodstock collected in 1995 and raised as part of the educational curriculum in Buctouche regional schools, under the auspices of the Atlantic Salmon Federation. Sites in the upper reaches of the main river or its tributaries (4,5,12) had negligible catches. Other tributaries not fished, such as McLean and Johnson Brooks, were observed to be blocked by a succession of beaver dams with essentially still pools in between. This certainly suggests that the best spawning and rearing habitat is found in the lower stretches of the main river and in the South Branch. Low numbers of juvenile salmon were found in Trout Brook and Mill Creek, which are tributary to the estuary but not the main Buctouche River, indicating that not all of the estimated returns spawn in the main river.

Stocking

In the fall of 1995, 7 large female and 8 small male salmon from the Buctouche River were spawned at the DFO Miramichi hatchery, yielding a total of 45,540 eggs. Of these, 2,400 were incubated in small aquaria in local schools and released as unmarked swim-up fry near Site 1 in June 1996. A total of 38,867 adipose-clipped fall fingerlings were released in November 1996, in lots of approximately 6,500 each at sites 1, 2, 4, 5, 6 and 17 (Fig. 1). This section of the Main stem, from the Forks pool upstream, was chosen because juvenile abundance appeared to be lowest here. Hence, the maximum benefit was expected to accrue from enhancement and subsequent monitoring, as an indication of a potential habitat constraint on juvenile survival.

Estimation of Stock Parameters

Returns of large salmon past the mark trap were calculated from tags placed at that facility and recovered at the counting fence, using a Bayesian estimator as described by Gazey and Staley (1986). The most probable population size given R recaptures out of M marks placed in a sampled catch of C was calculated over a range of possible population sizes. A tag loss rate was not factored into the calculations because it was thought to be negligible over the short period (one month) during which tags were recaptured. The corresponding small salmon returns were calculated from the mean proportion (0.44) of those observed at the mark trap and counting fence.

Total returns to the system were obtained by adding removals known to have occurred prior to marking. The corresponding spawning escapement was then computed by subtracting total known removals from total returns. Known removals were First Nation harvest, angling catch and broodstock removals, as detailed above. Because estimates of unrecorded catch (poaching) are unsubstantiated, those alleged to have occurred in the estuary have not been included in the estimates of total returns. The egg deposition rate (2.4 m^{-2}) used to calculate the conservation requirement compensates for in-river losses to poaching and disease. Consequently, in-river poaching estimates have not been subtracted from total returns to calculate spawning escapement.

Assessment Results

Total Returns and Spawning Escapement

The estimate of total returns to the river is 134 for large salmon and 127 for small salmon, with respective spawning escapements of 124 (95% CI: 78-310)and 78 (95% CI: 32-264). The probability of achieving the conservation requirement was only 4% for large and 8% for small salmon (Figs. 4, 5).

Based on fecundity values derived from stock characteristics observed in 1996 (5783 eggs/large salmon, 89 eggs/small salmon), total egg deposition was estimated at 46% of the conservation requirement for the system, assuming that all fish spawned in the Buctouche River and its tributaries. This is a decline of 21% relative to 1995. Since it was known that some fish had ascended the river past the counting fence site prior to the commencement of both tagging and fence operation, this estimate may be considered a minimum. However, this component was observed to be mostly small salmon, and would have contributed little to egg deposition. It is therefore concluded that the conservation requirement was not met on the Buctouche River in 1996.

Sources of Uncertainty

The proportion of the run which ascended the river prior to the operation of mark-recapture facilities is not known, but presumed to be negligible for large salmon.

Estimates of small salmon returns and escapement are based on proportion observed at capture facilities, but relative capture efficiencies are not known.

It has been assumed that all spawning occurred in the Buctouche River. However, several smaller streams flow into the estuary which have some spawning potential for salmon, since low numbers of juveniles were found there. It cannot be estimated what proportion of the returns may have used these streams, but is thought to be very small.

The conservation requirement for the Buctouche River may be unrealistically high in terms of the proportion of total habitat used or accessible to spawning salmon, and the overall quality of the habitat may be inferior to that assumed in the application of 2.4 eggs m^{-2}. Juvenile data suggest that the upper reaches of the Main stem may be inaccessible or inadequate for rearing, and many of the tributaries were blocked by numerous beaver dams. The gradient of the river is low, creating extensive areas of low flow at normal summer level, and much of the substrate was observed to be large rock or bedrock. The proportion of the total habitat judged to be riffle of fair to good quality, or run, was only 63%.

