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# Status of Atlantic salmon in the Restigouche River, 1984 

by

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#### Abstract

ABSIRACT

Severe controls on the harvest of large salmon in the Restigouche River in 1984 restricted homewater landings to 2,773 salmon, compared to 7,659 fish in 1983. Despite similar returns of large salmon in 1983 and 1984, a greater proportion potentially survived to spawning in 1984 ( $74 \%$ versus $38 \%$ in 1983) because of this reduced homewater harvest. Spawning escapement was estimated to be 42 to $114 \%$ of requirements. Grilse catches in 1984 were higher than in 1983 ( 7,983 versus 2,332 ) suggesting returns of grilse were greater. Large salmon returns in 1985 were forecasted to be about 12,000 fish; therefore, spawning requirements will only be met if there are no homewater removals. If returns of grilse in 1985 are average, there could be a surplus of 6,000 grilse.


## RÉSUME

Les prises de saumons rédibermarins dans la Rivière Restigouche en 1984 furent limitées à 2773 poissons, grâce à l'imposition de restrictions sévères sur la pêche. En 1983 ces prises se chiffraient à 7.659 poissons. Quoique les retours de saumons rédibermarins furent semblables pour 1983 et 1984, le potentiel de survie jusqu'au frai fut augmenté considérablement en 1984 (74\% contre 38\% en 1983) grâce à cette baisse dans les prises. Le nombre estimatif de géniteurs ayant échappé à la pêche se situe entre $42 \%$ et $114 \%$ des besoins calculés. Les prises de madeleineaux en 1984 furent supérieures à celles de 1983 ( 7983 contre 2332 en 1983), ce qui suggère une augmentation dans les retours. Les prévisions des retours de saumons rédibermarins pour. 1985 se chiffrent à environ 12000 . Les besoins en géniteurs seront donc atteints seulement si il n'y a aucune pêche dans les eaux natales. Si les retours de madeleineaux sont normaux en 1985, il pourrait y avoir un surplus d'environ 6.000 madeleineaux.

## INTRODUCTION

Regulations controlling the harvest of salmon from the Restigouche River in 1984 were more severe than in 1983. Commercial fishermen on the New Brunswick side of Baie des Chaleurs were restricted to a two-week season (July 9-20) with no quota, rather than a seven-week season (June 13 - July 31) and a quota of 4,000 salmon and 4,000 grilse as in 1983. There was no commercial fishery allowed on the Quebec shore of Baie des Chaleurs in 1984. New Brunswick anglers were restricted to a grilse only fishery (salmon < 63 cm ); large salmon were released. Quebec anglers were allowed to keep both grilse and salmon, but their daily and seasonal bag limits were reduced by $50 \%$ from 1983 (to 1 and 7 fish, respectively). Native fishermen at Cross Point were allocated a reduced quota of $6,995 \mathrm{~kg}$, compared to $16,648 \mathrm{~kg}$ in 1983. Native fishermen at Eel River Bar, as in 1983, were not restricted by quota.

Salmon from the Restigouche River are also intercepted in the Newfoundland and commercial fishery each year (Pippy 1982). Reduced seasons and closures in many areas of Newfoundland during 1984 should have reduced these interceptions.

The objective of this assessment was to (i) summarize 1984 landings, (ii) estimate current spawning escapement and (iii) evaluate the impact of the 1984 management plan on the salmon stock from the Restigouche River.

## METHODS

## a. Landings

Commercial salmon fishermen from Baie des Chaleurs reported landings on a weekly basis to DFO. Landings were divided by size into grilse ( $<63 \mathrm{~cm}$ ), small salmon ( $63-85 \mathrm{~cm}$ ) and large salmon ( $>85 \mathrm{~cm}$ ). Effort was calculated as total fishing days (season (d) X fishermen).

Angling catches from the Matapedia, Patapedia, Kedgwick and Main Restigouche Rivers were reported by the Ministère du Loisir, de la Chasse et de la Pêche (MLCP). New Brunswick angling catches were summarized monthly by DFO officers. Crown open and crown reserve angling data were provided by the New Brunswick Department of Natural Resources (DNR). Effort from all three sources was given in rod days, where 1 rod day was defined as 1 fishermen fishing a river for any portion of one day.

Native fishery landings from Cross Point, Quebec, were provided by MLCP. Landings from Eel River Bar, NB, were reported weekly to DFO by the Band Council Office.

Counts of salmon and grilse at a fish barrier in the upper Upsalquitch River were available from DNR. This fish barrier has been operated since 1980.

