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# STATUS OF THE ATLANTIC SALMON (Salmo salar L.) STOCK 

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#### Abstract

This is the eighth assessment of the Atlantic salmon stock of the Humber River. A markrecapture estimate of the run size in 1997 indicated that the number of small salmon was $51 \%$ less than in 1996 and that the number of large salmon was $3 \%$ less than in 1996. The number of small salmon was the second lowest since 1992 but the number of large salmon was among the highest. The proportion of large salmon recorded at the tagging traps was the highest recorded in the period of assessment. The percentage of the spawning requirement achieved in 1997 was $115 \%$ ( $95 \% \mathrm{Cl}=91 \%-169 \%$ ). The conservation requirement would not have been achieved if the proportion of large salmon had not increased from 1992-96 levels. Given the unexpected decrease in returns of small salmon in 1997, compared to 1996, any anticipation of returns in 1998 should be made with caution. Recreational harvests in 1998 should be closely monitored to avoid overexploiting the stock if the run size is below conservation requirements.


## RÉSUMÉ

Il s'agit de la huitième évaluation du stock de saumon atlantique de la rivière Humber. Une estimation par marquage-recapture de l'effectif de la remontée de 1997 a montré que, par rapport à 1996, le nombre de petits saumons était inférieur de $51 \%$ et celui de grands saumons de $3 \%$. Le nombre de petits saumons était le deuxième plus faible depuis 1992, mais celui des grands saumons comptait parmis les plus élevés. La proportion de grands saumons déterminée aux pièges de marquage a été la plus élevée de toute la période d'évaluation. Le pourcentage des besoins de géniteurs a atteint $115 \%$ en 1997 (IC à $95 \%=91 \%-169 \%$ ). Les besoins de conservation n'auraient pas été atteints si la proportion de grands saumons ne s'était pas accrue par rapport à la période 1992-1996. Étant donné la baisse imprévue des remontées de petits saumons en 1997, comparativement à 1996, toute prévision pour 1998 devrait être faite avec prudence. La récolte de la pêche récréative de 1998 devrait être contrôlée de près afin d'éviter de surexploiter le stock si l'effectif de la remontée s'avérait inférieur aux besoins de conservation.

## INTRODUCTION

This is the eighth assessment of the status of the Humber River salmon stock since 1990. Prior to the closure of the commercial salmon fishery in 1992, the stock achieved $60 \%$ and $27 \%$ of egg deposition requirement in 1990 and 1991, respectively (Chaput and Mullins MS 1991, 1992). After the closure of the commercial fishery and the implementation of effort controls in the recreational fishery beginning in 1992, the stock has shown signs of improvement. The low population size in 1994, compared to other years since 1992 was attributed to extremely low spawning escapement in 1989 which would have produced most of the recruitment in 1994.

The Humber River is the largest river flowing into the Bay of Islands, Newfoundland at the northern limit of Salmon Fishing Area (SFA) 13 (Fig. 1). The Humber River flows into the Humber Arm at latitude $48^{\circ} 57^{\prime} N$ and longitude $57^{\circ} 53^{\prime} \mathrm{W}$. It comprises $95 \%$ of the total drainage area of the Bay of Islands $\left(8,124 \mathrm{~km}^{2}\right)$ which is $57 \%$ of the total drainage area of SFA 13. The total length of all tributaries in the Humber River is $2,450 \mathrm{~km}$. Complete obstructions to anadromous Atlantic salmon occur at Main Falls (Fig. 2) which is 112.6 km from the river mouth and at Junction Brook. Junction Brook, which flowed into the Humber River at Deer Lake was diverted for hydroelectric development in 1925, resulting in the loss of anadromous salmon habitat on the Grand Lake system (Porter et al., MS 1974) (see Fig. 2). No fish passage facility was provided for fish to bypass the diversion.

Commercial and recreational salmon fisheries management measures implemented in Newfoundland and Labrador since 1978 that would have influenced the Humber salmon stock are:

1. 1978 - commercial season shortened from 15 May - 31 December to 1 June - 10 July.
2. 1984 - mandatory release of large salmon ( $\geq 63 \mathrm{~cm}$ fork length) in recreational fishery.
3. 1987 - recreational season bag limit of 15 small salmon ( $<63 \mathrm{~cm}$ fork length).
4. $1990-35 \mathrm{t}$ commercial quota in SFA 13 commercial fishery.
5. 1991-25 t commercial quota in SFA 13; recreational season bag limit of 10 small salmon.
6. 1992 - five year commercial moratorium; recreational quota of 5,000 small salmon in SFA 13 reached on 1 August; Adies Lake (Fig. 2) quota of 100 small salmon not reached; a catch and released fishery was permitted from 2 August to 7 September after the quota was reached; recreational season bag limit of eight small salmon.
7. 1993 - recreational quota of 5,200 small salmon in SFA $13(4,160$ for 5 June to 31 July and 1,040 for 1 August to 6 September) not reached; Adies Lake closed 31 July - quota of 100 small salmon not reached; daily bag limit of one fish; Cook's Brook was closed for the season.
8. 1994 - recreational season bag limit of three small salmon before 31 July and three after 31 July; Adies Lake closed 31 July - quota of 100 small salmon not reached; daily bag limit of two fish; daily catch and release limit of four fish.
9. 1995 - recreational season bag limit of three small salmon before 31 July and three after 31 July; Adies Lake closed 30 July - quota of 100 small salmon not reached; daily bag limit of two fish; daily catch and release limit of four fish.
10. 1996 - recreational season bag limit of three small salmon before 31 July and three after 31 July; Adies Lake closed 30 July - quota of 100 small salmon not reached; daily bag limit of two fish; daily catch and release limit of four fish; catch and release fall fishery permitted for the first time from 3-30 September.
11. 1997 - recreational season bag limit of three small salmon before 31 July and three after 31 July; Adies Lake closed 30 July - quota of 100 small salmon not reached; daily bag limit of two fish; daily catch and release limit of four fish; retention fishery closed on 27 July and catch and release permitted from 28 July to 1 Sept.; fall catch and release fishery 230 September.