Ecological Considerations

Water flows in the Buctouche River were adequate for fish to ascend prior to the installation of mark-recapture facilities, as evidenced by the occurrence and capture of small salmon and the occasional large salmon at the Forks pool. Persistent and heavy rain with accompanying high water levels prevailed from early October well into November. This caused difficulty maintaining the counting fence and a total count of salmon for the duration of its operation was not possible. Angling conditions were reportedly fair, and somewhat better than in 1995. High water for an extended period was probably beneficial to spawners, allowing them access to upriver spawning sites and potentially deterring poaching efforts.

Forecast/Prospects

At present there is no reliable method of forecasting returns of Atlantic salmon to the Buctouche River. Given a longer term data set, it may be possible to develop a stock/recruit relationship. However, for the four assessed years 1993 to 1996 the conservation requirement has not been met; the mean level being 53% (range 35% - 72%). It is therefore unlikely that conservation requirements will be met in 1997.

Management Considerations

There will probably not be a harvestable surplus of either large or small salmon from the Buctouche River in 1997.

Research Recommendations

1. Operate at least one marking trap in the estuary, in conjunction with a counting fence upriver. If the fence cannot be maintained, two estuary traps should be operated. Ideally, these facilities should be operated from the first week in September until the first week of November. Both large and small salmon should be marked in the estuary.

2. Repeat the electroseining survey to determine the extent of habitat use, validate spawning success, and monitor the survival of stocked fall fingerlings.

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Table 1. First Nation harvest and allocation of Atlantic salmon from the Buctouche River.

	Harvest		Allocation	
Year	Large	Small	Large	Small
1992	12	0		
1993	0	0		
1994	12	11	36	56
1995	0	15	36	56
1996	4	25	36	56

Table 2. Atlantic salmon angling catch on the Buctouche River, 1984 - 1995. Estimates provided by New Brunswick Department of Natural Resources and Energy. Small salmon numbers up to 1993 include released fish. Dashes (-) indicate insufficient data to calculate; 1996 data not available (na).

Bright Salmon

Year	Small Kept	Small Rel	Large Rel	Total	% Large	Rods	CPUE
1984	13		-	13	-	13	1.000
1985	-		-	-	-	-	-
1986	60		34	94	36.2	94	1.000
1987	-		-	-	-	53	-
1988	-		-	-	-	31	-
1989	-		52	52	-	192	0.271
1990	16		47	63	74.6	213	0.296
1991	-		-	-	-	308	-
1992	-		-	-	-	314	-
1993	57	7	35	99	35.4	817	0.121
1994	6	0	31	37	83.8	171	0.216
1995	33	0	0	33	0	50	0.660
1996	na	na	na	na	na	na	na
Mean,91-95	-	-	-	-	-	332	-
96+/- Mean	-	-	-	-	-	-	-

Table 3. Calculation of the conservation requirement for the Buctouche River.

AREAS SURVEYED: Total habitat - sq.m (DNRE database):	
Bouctouche main (above forks)	295493
Bouctouche main (below forks)	82354
Upper North Branch	22377
Richard Brook	6706
Unnamed tributary	4900
Johnson Brook	20645
McLean Brook	9820
Yankee Brook	8420
South Branch	206134
Bailey Brook	4369
Total Area	661218
STOCK CHARACTERISTICS: (mean 1993-95)	
Male proportion of large salmon	0.24
Female proportion of large salmon	0.76
Mean length of large female salmon (cm)	78.1
Eggs per large female (1.4132 x LN(FL) + 2.7560)(Randall MS1985)	7441
Eggs per large salmon (eggs / lg female x lg female proportion)	5655
Male proportion of small salmon	0.85
Female proportion of small salmon	0.15
Mean length of small female salmon (cm)	55.6
Eggs per small female (3.1718 x LN(FL) - 4.5636)(Randall MS1985)	3573
Eggs per small salmon (eggs / sm female x sm female proportion)	536
SPAWNING REQUIREMENTS:	
Egg deposition rate (no. / sq.m) (CAFSAC MS1991)	2.4
EGG REQUIREMENT (millions) (Total area x deposition rate)	1.587
TOTAL LARGE SALMON (egg target / eggs per lg salmon)	281
Large females (total large x lg female proportion)	213
Large males (total large - large females)	67
Small males needed (large females - large males)	146
TOTAL SMALL SALMON (sm males needed / sm male proportion)	172
2SW COMPONENT:	
Proportion 2SW (of total large salmon: mean 1992-1994)	0.87
TOTAL 2SW (total large x proportion 2SW)	244

Table 4. Fall fingerling Atlantic salmon stocked in the Buctouche River, 1978-79.