Biological characteristics and ages of spawning salmon were determined from about 200 fish sampled from the commercial and Native fisheries. Sampling included: recording gear, area and date; removing scales for aging; recording length ( cm ) and weight ( 0.1 kg ).

## b. Stock and recruitment

Juvenile salmon densities were estimated at 50 sites in the Restigouche River during 1984. Chadwick and Randall (1983) used historical juvenile densities (1972 to 1980) as an estimate of recruitment for calculating a stockrecruitment relationship. This relationship was updated for this assessment using current (1983 and 1984) parr densities. Angling catches of large salmon (New Brunswick) were used as an estimate of spawning stock.

## c. Egg deposition requirements

Methodology used for calculating spawning requirements for the Restigouche River was described by Randall (1984).

## d. Spawning escapement in 1984

As in the previous two assessments (Chadwick and Randall 1983; Randall and Pickard 1983), two methods were used to calculate spawning escapement. in 1984:

Method 1: An angling exploitation rate of 0.20 was used. This rate was calculated by Chadwick and Randall (1983) using tagging information for Restigouche salmon from 1972 and 1973. Escapement was estimated as angling catch / 0.20, minus angling and poaching removals. Total returns were calculated as the sum of escapement, harvest and poaching removals.

Method 2: A ratio of spawner to angled fish of 0.72 was used (Table 1). Total egg deposition (1972 to 1982) was back-calculated from small parr densities assuming $10 \%$ survival (Elson 1957, 1974; Chadwick 1982), and a rearing area of $29,768,000 \mathrm{~m}^{2}$. Spawners were calculated from egg deposition by dividing by eggs per salmon (Randall 1984) and were proportioned into salmon and grilse spawners using proportions of salmon from angling catches (Table 2). Escapement in 1984 was estimated as the product of the spawner to angled fish ratio and angling catch in 1984.

For both methods, mortalities of salmon due to poaching and disease were assumed to be 2,000 salmon and $1,000 \mathrm{grilse}$. Recorded furunculosis mortalities were 200 salmon and 50 grilse (A. Madden, DNR, Campbellton); however, poaching or unaccounted losses in freshwater were probably much higher, as discussed later.

Since New Brunswick anglers were not allowed to land large salmon in 1984, a hypothetical angling catch was estimated from (i) a correlation between Quebec angling and New Brunswick angling landings, 1970 to 1983, and (ii) a correlation between catch and release of salmon at four angling camps and total Restigouche catches, 1970 to 1983 (Chadwick et al. 1984).

## e. Forecast of 1985 returns of large salmon

Returns of large salmon to the Restigouche River in 1985 were predicted from a significant correlation between grilse at Kedgwick Lodge (year i) and total Restigouche salmon returns (year i +1). Data from Kedgwick Lodge are given by Chadwick et al. (1984).

## RESULTS

## a. 1984 Landings

Total Baie des Chaleurs commercial landings in 1984 were 2,026 salmon and 7,161 grilse (Table 3). Effort was substantially lower in 1984 than in 1983; fishing days (number of traps $X$ number of fishermen) were reduced from 836 to 220. This reduction was primarily because of the shorter season (July 9-20), but also fewer fishermen operated in 1984 (20) than in 1983 (25). Despite less effort, however, landings of grilse were up considerably (387\%) and salmon catches were comparable to 1983. It was difficult to interpret whether or not this indicated increased returns, however, since there was no quota in 1984.

Tagging studies in 1983 indicated some of the salmon landed in Statistical Districts 64 and 65 were destined for the Nepisiguit River (Lutzac 1984). Landings in 1984 were adjusted using these same proportions, and all remaining fish were assumed to be of Restigouche River origin (Table 3).

The New Brunswick angling season in 1984 was the same as in 1983 (June 15 to August 31) while the Quebec season was delayed by two weeks (June 15 until August 31). Angling landings were 590 salmon and 1,990 grilse (Table 4). In Quebec, since total effort was similar in 1984 to 1983 ( 6,915 rod days compared to 6,664 ), increased grilse catches in 1984 ( 612 compared to 181) suggest increased returns. Grilse catches were also up in New Brunswick (1,378 from 715), but at least part of this increase resulted from all angling effort being directed towards grilse. Large salmon catches in Quebec were down slightly in 1984 (590 compared to 587 in 1983), suggesting approximately equal returns in both years.