The present assessment provides an estimate of Atlantic salmon returns and spawning escapements in 1997. The methodology closely follows that presented for previous assessments in 199096 (Mullins et al., 1998, in press; Mullins and Reddin, MS 1996; Mullins and Reddin, MS 1995; Mullins and Chaput, MS 1995; Mullins and Chaput, MS 1993; Chaput and Mullins, MS 1992; Chaput and Mullins, MS 1991).

## MATERIALS AND METHODS

## Recreational Fishery Harvest

The recreational catch of Atlantic salmon on the Humber River in 1997 was determined from the results of a creel survey at Big Falls (Fig. 2). Anglers leave the fishing area at Big Falls via only two exit points making it possible for creel survey clerks to observe $100 \%$ of the catch.

Each of the two exit points was monitored 16 hours per day in 1997. The sampling day at each exit was divided into two eight-hour time periods: 0600-1400 hours and 1400-2200 hours. A survey clerk was assigned to each time period throughout the fishing season. The clerks interviewed anglers as they exited the fishing area and recorded the number of hours fished and the number of salmon retained and released. They also collected biological samples and examined retained salmon for the presence of Carlin tags but this was secondary to recording the catch and effort information.

As in 1994 (Mullins and Reddin, MS 1995) and 1996, the 1997 survey was based on full coverage of the fishing area throughout the fishing season. The number of anglers interviewed in the survey was expressed in terms of rod days by subtracting the anglers that were interviewed more than once. The daily catches and effort were adjusted for the number of anglers and catch that remained on the river after the last survey period of the day and for the proportion of the total scheduled survey periods that were not surveyed. Some scheduled survey periods were not surveyed because of occasional illness of clerks. No adjustment was made for anglers that may have left the river before the start of the census day.

The total catch of retained small salmon on the Humber River in 1997 was derived from the creel survey results at Big Falls according to the equation:

$$
\mathrm{C}=\mathrm{C}_{b f} / \text { Prop }_{b f}
$$

Where:
C = Catch of retained small salmon on the Humber River
$\mathbf{C}_{b f}=$ Catch of retained small salmon at Big Falls based on the creel survey
Prop $_{b f}=$ Number of tags returned voluntarily by anglers at Big Falls / Total number of tags returned voluntarily by anglers on the Humber River

Any bias in the voluntary tag reporting rate by anglers at Big Falls compared to other sections of the Humber River as a result of the presence of the creel survey clerks is believed to be minimal. Clerks were instructed not to prompt anglers in any way to return tags. Clerk also would not have observed all tags recovered at Big Falls because only fish sampled for biological information were examined closely. In addition, many anglers reported they did not observe tags in retained salmon until later examination away from the river.

The number of small salmon released on the Humber River in 1997 was estimated from the total catch of retained small salmon based on the relative proportions of small salmon retained and released at Big Falls in 1997.

The number of large salmon released on the Humber River in 1997 was estimated based on the number of large released at Big Falls and the proportion (0.354) of the total catch of large released at Big Falls in 1992-96 (Mullins et al., MS 1997). This proportion was derived from DFO catch statistics collected over the entire angling season in these years. Angling effort for large salmon in 1997, probably would not have been as affected by the closure of the retention fishery as would effort for released small salmon because the fishery for large salmon is generally later in the season when the effort for small salmon is much lower.

Recreational effort and catch of retained and released small ( $<63 \mathrm{~cm}$ ) and large ( $\geq 63 \mathrm{~cm}$ ) salmon prior to 1997 were observed and estimated by DFO river guardians and fisheries officers according to methods described by Mullins and Claytor, MS 1989 and Mullins et al., MS 1989. These statistics were not collected in 1997 so no comparison could be made with pervious years. It is cautioned that the effort and catch actually observed, as opposed to estimated by this method, declined since 1992 (Mullins and Reddin, MS 1996). Hence, the most recent years were only indirectly comparable to those previous.