Location	Map site	Year	Number	Fork lgth (mm)	Origin
Main R.,Coates Mill Bridge	H	1978	3731	61	Miramichi/Sevogle R. (early run)
		1979	2320	65	Miramichi/Sevogle R. (grilse matings)
Main R., St. Paul contact	17	1978	4606	61	Miramichi/Sevogle R. (early run)
		1979	1384	65	Miramichi/Sevogle R. (grilse matings)
Main R., St. Paul crossroad	4	1978	3964	61	Miramichi/Sevogle R. (early run)
		1979	1221	65	Miramichi/Sevogle R. (grilse matings)
Main R., Sweeneyville	6	1978	3615	61	Miramichi/Sevogle R. (early run)
		1979	692	65	Miramichi/Sevogle R. (grilse matings)
Main R., (Rte. 490)	2	1978	5422	61	Miramichi/Sevogle R. (early run)
		1979	1018	65	Miramichi/Sevogle R. (grilse matings)
Rte. 520 contact	7	1978	2390	61	Miramichi/Sevogle R. (early run)
		1979	1384	65	Miramichi/Sevogle R. (grilse matings)
Johnson Br. (Rte. 510)	13	1978	991	61	Miramichi/Sevogle R. (early run)
South Branch (0.2 km above Forks)	8	1978	2740	61	Miramichi/Sevogle R. (early run)
		1979	1221	65	Miramichi/Sevogle R. (grilse matings)
Yankee Brook (Rte. 490)	14	1978	350	61	Miramichi/Sevogle R. (early run)
All sites		1978	27809	61	Miramichi/Sevogle R. (early run)
		1979	9240	65	Miramichi/Sevogle R. (grilse matings)

Table 5. Salmon catches by day and standard week in the Mark trap and Counting fence, Buctouche River, 1996. Shaded figures indicate days when the counting fence was not operating, or only partially.

Date	Mark		Fence	
Mo/Da	Large	Small	Large	Small
917	0	2	-	-
918	2	1	-	-
919	0	0	-	-
920	6	10	-	-
921	0	0	-	-
922	0	0	-	-
923	2	3	-	-
924	1	3	-	-
925	0	0	-	-
926	1	1	-	-
927	3	2	-	-
928	0	0	-	-
929	0	0	-	-
930	6	1	-	-
1001	0	0	-	-
1002	0	0	-	-
1003	0	0	-	-
1004	0	0	-	-
1005	0	0	-	-
1006	0	0	-	-
1007	1	1	-	-
1008	0	0	-	-
1009	1	0	0	5
1010	0	0	4	6
1011	0	0	8	6
1012	0	0	0	0
1013	0	0	1	1
1014	0	0	3	1
1015	0	0	0	0
1016	0	0	0	0
1017	1	1	0	0
1018	1	0	0	0
1019	0	0	0	1
1020	0	0	0	2
1021	1	0	1	4
1022	0	0	3	3
1023	0	0	16	4
1024	0	0	3	0
1025	0	0	11	1
1026	0	0	0	0
1027	0	0	1	0
1028	0	0	1	0
1029	-	-	0	1
1030	-	-	0	0
1031	-	-	0	0
1101	-	-	0	0
1102	-	-	0	0
1103	-	-	1	0

	Mark		Fence	
Std. Week	Large	Small	Large	Small
38	10	16		
39	11	7		
40	1	1		
41	1	0	16	19
42	3	1	1	7
43	0	0	35	8
44			1	1

Cumulative Total

	Mark		Fence	
Std. Week	Large	Small	Large	Small
38	10	16		
39	21	23		
40	22	24		
41	23	24	16	19
42	26	25	17	26
43	26	25	52	34
44			53	35

Standardized weeks used to describe run timing.

Week	Month	Days
38	September	17-23
39	September	24-30
40	October	01-07
41	October	08-14
42	October	15-21
43	October	22-28
44	October	29-04

Table 6. Age distribution of Buctouche River salmon, 1995. SW = sea winter; repeat spawner categories indicate total sea age followed by sea ages at which the fish spawned.