Native fishermen at Cross Point reported landing 1,081 salmon and 173 grilse; thus they attained their quota. Native fishermen at Eel River Bar reported a catch of 213 salmon.

Total Restigouche landings in 1984 were 2,773 salmon and 7,983 grilse (Table 5). These landings are compared to historical catches in Table 6.

Counts of both salmon and grilse in the Upsalquitch River were up in 1984 compared to 1983 (Table 7). However, grilse returns were below the 1980-82 average, while salmon returns were average.

Samples of fish examined from commercial and Native fisheries indicated salmon and grilse were predominately from the 1979 and 1980 year-classes, respectively. Biological characteristics of salmon are given below:

| Sea age <br> $(\mathrm{yr})$ | n | Fork length <br> $(\mathrm{cm})$ | Weight <br> $(\mathrm{kg})$ | Condition |
| :---: | :---: | :---: | :---: | :---: |
| 1SW | 72 | 52.7 | 1.41 | 0.95 |
| 2SW | 103 | 75.7 | 4.51 | 1.03 |
| 3SW | 23 | 91.0 | 8.58 | 1.13 |
| Multiple spawner | 11 | 101.5 | 12.36 | 1.16 |

## b. Stock and recruitment

Densities of fry, small parr and large parr were down slightly in 1984 from 1983 (Table 8). A stock-recruitment relationship for Restigouche salmon, using these data, is illustrated in Figure 1. Small parr (recruitment) were significantly correlated to angled salmon (spawning stock) as described by the equation: $y=1.91+0.0012 \times(r=0.75, P<0.01)$, where $y=\operatorname{parr}($ year $i+2)$ and $x=$ angled salmon (year i).

## c. Spawning requirements

Egg deposition requirements for the Restigouche River were calculated to be 71,443,200 eggs (Randall 1984). About 12,200 salmon are required to achieve this deposition; another 2,600 grilse are required to ensure a $1: 1$ sex ratio at spawning.

## d. Spawning escapement in 1984

The two estimates of total angling catch of large salmon in the Restigouche River for 1984 (Quebec catch plus hypothetical NB landings) were not significantly different:

| Method | $\frac{R^{2}}{}$ | Predicted catch of <br> large salmon |  | Adjusted total <br> catch |
| :--- | :---: | :---: | :---: | :---: |
| 1) Quebec versus NB angling | 0.52 | $1,937(0-4,401)$ | 2,527 |  |
| 2) NB camps versus total angling |  |  |  |  |
| (Chadwick et al. 1984) | 0.88 | $2,837(1,895-4,759)$ | 3,327 |  |

Both estimates had inherent biases. Quebec angling slightly underestimated total Restigouche angling since effort in 1984 was less than in previous years (bag limits). On the other hand, total angling estimated from camp data (Chadwick et al. 1984) was an overestimate; the 1984 prediction was based on catch and release data which, since no salmon were landed, was probably inflated because of recaptures. However, the latter estimate $(3,300)$ was used since the correlation was better.

Spawning escapements as estimated by Methods 1 and 2 were substantially different:

| 1. Total returns | 18,683 | 15,943 | 9,893 | 10,416 |
| :--- | ---: | ---: | ---: | ---: |
| 2. Harvest | 2,773 | 7,983 | 2,773 | 7,983 |
| 3. Poaching and disease | 2,000 | 1,000 | 2,000 | 1,000 |
| 4. Broodstock | 34 | 0 | 34 | 0 |
| 5. Spawning escapement | 13,876 | 6,960 | 5,086 | 1,433 |
| 6. Target spawners | 12,200 | 2,600 | 12,200 | 2,600 |
|  |  |  |  |  |
| \% of target achieved | $114 \%$ | $268 \%$ | $42 \%$ | $55 \%$ |

Escapement estimated from the angling exploitation rate indicated spawning requirements were met, while escapement estimated from the ratio of spawners to angled fish indicated salmon and grilse spawners were below requirements by 58 and 45\%, respectively. In terms of egg deposition, Method 2 indicated a spawning deposition of $30.2 \times 10^{6}$ eggs ( $42 \%$ of requirements).

## e. Prediction of 1985 returns

Total large salmon returns to the Restigouche River in 1985 were predicted from the equation (Table 9):
$y=6842.1+64.8 \times(r=0.76, P<0.01)$
where $y=$ salmon returns (year i +1 )
$x=$ grilse catch at Kedgwick Lodge (year i)
The 1985 predicted return of salmon was 12,219 (6,195-18,243).
Grilse returns, assuming average returns from 1982 to 1984, could be about 9,000 fish. Grilse in 1985 will be predominantly from the 1981 year-class; fry and parr densities of this year-class were average (Table 8).