Daily estimated catches and effort at Big Falls were summarized by standardized weeks.

| Standardized <br> Week | Time Period |
| :--- | :--- |
| 22 | May 28-June 3 |
| 23 | June 4-10 |
| 24 | June 11-17 |
| 25 | June 18-24 |
| 26 | June 25 - July 1 |
| 27 | July 2-8 |
| 28 | July 9 - 15 |
| 29 | July 16-22 |
| 30 | July 23-29 |
| 31 | July 30 - August 5 |
| 32 | August 6-12 |
| 33 | August 13-19 |
| 34 | August 20 to 26 |
| 35 | August 27-Sept. 2 |
| 36 | Sept. 3-9 |
|  |  |

## Estimation of Angling Exploitation Rate, Total Returns, Spawning Escapements and Potential Egg Deposition

Equations used to calculate estimates of angling exploitation, total catch and total returns are summarized in Table 1. Unless otherwise specified, confidence intervals around various estimated parameters were derived by simulation techniques. Each parameter was recalculated 5000 times by resampling at random from a binomial probability distribution dictated by the available data. The values corresponding to the $2.5^{\text {th }}$ and $97.5^{\text {th }}$ percentiles in the bootstrapped frequency distribution for each parameter were used as the lower and upper confidence limits, respectively. The bootstrap technique is described in detail by Diaconis and Efron (1983) and Efron and Tibshirani (1986).

## a. Angling Exploitation Rate

Carlin tags were applied to salmon captured at two tagging traps operated in the estuary (Fig. 1). The Lower trap has been fished in the same location at Wild Cove, Humber Arm, since 1990. The

Upper trap was fished about 1.5 km upstream from the Lower trap (the same location as in 1993 and 1995). In the 1994 assessment this trap was fished approximately 10 km further upstream. The trap designs and installation in 1997 were identical to those in the 1990-96 assessments. Tags were applied using a double stainless steel wire attachment directly under the anterior end of the dorsal fin. All salmon captured in the two traps were measured (fork length 0.1 cm ), and scale sampled. Injured salmon were not tagged. Both small and large salmon were tagged.

The estimated angling exploitation rate (er) for retained small salmon was based on tags recaptured in the angling fishery according to the formulae:

$$
e r=\mathbf{R} / \mathbf{M}
$$

Where:

$$
\begin{aligned}
& \text { R = Rv / rr } \\
& M=M a \times(1-\mathrm{TL}(0.009 \times \text { Median Days to Recapture })) \\
& \mathrm{rr}=\text { \# Tags Returned from Big Falls } / \text { \# Tags Recaptured at Big Falls }
\end{aligned}
$$

Where:
$R=$ Total number of recaptures by anglers
$\mathrm{Rv}=$ Number of recaptures reported voluntarily by anglers
$\mathrm{Ma}=$ Number of tags applied to small salmon
$M=$ Number of tags available to angling
TL = Tag loss rate due to tag shedding
$\mathrm{rr}=$ Voluntary tag reporting rate by anglers
The voluntary reporting rate (rr) of tags by anglers was estimated from recaptures of small salmon observed by the creel survey clerks at Big Falls. Clerks were instructed to observe only and not to prompt anglers to return tags. Note: the ratio (tags/catch at Big Falls) : (tags/catch for the rest of the river) does not give a valid estimate of the reporting rate because it cannot be assumed that the creel clerks observed $100 \%$ of the tags recaptured at Big Falls.

The number of tags available ( M ) to the small salmon retention fishery were estimated from the number of tags applied (Ma), adjusted for the proportion of tags retained (1- Tag-Loss Rate), as in previous years. The tag-loss rate (TL) was estimated based on 0.009 tags shed per day at large which was derived for the Margaree River in 1992 (Chaput et al., MS 1993). The method of tag application in the Margaree tagging program was the same as for the Humber River. The median number of days at large for tagged fish was determined according to Sokal and Rohlf (1969). No adjustment was made to the number of tags available to account for tags removed from released small salmon because these tags would have also been available to the retention fishery for a period of time before being caught and released. In the 1995 assessment (Mullins and Reddin, MS 1996), if the number of tags available to the retention fishery had been adjusted for tags removed from released fish, the exploitation rate calculation would have increased by less than $1.5 \%$.

## b. Total Returns

The total number of small salmon $\left(\mathrm{N}_{s m}\right)$ was estimated based on total adjusted angling catch of small salmon retained and the angling exploitation rate according to the Petersen (Single Census) method (Ricker, 1975):

$$
\mathrm{N}_{s m}=\mathrm{C} / \mathrm{er}
$$

The total number of large salmon $\left(\mathrm{N}_{l g}\right)$ was estimated from small salmon returns based on the proportion of small and large salmon captured in the two tagging traps:

$$
\mathbf{N}_{l g}=\mathbf{N}_{s m} / \operatorname{Prop}_{s m}-\mathbf{N}_{s m}
$$

In the 1990 and 1991 assessments, the relative proportions of small and large salmon returns was considered to be equivalent to the proportion observed in the recreational fishery prior to 1984 when large salmon could be retained (Chaput and Mullins, MS 1991, 1992). However, a commercial fishery was also permitted in these years. Because of the closure of the commercial fishery in 1992 and the potential for an increase in the proportion of large salmon, the relative proportions captured in the tagging traps was considered to be more representative of the true population value.