			Repeat Spawners						
Smolt Age	1SW	2SW	3.1	3.2	4.2	4.2.3	6.2.4	Total	% known age
2+	38	20	1	3	1	0	0	63	54
3+	26	20	0	0	4	1	1	52	45
4+	1	0	0	0	0	0	0	1	1
?	0	1	0	0	4	0	0	1	
Total	65	41	1	3	5	1	1	117	

Proportion repeat spawners of MSW = 21%
Proportion repeat 1SW of MSW = 2%
Proportion 2SW of MSW = 79%

Table 7. Densities of juvenile salmonids and dace from closed site electroseining on the Buctouche R., 1996; (nc - not calculable, * variances unreliable due to small catch or negative value).

Location	Map Site	Area (m^2)	No. of Sweeps	Life Stage	Sweep Catch	Pop. Estimate	Variance	Upsweep Catch	Total Estimate	Density ($100\,m^{-2}$)	Mean FL(cm)	PHS
Salmon												
Main R. (above Forks)	1	576	3	Fry	12	17.5	*-439.1	11	28.5	5.0	5.4	0.7
Main R. (below Rte. 490)	2	325	3	Fry	8	11.7	*-79.2	5	16.7	5.1	5.0	0.6
South Branch (below Rte. 490)	3	327	3	Fry	13	14.5	*83.0	9	23.5	7.2	5.6	1.1
Main R. (0.3 km below Johnson Brook)	6	440	3	Fry	7	8.3	*0.3	3	11.3	2.6	5.2	0.3
Main R. (100 m above Forks)	1	576	3	Parr	18	18.1	*0.02	16	34.1	5.9	9.5	3.6
Main R. (below Rte. 490)	2	325	3	Parr	12	nc	nc	3	nc	nc	10.6	nc
South Branch (below Rte. 490)	3	327	3	Parr	31	70	17083.5	15	85.0	26.0	10.2	19.2
Main R. (0.3 km below Johnson Brook)	6	440	3	Parr	16	27.8	*-3487.5	11	38.8	8.8	10.3	6.6
Dace												
Main R. (100 m above Forks)	1	576	3		238	376.3	3313.9	112	488.3	84.8	5.0	
Main R. (below Rte. 490)	2	325	3		176	267.9	1910.6	87	354.9	109.2	4.5	
South Branch (below Rte. 490)	3	327	3		153	342.3	19728.3	85	427.3	130.7	5.0	
Main R. (0.3 km below Johnson Brook)	6	440	3		253	425.6	5372.1	125	550.6	125.1	5.2	

Table 8. Catch per 15 minute upstream sweep at all electroseining sites, Buctouche R., 1996.

Location	Map Site	Salmon fry	Salmon parr	Trout	Chub	Dace	Eel	Lamprey	Sculpin	Shiner	Stickle-back	Sucker
Main R. (100 m above Forks)	1	10	14	0	0	97	2	0	0	0	0	8
Main R. (below Rte. 490)	2	4	[illegible]	0	10	63	0	1	4	0	1	5
South Branch (below Rte. 490)	3	6	10	0	5	56	0	4	1	0	1	3
Main R. (0.6 km below St. Paul crossroad)	4	0	2	0	25	44	0	4	0	0	2	0
Upper N. Br. (below Rte. 510)	5	0	2	1	38	8	0	1	0	0	2	14
Main R. (0.3 km below Johnson Brook)	6	2	7	0	14	83	0	1	0	0	0	5
Main R. (0.5 km above Coates Mill Bridge	7	20	23	0	6	41	0	0	1	2	1	18
South Branch (0.2 km above Forks)	8	2	8	0	8	74	1	0	0	2	2	9
Trout Brook (below Rte. 515)	9	1	11	14	2	1	0	0	108	0	0	0
Mill Creek (below McNairn road)	10	0	1	3	12	16	0	2	26	0	0	12
South Branch (3.5 km below Rte. 490)	11	17	15	0	7	111	0	0	1	6	2	5
Main R. (below Rte. 485)	12	0	0	0	39	43	0	3	0	2	10	29

Table 9. Comparison of wild juvenile Atlantic salmon densities on the Buctouche R., 1977-96; (nc - not calculable). Presence (P) or absence (A) is shown for spot checks in 1974.