## DISCUSSION

Angling landings (Quebec) and catch and release data (New Brunswick) indicate large salmon returns to the Restigouche River in 1984 were similar to 1983. Predicted returns (from Randall and Pickard 1983) are compared to actual returns below:

Method $1 \quad$ Method 2

| Predicted returns | 16,000 | 11,300 |
| :--- | ---: | ---: |
| Actual | 18,700 | 9,900 |
| $\%$ difference | +17 | -12 |

Both methods were reasonably accurate in estimating salmon returns in 1984. Actual total returns ( $10,000-20,000$ salmon) were comparable to estimated returns in 1982 and 1983 (Chadwick and Randall 1983; Randall and Pickard 1983), indicating Restigouche stocks have remained low.

Greater restrictions on the harvest of Restigouche salmon in homewaters during 1984, however, increased the survival of returned salmon to spawning. Potential spawning escapement from 1982 to 1984 is compared to total returns below:

|  | $\underline{1984}$ | $\underline{1983}$ | $\underline{1982}$ |
| :--- | :---: | :---: | :---: |
| Total returns | 18,700 | 15,700 | 24,200 |
| Potential spawners | 13,900 | 5,900 | 12,600 |
| $\%$ survival | $74 \%$ | $38 \%$ | $52 \%$ |

Survival of homewater returns to spawning thus increased from 38\% in 1983 to $74 \%$ in 1984, primarily because of reduced harvests. Most egg deposition (greater than $95 \%$ ) in the Restigouche River comes from large salmon (Randall 1984). Spawning escapement of large salmon as calculated using Methods 1 and 2 indicated between 42 and $114 \%$ of spawning requirements were achieved in 1984.

The large discrepancy observed between estimates of egg deposition result from the fact that Method 1 estimates potential spawners (from angling catches) while Method 2 estimates actual spawners (from parr densities). Differences between potential and actual egg depositions from 1972 to 1982 were considerable (average 82\%; Table 11). These differences could result from:
(i) the use of an angling exploitation rate that was much too low;
(ii) greater mortalities after angling and before spawning (from disease and poaching) than we presently assume.

Probably both factors contribute to the discrepancy, but whatever the reason, these results indicate spawning escapement as estimated by Method 1 was much too high.

The stock-recruitment relationship for the Restigouche River (Figure 1) verified that spawning levels have been low in recent years. The relationship was linear and not asymptotic, indicating that carrying capacity for juveniles had not been achieved.

Because estimates using Method 1 were too optimistic, escapement and total returns for forecasting were calculated using Method 2 (Table 10). Grilse catches at Kedgwick Lodge in 1984 predict a total return of large salmon of about 12,200 fish in 1985. Thus, spawning requirements could be met, but only if there is no homewater fishing mortality and if unaccounted losses in freshwater (i.e. poaching) are reduced.

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Table 1. Ratios of spawner per angled fish in the Restigouche River, 1972 to 1982.

| Year (i) | $\begin{aligned} & \text { Parr } \\ & (\mathrm{i}+2) \end{aligned}$ | Eggs/ Salmon | Proportion salmon | Spawners |  | Ratio of spawner per angled fish |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Salmon | Grilse |  |
| 1972 | 0.071 | 5,661 | 0.82 | 3,733 | 820 | 0.74 |
| 1973 | 0.097 | 6,282 | 0.76 | 4,596 | 1,452 | 0.94 |
| 1974 | 0.084 | 6,056 | 0.84 | 4,129 | 786 | 0.69 |
| 1975 | 0.044 | 6,565 | 0.69 | 1,995 | 896 | 0.69 |
| 1976 | 0.083 | 6,441 | 0.67 | 3,836 | 1,889 | 0.70 |
| 1977 | 0.071 | 5,445 | 0.71 | 3,882 | 1,585 | 0.58 |
| 1978 | 0.041 | 6,094 | 0.76 | 2,003 | 632 | 0.40 |
| 1979 | 0.036 | 6,155 | 0.42 | 1,741 | 2,404 | 0.96 |
| 1980 | 0.044 | 4,700 | 0.66 | 2,787 | 1,435 | 0.45 |
| 1981 | 0.069 | 5,933 | 0.54 | 3,462 | 2,949 | 0.82 |
| 1982 | 0.050 | 5,933 | 0.48 | 2,509 | 2,717 | 0.97 |
| Mean |  |  |  |  |  | 0.72 |
| S.D. |  |  |  |  |  | 0.19 |