## c. Spawning Escapements

The spawning escapements of small and large salmon were obtained by subtracting total angling removals from the total returns. Angling removals included retained small salmon and a $10 \%$ mortality rate on released small and large salmon.

## d. Potential Egg Depositions

The potential egg deposition by small and large salmon in 1997 was calculated based on estimates of the number of eggs deposited per small and large female spawner. These estimates were derived from biological characteristics (mean weight of females and percent female) collected from the 1997 run and an estimate of the relative fecundity of small and large female spawners combined. The relative fecundity value used was 1,540 eggs/kg taken from (Porter and Chadwick, MS 1983). Small and large salmon can have different relative fecundity (Randall, 1989). However, the current estimate of the proportion of large salmon spawners in the Humber River stock is low on average ( $<10 \%$ ) and agespecific fecundity estimates are lacking. The mean weight and percent female of small salmon were obtained from retained catches at Big Falls in 1997. These and other biological characteristics of Atlantic salmon on the Humber River are shown in Appendices 1-6. The mean weight of female large salmon was 3.7 kg (Porter and Chadwick, MS 1983) and the percentage female was $68.6 \%$ based on commercial catches in the Bay of Islands in 1991 (Mullins and Chaput, MS 1992).

## Estimation of Conservation Requirements

The conservation egg deposition requirement was calculated based on an optimal egg deposition rate for fluvial (Porter and Chadwick, MS 1983) and lacustrine (Mullins and Chaput, MS 1995) parr rearing habitat. The egg deposition rate for fluvial habitat was $2.4 \mathrm{eggs} / \mathrm{m}^{2}$ (Elson, 1957), which includes an adjustment for egg losses due to poaching and disease. The egg deposition rate for lacustrine habitat was 368 eggs/ha, as described by O'Connell et al. (MS 1991) which does not include an adjustment for poaching and disease.

The conservation requirement of 28.3 million eggs expressed in terms of number of spawners is 15,749 small and 934 large salmon (Mullins et al., MS 1997).

## Long Term Population Trends

## Analysis to Detect Recruitment Overfishing

Details of the analysis to detect recruitment overfishing is provided by O'Connell, et al. (1995). Spawning escapements that produced small and large salmon spawners on the Humber River in 1980-

1997 were constructed by weighting previous spawning escapements by the smolt age distribution of 1SW salmon on the Humber River in 1993.

## RESULTS

## Recreational Fishery Harvest

The recreational fishery on the Humber River in 1997 opened on 1 June and closed on 1 September. Angling was restricted to catch and release only from 28 July to the end of the season as a result of an in-season review that indicated returns in 1997 had declined from 1996. The Adies Lake (Fig. 2) quota of 100 small salmon retained was not reached. The Tailrace area of Deer Lake which was closed to angling for the first time in 1996 ( 29 July to 25 August) was reopened in 1997 but as part of the scheduled waters of the Humber River. The closure of the Tailrace in 1996 may have affected the total catch and effort for the river as well as the number of tag recaptures.

The 1997 creel survey at Big Falls was conducted from 24 June to 1 September. A total of 3,599 interviews were conducted with anglers as they exited the fishing area (including 311 interviews with anglers leaving for the second or third time on the same day) (Table 2). The peak of angling effort and catch occurred during the week 27 (2 July to 8 July) for the retention fishery which was one week later than in 1996 (Mullins et al., MS 1997).

Catch and effort dropped off considerably after the closure of the retention fishery on 27 July. Only about $3 \%$ of the total effort occurred during the period of the release fishery compared to $16 \%$ in the 1996 and $20 \%$ in 1994 creel surveys.

| Year | Retention Fishery |  |  |  | Release Fishery |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Rods | Small |  | Large Released | Rods | Small |  | Large Released |
|  |  | Retained | Released |  |  | Retained | Released |  |
| 1994 | 79.6 | 92.3 | 97.5 | 96.8 | 20.4 | 7.7 | 2.5 | 3.2 |
| 1996 | 83.7 | 95.5 | 96.7 | 98.6 | 16.3 | 4.5 | 3.3 | 1.4 |
| 1997 | 97.3 | 100.0 | 94.3 | 90.5 | 2.7 | 0.0 | 5.7 | 9.5 |

The observed catch of 1,009 retained small salmon in 1997 was $16 \%$ less than in the same period in 1996 but $43 \%$ more than in 1994.

|  | Retention Fishery |  |  | Release Fishery |  |  |  | Large |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Rods | Small | Large |  | Small |  | Retained | Released |
|  | Released | Rods | Retained | Released | Released |  |  |  |
|  | 5116 | 704 | 425 | 61 | 1312 | 59 | 11 | 2 |
| 1996 | 5405 | 1174 | 756 | 72 | 1047 | 55 | 26 | 1 |
| 1997 | 4431 | 1009 | 541 | 38 | 124 | 0 | 33 | 4 |

The proportion of small salmon released in 1997 was similar to the mean for 1994-96 when the season was split at 31 July based on tag allotments (Table 3). Anglers fished for an average of 8.3 hours to catch one fish in 1997 which was only 7\% lower than the effort expended for one fish in 1996.