FRY

Location	Map Site	1974	1977	1978	1979	1980	1982	1994	1995	1996
Main R. (100 m above Forks)	1	-	-	-	-	-	-	0.0	2.6	5.0
Main R. (below Rte. 490)	2	-	0.0	nc	0.0	2.0	0.0	-	-	5.1
South Branch (below Rte. 490)	3	-	0.0	77.5	29.5	6.1	3.3	0.0	0.0	7.2
Main R. (0.6 km below St. Paul crossroad)	4	-	0.0	8.7	13.7	6.5	nc	-	-	-
Main R. (0.3 km below Johnson Brook)	6	-	-	-	-	-	-	-	-	2.6
South Branch (0.2 km above Forks)	8	-	0.5	11.9	0.0	-	0.0	-	-	-
Johnson Br. (Rte. 510)	13	-	0.0	4.1		-	-	-	-	-
Yankee Br. (Rte. 490)	14	P	0.0	9.6	0.0	-	2.6	-	-	-
Main R. (1 km above Forks)	15	-	nc	17.6	nc	-	-	-	-	-
Bailey Br.	16	A	-	-	-	-	-	-	-	-

PARR

Location	Map Site	1974	1977	1978	1979	1980	1982	1994	1995	1996
Main R. (100 m above Forks)	1	-	-	-	-	-	-	2.7	1.5	5.9
Main R. (below Rte. 490)	2	-	1.2	nc	10.0	3.5	nc	-	-	nc
South Branch (below Rte. 490)	3	-	24.8	10.5	25.8	11.5	10.6	0.0	1.4	26.0
Main R. (0.6 km below St. Paul crossroad)	4	-	5.6	nc	7.2	2.9	5.1	-	-	-
Main R. (0.3 km below Johnson Brook)	6	-	-	-	-	-	-	-	-	8.8
South Branch (0.2 km above Forks)	8	-	3.1	1.5	5.6	-	9.0	-	-	-
Johnson Br. (Rte. 510)	13	-	nc	nc	-	-	-	-	-	-
Yankee Br. (Rte. 490)	14	P	0.7	0.0	5.9	-	2.0	-	-	-
Main R. (1 km above Forks)	15	-	nc	2.1	13.3	-	-	-	-	-
Bailey Br.	16	P	-	-	-	-	-	-	-	-