Table 2. Angling catches in the Restigouche River, 1970 to 1984.

| Year | Salmon |  |  | Grilse |  |  | Proportion salmon |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | PQ | NB | Total | PQ | NB | Total |  |
| 1970 | 326 | 1,716 | 2,042 | 166 | 1,340 | 1,506 | 0.58 |
| 1971 | 259 | 757 | 1,016 | 173 | 999 | 1,172 | 0.46 |
| 1972 | 1,171 | 3,870 | 5,041 | 111 | 978 | 1,089 | 0.82 |
| 1973 | 1,146 | 3,740 | 4,886 | 147 | 1,423 | 1,570 | 0.76 |
| 1974 | 1,163 | 4,785 | 5,948 | 129 | 1,038 | 1,167 | 0.84 |
| 1975 | 741 | 2,160 | 2,901 | 149 | 1,130 | 1,279 | 0.69 |
| 1976 | 1,029 | 4,481 | 5,510 | 377 | 2,345 | 2,722 | 0.67 |
| 1977 | 1,579 | 5,128 | 6,707 | 459 | 2,333 | 2,792 | 0.71 |
| 1978 | 1,652 | 3,373 | 5,025 | 282 | 1,322 | 1,604 | 0.76 |
| 1979 | 826 | 997 | 1,823 | 556 | 1,990 | 2,546 | 0.42 |
| 1980 | 2,059 | 4,098 | 6,157 | 409 | 2,833 | 3,242 | 0.66 |
| 1981 | 1,408 | 2,832 | 4,240 | 635 | 3,010 | 3,645 | 0.54 |
| 1982 | 962 | 1,620 | 2,582 | 402 | 2,449 | 2,851 | 0.48 |
| 1983 | 587 | 1,481 | 2,068 | 181 | 715 | 896 | 0.70 |
| 1984 | 590 | 0 | 590 | 612 | 1,378 | 1,990 | 0.23 |

Table 3. Baie des Chaleurs commercial landings, 1983 and 1984. Proportion of fish destined for Nepisiguit River is given (Lutzac 1984); the remainder are assumed to be Restigouche salmon.


Table 4. Angling statistics for the Restigouche River, 1984.

| Salmon |
| :--- | :--- |


| New Brunswick |
| :--- | :--- | :--- |


| Angling camps |
| :--- |
| Crown open and |
| reserve |

Quebec

Table 5. Preliminary 1984 landings in Restigouche River from the commercial, Native and recreational fisheries. The 1983 landings are updated from Randall and Pickard (1983).

| Fishery | 1984 |  | 1983 |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Salmon | Grilse | Salmon | Grilse |
| Commercial traps |  |  |  |  |
| New Brunswick | 889 | 5,819 | 1,773 | 1,319 |
| Quebec | - | - | 2,342 | 85 |
| Native |  |  |  |  |
| Cross Point | 1,081 | 173 | 1,216 | 32 |
| Eel River Bar | 213 | 1 | $260^{\text {a }}$ | - |
| Recreational | 590 | 1,990 | 2,068 | 896 |
| TOTAL | 2,773 | 7,983 | 7,659 | 2,332 |

a Eel River Bar landings were not used in 1983 assessment.

Table 6. Commercial and recreational salmon landings from Baie des Chaleurs and Pestigouche River, 1951 to 1984. Data are numbers $\times 10^{3}$ (Lpdated from Randall and Pickard 1983).