The survey clerks at Big Falls were successful in monitoring $96 \%$ of the scheduled survey periods during the retention fishery, $80 \%$ for the release fishery and $88 \%$ over the entire season (Table 4). After adjustment for the proportion of periods monitored, the total catch at Big Falls was 1,112 small retained (Table 5), 651 small released (Table 6) and 47 large salmon released (Table 7).

## Returns, Spawning Escapement and Percentage of the Conservation Egg Deposition Achieved

## a. Angling Exploitation Rate

The Lower tagging trap was operated from 10 June to 1 September and the Upper Trap was operated from 3 June to 3 September. A total of 384 small and 67 large bright salmon were captured in the two tagging traps (Table 8). This was less than the total catch in the previous four years but the proportion of large salmon increased by $61 \%$ from the 1992-96 mean.

A total of 369 (233 Lower and 136 Upper) small salmon were tagged and released and considered to be available to the retention fishery in 1997 (Table 9). The five small salmon tagged in week 31 at the Lower trap were not considered to be available to the retention fishery.

Tags were not applied at water temperatures above 15 C . Higher temperatures occurred in the later part of the run, hence, the difference in the recapture rate of tags could be either due to water temperature or to the closure of the retention fishery. However, because of the relatively cool temperatures at the time of tagging, the experience of tagging personnel, the fact that fish were submerged in water while being tagged and that injured fish were not tagged, tagging mortality was believed to be negligible. The tag application process takes approximately 45 seconds.

Similar distribution of catches of small salmon in both the Lower and Upper tagging traps indicated that the tagging occurred over the entire run in 1997 (Figs. 3a-b). Based on the distribution of catches, it does not appear likely that a large number of small or large salmon would have entered the river prior to the installation of the traps. The run timing of small salmon at the Lower Trap was the second earliest recorded in eight years of operation and the run timing of large salmon was among the latest (Fig. 4a-b).

The distribution of tags applied and recaptured in the retention fishery were the same for both tagging traps (Fig. 5a-b). The distribution of tagged and untagged small salmon in the retention fishery (Fig. 5c) indicated that tagged small salmon were evenly dispersed in the population and available to the fishery at the same time as untagged salmon.

A total of 37 Carlin tags were returned by anglers from retained and released small salmon in 1997 (Table 10). These were distributed throughout all major segments of the river with the largest number recaptured at Big Falls and Little Falls and Harriman's Steady. These areas also produced the highest number of tag recaptures in previous years. A total of 33 tags were considered to be from retained small salmon including one that was not reported as retained or released (Table 10). A total of 15 tagged small salmon were retained at Big Falls. There were no reported angling recaptures of large salmon.

Out of a total of 11 tags (retained and released) observed by the creel survey clerks at Big Falls, $63.64 \%$ (7/11) were returned voluntarily by anglers (Table 11). This was similar to the reporting rate estimated for previous years, as shown in the text table below.

| Year | Reported Rate (\%) |
| :--- | :--- |
| 1994 | 64.0 |
| 1995 | 60.9 |
| 1996 | 60.7 |
| 1997 | 63.64 |

Zale and Bain (1994), in an estimate of the willingness of anglers to co-operate when given a certain level of reward, reported that under simulated conditions $64-67 \%$ of anglers voluntarily returned tags.

The median number of days at large for recaptured small salmon was 16 days (Table 12). This was four days longer than in 1996. The minimum days at large in 1997 was two and the maximum was 40 days. The estimated overall proportion of tags retained during this period was 0.856 . After adjustment for tag loss and reporting rate, the angling exploitation rate on retained small salmon was estimated at 0.1646 , similar to the 1996 value of 0.1557 . The angling exploitation rate on the Humber River in the last two years was been the lowest in eight years of assessment ( 0.1846 in 1995; 0.2865 in 1994; 0.2213 in 1993; 0.22 in 1992; and 0.25 in 1990-91).

The early run timing of small salmon in the last two years (Fig. 4a) may have resulted in fish being available to the fishery for a shorter period of time due quick passage through the system. This would explain the low angling exploitation rates in 1996 and 1997 compared to previous years. The highest angling exploitation rate recorded in the period of assessment was in 1994. The total angling effort was lower in 1994 than in 1996 and 1997 but the run timing was later and occurred over a much longer time period. This may have resulted in the population being available to the fishery longer in 1994 than in 1996 and 1997 and, therefore, the exploitation rate was higher. The closure of the Tailrace portion of Deer Lake in 1996 would also have reduced angling exploitation.

It is noted that five Humber River small salmon tagged on 27-28 July 1995 and held in captivity until 23 November, had $0.0 \%$ tag loss at the time of release, 119 days after being tagged. Although this sample size is insufficient to estimate tag loss in the wild, a higher tag retention rate than estimated in Table 10 would have resulted in an even lower angling exploitation rate.

Angling exploitation was highest on small salmon tagged and released in week 24 (0.2941) and lowest on those tagged in week 26 ( 0.0926 ). The range of angling exploitation rates calculated in Table 12 indicates that, to some extent, the fishery harvested certain portions of the salmon run more than others. However, the numbers of fish tagged and recaptured varied greatly between these two release periods and would have biased the exploitation rate estimates. A stratified estimate of the population size based on weekly exploitation rates may yield a slightly different estimate than that based on a single exploitation rate for the season. However, with such low numbers of tags this would not be appropriate. In previous assessments, such stratified estimates, using the Darroch (1961) estimator, were not significantly different than the single census Petersen because pooling of release strata was necessary in order to obtain sufficient sample sizes for the estimator to work.