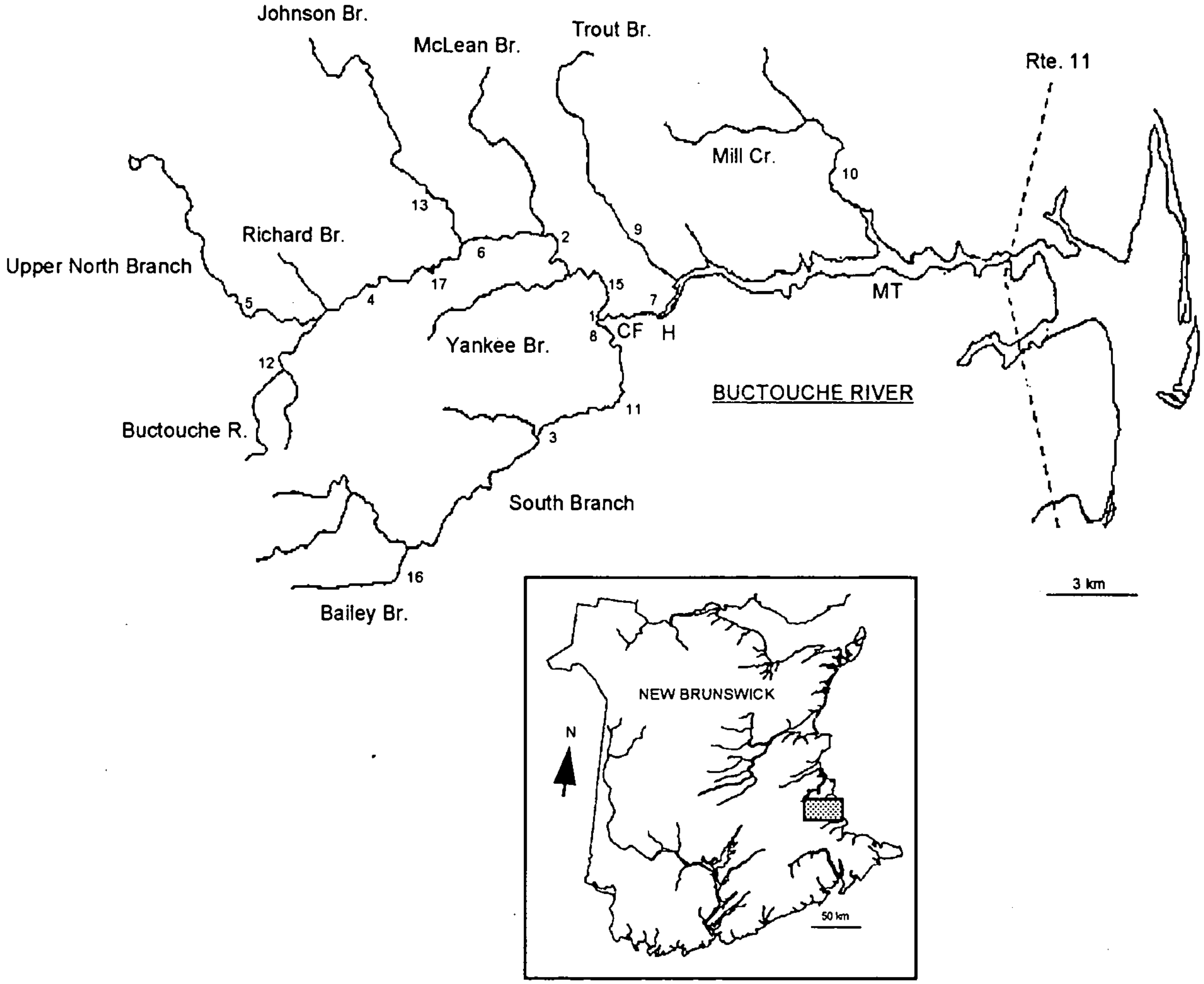

Figure 1. Location of mark trap (MT), head of tide (H), counting fence (CF), and electroseining/stocking sites (1 - 17) on the Buctouche River.

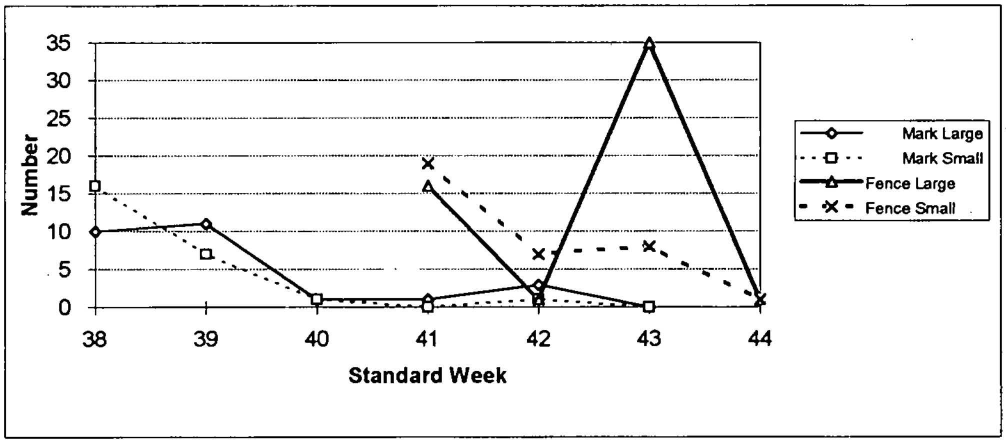

Figure 2. Salmon catches by standard week in the Mark trap and Counting fence, Buctouche River, 1996.