| Year | COMMERCIAL |  |  |  |  |  |  | PECPEATIONAL |  |  |  |  |  |  | $\begin{aligned} & \text { GRAND } \\ & \text { TOTAL } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | New Brunswick |  |  | Québec |  |  | TOTAL | New Brunswick |  |  | Québec |  |  | TOTAL |  |
|  | Gr. | Sal. | Total | Gr. | Sal. | Total |  | Gr . | Sal. | Total | Gr. | Sal. | Total |  |  |
| 1951 |  | 17.7 | 17.7 |  | 24.7 | 24.7 | 42.4 |  |  | 3.5 | 0.0 | 0.2 | 0.2 | 3.7 | 46.1 |
| 1952 |  | 19.2 | 19.2 |  | 20.4 | 20.4 | 39.6 |  |  | 5.7 | 0.1 | 0.4 | 0.5 | 6.2 | 45.8 |
| 1953 |  | 16.9 | 16.9 |  | 15.0 | 15.0 | 31.9 |  |  | 3.0 | 0.1 | 0.1 | 0.2 | 3.2 | 35.1 |
| 1954 |  | 17.1 | 17.1 |  | 14.2 | 14.2 | 31.3 |  |  | 2.9 | 0.1 | 0.4 | 0.5 | 3.4 | 34.7 |
| 1955 |  | 8.2 | 8.2 |  | 10.1 | 10.1 | 18.3 |  |  | 2.0 | 0.1 | 0.2 | 0.3 | 2.3 | 20.6 |
| 1956 |  | 7.5 | 7.5 |  | 7.7 | 7.7 | 15.2 |  |  | 2.3 | 0.1 | 0.2 | 0.3 | 2.6 | 17.8 |
| 1957 |  | 9.6 | 9.6 |  | 10.3 | 10.3 | 19.9 |  |  | 3.4 | 0.1 | 0.3 | 0.4 | 3.8 | 23.7 |
| 1958 |  | 15.4 | 15.4 |  | 11.4 | 11.4 | 26.8 |  |  | 9.1 | 0.2 | 0.4 | 0.6 | 9.7 | 36.5 |
| 1959 |  | 16.2 | 16.2 |  | 15.9 | 15.9 | 32.1 |  |  | 3.2 | 0.1 | 0.2 | 0.3 | 3.5 | 35.6 |
| 1960 |  | 13.5 | 13.5 |  | 17.1 | 17.1 | 30.6 |  |  | 3.0 | 0.0 | 0.0 | 0.0 | 3.0 | 33.6 |
| 1961 |  | 12.1 | 12.1 |  | 9.9 | 9.9 | 22.0 |  |  | 3.2 | 0.0 | 0.0 | 0.0 | 3.2 | 25.2 |
| 1962 |  | 16.4 | 16.4 |  | 11.0 | 11.0 | 27.4 |  |  | 3.4 | 0.0 | 0.0 | 0.0 | 3.4 | 30.8 |
| 1963 |  | 13.8 | 13.8 |  | 10.3 | 10.3 | 24.1 |  |  | 7.4 | 0.0 | 0.0 | 0.0 | 7.4 | 31.5 |
| 1964 |  | 15.9 | 15.9 |  | 12.9 | 12.9 | 28.8 |  |  | 6.5 |  |  | 0.4 | 6.9 | 35.7 |
| 1965 |  | 22.8 | 22.8 |  | 16.8 | 16.8 | 39.6 | 3.9 | 3.0 | 6.9 |  |  | 0.7 | 7.6 | 47.2 |
| 1966 |  | 17.8 | 17.8 |  | 15.5 | 15.5 | 33.3 | 1.7 | 1.7 | 3.4 |  |  | 0.7 | 4.1 | 37.4 |
| 1967 |  | 21.4 | 21.4 |  | 13.3 | 13.3 | 34.7 | 1.1 | 2.4 | 3.5 |  |  | 0.8 | 4.3 | 39.0 |
| 1968 |  | 15.7 | 15.7 |  | 11.0 | 11.0 | 26.7 | 0.4 | 0.6 | 1.0 |  |  | 0.2 | 1.2 | 27.9 |
| 1969 |  | 10.2 | 10.2 |  | 8.2 | 8.2 | 18.4 | 1.4 | 1.2 | 2.6 |  |  | 0.4 | 3.0 | 21.4 |
| 1970 |  | 9.1 | 9.1 |  | 9.1 | 9.1 | 18.2 | 1.4 | 1.7 | 3.1 | 0.2 | 0.3 | 0.5 | 3.6 | 21.8 |
| 1971 |  | 3.9 | 3.9 |  | 5.0 | 5.0 | 8.9 | 1.0 | 0.8 | 1.8 | 0.2 | 0.2 | 0.4 | 2.2 | 11.1 |
| 1972 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 3.8 | 4.8 | 0.1 | 1.2 | 1.3 | 6.1 | 6.2 |
| 1973 | 0.7 | 0.2 | 0.9 | 0.6 | 0.1 | 0.7 | 1.6 | 1.4 | 3.8 | 5.2 | 0.2 | 1.1 | 1.3 | 6.5 | 8.1 |
| 1974 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 1.0 | 4.8 | 5.8 | 0.1 | 1.2 | 1.3 | 7.1 | 7.3 |
| 1975 | 0.2 | 0.9 | 1.1 | 0.0 | 0.1 | 0.1 | 1.2 | 1.1 | 2.2 | 3.3 | 0.2 | 0.7 | 0.9 | 4.2 | 5.4 |
| 1976 | 3.7 | 0.1 | 3.8 | 1.4 | 0.1 | 1.5 | 5.3 | . 2.3 | 4.5 | 6.8 | 0.4 | 1.0 | 1.4 | 8.2 | 13.5 |
| 1977 | 1.1 | 0.2 | 1.3 | 0.0 | 0.0 | 0.0 | 1.3 | 2.4 | 5.1 | 7.5 | 0.4 | 1.6 | 2.0 | 9.5 | 10.8 |
| 1978 | 1.5 | 0.2 | 1.7 | 0.0 | 0.0 | 0.0 | 1.7 | 1.3 | 3.4 | 4.7 | 0.3 | 1.6 | 1.9 | 6.6 | 8.3 |
| 1979 | 0.1 | 0.7 | 0.8 | 0.0 | 0.0 | 0.0 | 0.8 | 2.0 | 1.0 | 3.0 | 0.6 | 0.8 | 1.4 | 4.4 | 5.2 |
| 1980 | 2.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 2.0 | 2.8 | 4.1 | 6.9 | 0.4 | 2.1 | 2.5 | 9.4 | 11.4 |
| 1981 | 3.1 | 3.5 | 6.6 | 0.0 | 0.0 | 0.0 | 6.6 | 3.0 | 2.8 | 5.8 | 0.6 | 1.4 | 2.0 | 7.8 | 14.4 |
| 1982 | 2.1 | 2.6 | 4.7 | 0.1 | 1.9 | 2.0 | 6.7 | 2.5 | 1.6 | 4.1 | 0.4 | 1.0 | 1.4 | 5.5 | 12.2 |
| 1983 | 1.5 | 2.2 | 3.7 | 0.1 | 2.3 | 2.4 | 6.1 | 0.7 | 1.5 | 2.2 | 0.2 | 0.6 | 0.8 | 3.0 | 9.1 |
| 1984 | 7.2 | 2.0 | 9.2 | 0.0 | 0.0 | 0.0 | 9.2 | 1.4 | 0.0 | 1.4 | 0.6 | 0.6 | 1.2 | 2.6 | 11.8 |