Three small salmon tagged and released in 1997 were recaptured at Hughes Brook (Fig.1). Hughes Brook flows into the Humber Arm about 3.0 km north of the Humber River estuary. Tagged small salmon were also recaptured in Hughes Brook in the past (2-12 in 1990-93). If a total of 12 small salmon had been subtracted from the number of small salmon tagged in 1997 to account for those destined for Hughes Brook, the angling exploitation rate estimate would have increased by $2.6 \%$ and the returns estimate would have been approximately $2.5 \%$ less ( $\sim 329$ small salmon). This was considered to be negligible and no adjustment was made to the angling exploitation rate.

## b. Returns and Escapements of small and large salmon

As shown in the following text table, the Big Falls area produced almost $45.6 \%$ of the tag recoveries from retained small salmon on the Humber River in 1997. This is comparable with the percentage of tag returns from Big Falls in most years since 1992 and the 1992-96 mean. The percentage of tags returned from Big Falls is also comparable with the percentage of the Humber angling catch retained at Big Falls in some years but the decreased emphasis on the collection of angling catch statistics by DFO may have affected the calculation for recent years.

|  | Angling Catch |  |  | Tag Returns |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Small salmon Retained | Small salmon Retained |  |  |  |  |
|  | Humber | Big Falls |  | Humber | Big Falls |  |
|  | N | N | $\%$ | N | N | $\%$ |
| 1992 | 2234 | 1497 | 67.0 | 32 | 22 | 68.8 |
| 1993 | 2206 | 882 | 40.0 | 119 | 48 | 40.3 |
| 1994 | 1550 | 651 | 42.0 | 97 | 37 | 38.1 |
| 1995 | 1825 | 549 | 30.1 | 189 | 93 | 49.2 |
| 1996 | 2448 | 1237 | 50.5 | 79 | 25 | 31.6 |
| 1997 | $\cdot$ | $\cdot$ | . | 33 | 15 | 45.5 |
| Mean (92-96) |  |  | 45.9 |  |  | 45.6 |

The adjusted angling catch of retained small salmon in 1997 was 2,447 ( $95 \% \mathrm{Cl}=1,748$ -
$3,670)$ (Table 13). Based on this catch and the angling exploitation rate of $0.1646(95 \% \mathrm{Cl}=0.1204-$ $0.2725)$, it was estimated that $14,866(95 \% \mathrm{Cl}=11,340-19,501)$ small salmon entered the Humber River in 1997 (Table 14). Based on the proportion of small salmon caught in the tagging traps of 0.8514 $(95 \% \mathrm{CI}=0.8180-0.8820), 2,595(95 \% \mathrm{CI}=2,523-4,339)$ large salmon also entered the river in 1997 (Table 14).

The potential spawning escapement in 1997, after angling removals, was 12,276 ( $95 \% \mathrm{CI}=$ $8,750-16,911)$ small and $2,582(95 \% \mathrm{Cl}=2,510-4,326)$ large salmon (Table 14). This escapement of small salmon was below the conservation spawner requirement for small, whereas the escapement of large salmon was above the conservation spawner requirement for large (Figs. 6a-b). The total potential egg depositions from these spawners was $115 \%(95 \% \mathrm{Cl}=91 \%-169 \%)$ of the conservation egg deposition requirement (Table 15), a decline of nearly $38 \%$ from 1996 (Table 16). If the proportion of small salmon observed in 1997 had been equivalent to the 1992-96 mean of 0.9221 , the estimate of large salmon returns would have been $52 \%$ lower and the percentage of the conservation requirement achieved would have been $16 \%$ lower.

## Long term Population Trends

Since the closure of the commercial salmon fishery in 1992, with the exception of 1994 and 1997, the number of spawners on the Humber River has generally been above estimates of their cohorts derived by weighting previous spawners by the smolt-age distribution of their progeny (Fig. 7).

Spawners were above the replacement (diagonal) line (Fig. 8) in four out of six years since 1992. In 1991 the number of spawners was well below the replacement line. Of the total of eight data points, two were below the replacement line indicating that the stock has been in an overall increasing trend in the time period examined.

## DISCUSSION

The low returns of small Atlantic salmon to the Humber River in 1997 compared to 1995 and 1996 was unexpected because the number of recruits produced per spawner in the three previous years had increased. For example, returns to the river in 1995 and 1996 were about twice those expected based on the number of spawners, whereas, returns in 1997 were only equivalent to the spawners that
produced them. The decline in 1997, may have been due in part to natural variability in recruitment but because of the magnitude of the decline, compared to the previous year, it was more likely the result of a major change in survival rate.