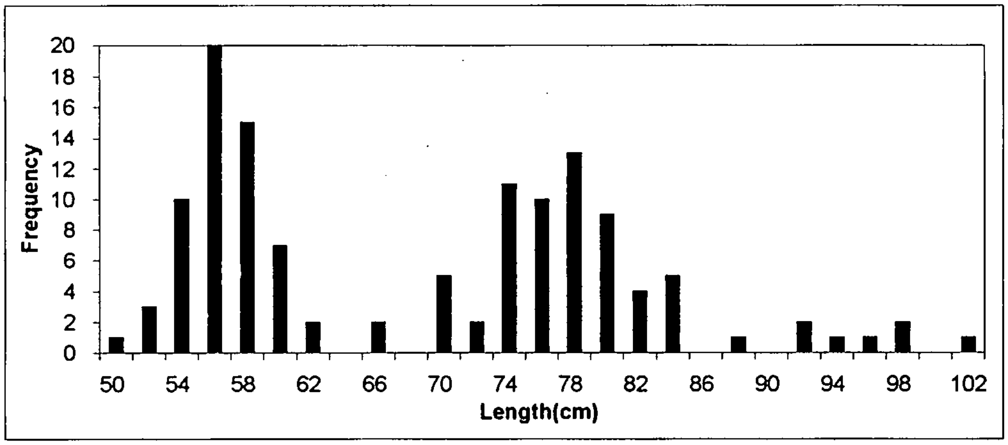

Figure 3. Length frequencies of salmon caught in Buctouche R. counting facilities, 1996. Recaptures have been excluded (N=127).

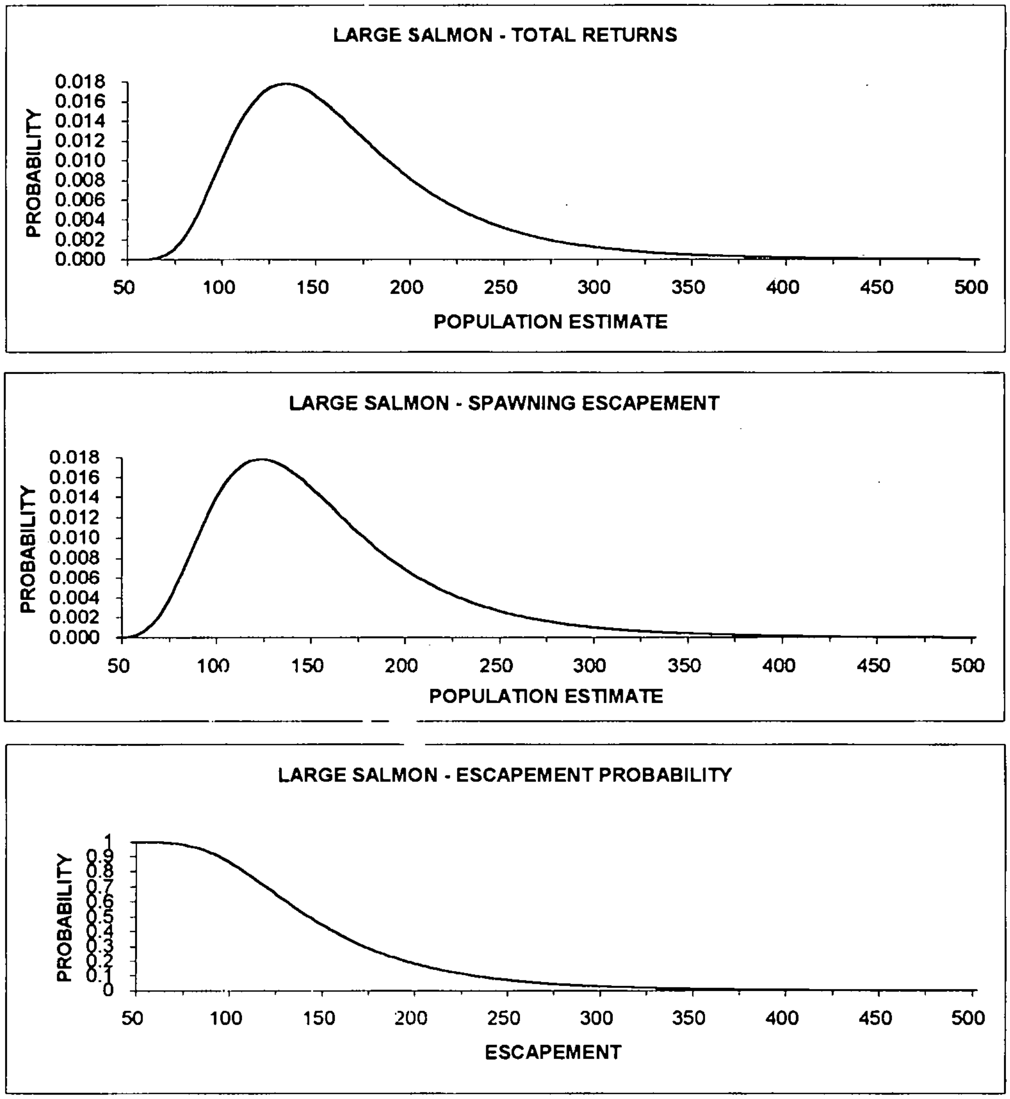

Figure 4. Bayesian estimates of large salmon total returns (134), spawning escapement (124) and probability (0.04) of achieving conservation spawning escapement (281) for the Buctouche River in 1996.