Table 7. Counts of salmon and grilse at the fish barrier on the N.W. Upsalquitch River, 1980 to 1984.

| Year <br> Yrilse | Salmon |  |
| :---: | :---: | :---: |
| 1980 | 843 | 887 |
| 1981 | 789 | 481 |
| 1982 | 819 | 622 |
| 1983 | 430 | 301 |
| 1984 | 512 | 612 |

Table 8. Juvenile Atlantic salmon densities in the Restigouche River, 1972 to 1984. $n=$ number of sites.

| Year | n | Mean Density / $100 \mathrm{~m}^{2}$ |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Fry | Small Parr | Large Parr |
| 1972 | 22 | 4.99 | 2.00 | 1.07 |
| 1973 | 25 | 17.29 | 2.54 | 0.99 |
| 1974 | 26 | 12.57 | 7.12 | $<1.00$ |
| 1975 | 31 | 31.25 | 9.66 | 2.67 |
| 1976 | 30 | 15.08 | 8.35 | 1.55 |
| 1977 | 34 | 18.99 | 4.36 | 1.60 |
| 1978 | 38 | 23.38 | 8.26 | 1.40 |
| 1979 | 40 | 10.73 | 7.13 | 2.07 |
| 1980 | 41 | 10.88 | 4.14 | 1.68 |
| 1981 | 44 | 17.27 | 3.57 | $<1.00$ |
| 1982 | 46 | 8.83 | 4.36 | $<1.00$ |
| 1983 | 50 | 33.52 | 6.87 | 3.45 |
| 1984 | 50 | 24.55 | 5.00 | 1.57 |

Table 9. Total returns of salmon to Restigouche River and catch of grilse at Kedgwick Lodge in the previous year (1969-84). Total returns are calculated in Table 10. Returns of salmon predicted for 1984 and 1985 are given in parenthesis.