Returns of large salmon did not decrease to the same degree as small salmon in 1997. This may have been due to the fact that large salmon are predominantly repeat spawning 1 SWs and may not be subject to the same marine conditions as either returning virgin 1SW salmon or smolts. Large salmon on the Humber River are typically 30 to $40 \%$ virgin 2SW salmon. Therefore, returns of 2SW salmon in 1998 would also be expected to be low, given the low survival of 1 SW salmon in 1997. However, if there has been a delay in age at maturity of small salmon, these fish would return as 2SWs in 1998 and could result in an increase in returns of large salmon. In addition, the first 2SW recruits from the 1992 yearclass will return to the river in 1998.

In a stock with a healthy spawning population it is suggested that points in the spawner-recruit relationship described in Fig. 8 should fall both above and below the line in a $50: 50$ distribution. Five of the last eight years on the Humber have fallen above the replacement line. Also, in a healthy population, the conservation requirement should be achieved each year. In the case of the Humber this has occurred in only four of the last eight years but in four of the last six years since 1992. It is concluded from this that the Humber River salmon stock, while below the conservation requirement in some years, is showing signs of improvement. However, growth of the spawning population in 1997 was minimal. If the survival rate of year-classes contributing to returns to the river in 1998 is as low as for 1997 returns, then a second consecutive year of low population growth could be experienced in 1998. Because the potential for overexploiting the stock if the returns in 1998 are again low, angling exploitation in 1998 should be closely monitored.

The current assessment of the status of the Humber River Atlantic salmon stock is based on returns to the river in June to August. While these returns represent by far the majority of the stock size, there is evidence that a run of large salmon enters the river in the fall, presumably spawning in the lower part of the river. Mullins et al. (MS 1997) determined that the fall run consists of 2SW and 3SW salmon, as well as previous spawners and that the size of the run increased in 1994-96 compared to previous years. However, the population appeared to be low, probably less that 600 salmon, with the 3SW component probably less than 200 salmon. The 3SW component is unique to Newfoundland and should be given special protection to minimize and to prevent any increase in fishing mortality.

## ACKNOWLEDGEMENTS

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Table 1. Equations used in estimation of angling exploitation rate, total catch and total returns of Atlantic salmon in the Humber River in 1997. Parameters in bold type changed value with each iteration of the simulation procedure.

| 1. EXPLOITATION RATE | Tags Recaptured Tags Available |
| :---: | :---: |
| a. Tags Recaptured | Tags Returned Reporting Rate |
| Reporting Rate | $\frac{\text { Tags Returned from Big Falls }}{\text { Tags Recaptured at Big Falls }}=\frac{7}{11}=0.6364$ |
| b. Tags Available | Tags Applied x Proportion Tags Retained |
| Proportion Tags Retained | 1 - (Tag Loss Rate (TL)) <br> TL = (0.009 tags/day $\times$ Median Days to Recapture) <br> Range of Days to Recapture = 2 to 40 days; Median = 16 |
| 2. CATCH (Small) | Adjusted Catch at Big Falls <br> Proportion of Tags from Big Falls <br> (Proportion of tags from Big Falls $=15 / 33=0.4545$ ) |
| 3. RETURNS (Small) (Petersen single census) | $\frac{\text { CATCH (Small) }}{\text { EXPLOITATION RATE }}$ |
| 4. RETURNS (Large) | RETURNS (Small) / Prop. Small - RETURNS (Small) (Prop. Small $=384 / 451=0.8514$ ) |
| The equations were solved 5000 determined. | s to generate the distribution from which confidence limits were |

Table 2. Creel survey observations at Big Falls, 1997.
Note: Catches and effort include numbers left on the river after the last survey period of the day. Rod days are adjusted for anglers interviewed more than once.