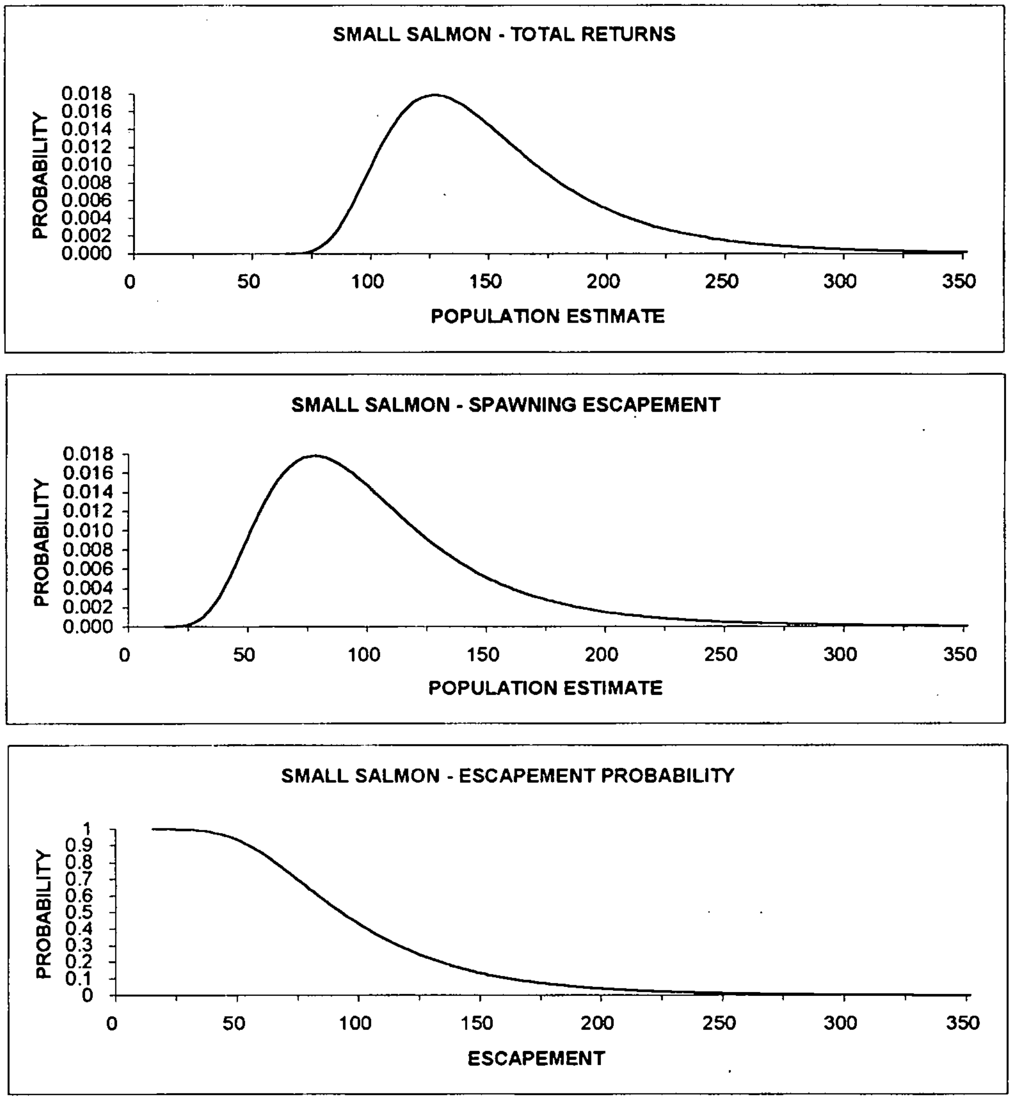

Figure 5. Bayesian estimates of small salmon total returns (127), spawning escapement (78) and probability (0.08) of achieving conservation spawning escapement (172) for the Buctouche River in 1996.