| Year (i) | Kedgwick Lodge grilse catch (year i) | Total returns of salmon to Restigouche (year i +1) |
| :---: | :---: | :---: |
| 1969 | 174 | 21,600 |
| 1970 | 124 | 10,600 |
| 1971 | 72 | 8,600 |
| 1972 | 36 | 8,700 |
| 1973 | 30 | 10,400 |
| 1974 | 27 | 6,500 |
| 1975 | 33 | 11,600 |
| 1976 | 71 | 14,700 |
| 1977 | 37 | 9,300 |
| 1978 | 25 | 5,600 |
| 1979 | 128 | 14,300 |
| 1980 | 26 | 11,200 |
| 1981 | 45 | 11,200 |
| 1982 | 69 | 9,600 |
| 1983 | 44 | $(9,700)$ |
| 1984 | 83 | $(12,200)$ |

Table 10. Returns of large salmon (numbers $\times 10^{3}$ ) to the Restigouche River, 1970 to 1984. Escapement ( 1970 to 1983) was estimated as total angling $\times 0.72$ (see text). Escapement in 1984 was calculated from a hypothetical total angling harvest of 3,300 salmon $[(3,300 \times 0.72)+(3,300-590)]$.

| Year | Angling |  | Commercial |  | Native | Disease | Escapement | Total |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | NB | PQ | NB | PQ |  |  |  |  |
| 1970 | 1.7 | 0.3 | 9.1 | 9.1 | - | - | 1.4 | 21.6 |
| 1971 | 0.8 | 0.2 | 3.9 | 5.0 | - | - | 0.7 | 10.6 |
| 1972 | 3.8 | 1.2 | 0.0 | 0.0 | - | - | 3.6 | 8.6 |
| 1973 | 3.8 | 1.1 | 0.2 | 0.1 | - | - | 3.5 | 8.7 |
| 1974 | 4.8 | 1.2 | 0.0 | 0.1 | - | - | 4.3 | 10.4 |
| 1975 | 2.2 | 0.7 | 0.9 | 0.1 | - | 0.5 | 2.1 | 6.5 |
| 1976 | 4.5 | 1.0 | 0.1 | 0.1 | 1.6 | 0.3 | 4.0 | 11.6 |
| 1977 | 5.1 | 1.6 | 0.2 | 0.0 | 2.7 | 0.3 | 4.8 | 14.7 |
| 1978 | 3.4 | 1.6 | 0.2 | 0.0 | - | 0.5 | 3.6 | 9.3 |
| 1979 | 1.0 | 0.8 | 0.7 | 0.0 | 0.8 | 1.0 | 1.3 | 5.6 |
| 1980 | 4.1 | 2.1 | 0.0 | 0.0 | 1.6 | 2.0 | 4.5 | 14.3 |
| 1981 | 2.8 | 1.4 | 3.5 | 0.0 | - | 0.5 | 3.0 | 11.2 |
| 1982 | 1.6 | 1.0 | 2.6 | 1.9 | 1.7 | 0.5 | 1.9 | 11.2 |
| 1983 | 1.5 | 0.6 | 2.2 | 2.3 | 1.2 | 0.3 | 1.5 | 9.6 |
| 1984 | 0.0 | 0.6 | 2.0 | 0.0 | 1.1 | 0.2 | 5.1 | 9.0 |

Table 11. Potential and actual egg deposition in the Restigouche River, 1978 to 1982. Potential and actual depositions were calculated using Methods 1 and 2 , respectively (see text).

| Year | $\frac{\text { Egg depos: }}{\text { Potential }}$ | $\frac{\left(x 10^{6}\right)}{\text { Actual }}$ | Percent eggs lost |
| :---: | :---: | :---: | :---: |
| 1972 | 114.1 | 21.1 | 82 |
| 1973 | 122.8 | 28.9 | 76 |
| 1974 | 144.1 | 25.0 | 83 |
| 1975 | 76.2 | 13.1 | 83 |
| 1976 | 142.0 | 24.7 | 83 |
| 1977 | 146.1 | 21.1 | 86 |
| 1978 | 122.5 | 12.2 | 90 |
| 1979 | 44.9 | 10.7 | 76 |
| 1980 | 115.8 | 13.1 | 89 |
| 1981 | 100.6 | 20.5 | 80 |
| 1982 | 61.3 | 14.9 | 76 |
| Mean |  |  | 82.18 |
| S.D. |  |  | 4.94 |



Fig. 1. Stock-recruitment relationship for Atlantic salmon in the Restigouche River. Angled salmon (year i) were used as an index of spawning stock, and age 1+ parr (year i +2 ; number per $100 \mathrm{~m}^{2}$ ) as an index of recruitment.