| Week | Anglers Interviewed | Effort |  | Hours per Angler | Small |  | LargeReleased | Total Catch | Hours per Fish |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Rods Days | Hours |  | Retained | Released |  |  |  |
| Retention Fishery |  |  |  |  |  |  |  |  |  |
| 25 | 82 | 89 | 212 | 2.6 | 16 | 7 | 1 | 24 | 8.82 |
| 26 | 920 | 1173 | 3083 | 3.4 | 288 | 215 | 9 | 512 | 6.02 |
| 27 | 1053 | 1402 | 4346 | 4.1 | 426 | 225 | 13 | 664 | 6.54 |
| 28 | 650 | 861 | 2641 | 4.1 | 138 | 42 | 1 | 181 | 14.59 |
| 29 | 460 | 569 | 1793 | 3.9 | 93 | 19 | 7 | 119 | 15.06 |
| 30 | 322 | 337 | 1200 | 3.7 | 48 | 33 | 7 | 88 | 13.64 |
| Total | 3487 | 4431 | 13274 | 3.8 | 1009 | 541 | 38 | 1588 | 8.36 |
| \% | 96.9 | 97.3 | 97.9 |  | 100.0 | 94.3 | 90.5 | 97.7 |  |
| Release Fishery |  |  |  |  |  |  |  |  |  |
| 30 | 6 | 16 | 17 | 2.8 | 0 | 2 | 0 | 2 | 8.25 |
| 31 | 75 | 78 | 184 | 2.5 | 0 | 24 | 4 | 28 | 6.57 |
| 32 | 18 | 17 | 37 | 2.1 | 0 | 5 | 0 | 5 | 7.42 |
| 33 | 11 | 11 | 39 | 3.6 | 0 | 2 | 0 | 2 | 19.65 |
| 34 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 | . |
| 35 | 2 | 2 | 3 | 1.3 | 0 | 0 | 0 | 0 |  |
| 36 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |  |
| Total | 112 | 124 | 279 | 0.0 | 0 | 33 | 4 | 37 | 7.55 |
| \% | 3.1 | 2.7 | 2.1 |  | 0.0 | 5.7 | 9.5 | 2.3 |  |
| Total |  |  |  |  |  |  |  |  |  |
| 25 | 82 | 89 | 212 | 2.6 | 16 | 7 | 1 | 24 | 8.82 |
| 26 | 920 | 1173 | 3083 | 3.4 | 288 | 215 | 9 | 512 | 6.02 |
| 27 | 1053 | 1402 | 4346 | 4.1 | 426 | 225 | 13 | 664 | 6.54 |
| 28 | 650 | 861 | 2641 | 4.1 | 138 | 42 | 7 | 181 | 14.59 |
| 29 | 460 | 569 | 1793 | 3.9 | 93 | 19 | 7 | 119 | 15.06 |
| 30 | 328 | 353 | 1217 | 3.7 | 48 | 35 | 7 | 90 | 13.52 |
| 31 | 75 | 78 | 184 | 2.5 | 0 | 24 | 4 | 28 | 6.57 |
| 32 | 18 | 17 | 37 | 2.1 | 0 | 5 | 0 | 5 | 7.42 |
| 33 | 11 | 11 | 39 | 3.6 | 0 | 2 | 0 | 2 | 19.65 |
| 34 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |  |
| 35 | 2 | 2 | 3 | 1.3 | 0 | 0 | 0 | 0 |  |
| 36 | 0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |  |
| Total | 3599 | 4555 | 13553 | 3.8 | 1009 | 574 | 42 | 1625 | 8.34 |

Table 3. Creel survey observations at Big Falls, 1991-1997.
Creel surveys were conducted between 0600-2200 hours daily.

| Year | Survey Dates | Anglers Interviewed | Hours Fished | Hours per Angler | Small salmon |  |  |  | Large Released | Total Catch | Hours* per Fish | CarlinTagsObserved |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Retained | Released | Total | Prop. Released |  |  |  |  |
| 1991 | 22 Jun.-30 Aug. | 726 | 1600 | 2.20 | 136 | 9 | 145 | 0.0621 | 3 | 148 | 10.81 | 0 |
| 1992** | 16 Jun.-30 Aug. | 607 | 2628 | 4.33 | 738 | 59 | 797 |  | 25 | 822 |  | 5 |
| 1993 | 9 Jun.- 20 Aug. | 1613 | 6031 | 3.74 | 412 | 30 | 442 | 0.0679 | 20 | 462 | 13.05 | 2 |
| 1994*** | 19 Jun.-5 Sept. | 3839 | 14219 | 3.70 | 765 | 436 | 1201 | 0.3630 | 63 | 1264 | 11.25 | 14 |
| 1995 | 17 Jun.-5 Sept. | 1244 | 4767 | 3.83 | 375 | 137 | 512 | 0.2676 | 17 | 529 | 9.01 | 23 |
| 1996*** | 18 Jun.-2 Sept. | 5331 | 18867 | 3.54 | 1229 | 782 | 2011 | 0.3889 | 73 | 2084 | 9.05 | 28 |
| 1997*** | 24 Jun.-1 Sept. | 3599 | 13553 | 3.77 | 1009 | 574 | 1583 | 0.3626 | 42 | 1625 | 8.34 | 11 |

* Hours per Fish based on total catch
** Only anglers with catch interviewed in 1992
*** 1994,96\&97 values represent the entire catch and effort at Big Falls.

Table 4. Proportion of available creel survey periods that were actually surveyed at two fishing locations at Big Falls.

| Location | Week | Fishery |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Retention |  |  |  |  | Release |  |  |  |  | Total |  |  |  |  |
|  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  |
|  |  | A | B | C | D | Total | A | B | C | D | Total | A | B | C | D | Total |
| Boat | 25 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 26 | 0.86 | 0.86 | 1.00 | 1.00 | 0.93 |  |  |  |  |  | 0.86 | 0.86 | 1.00 | 1.00 | 0.93 |
|  | 27 | 0.71 | 0.71 | 1.00 | 1.00 | 0.86 |  |  |  |  |  | 0.71 | 0.71 | 1.00 | 1.00 | 0.86 |
|  | 28 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 29 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.50 | 1.00 | 0.88 | 1.00 | 1.00 | 0.86 | 1.00 | 0.96 |
|  | 31 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 32 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 33 |  |  |  |  |  | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 |
|  | 34 |  |  |  |  |  | 0.00 | 0.00 | 0.57 | 0.57 | 0.29 | 0.00 | 0.00 | 0.57 | 0.57 | 0.29 |
|  | 35 |  |  |  |  |  | 0.00 | 0.00 | 0.33 | 0.33 | 0.17 | 0.00 | 0.00 | 0.33 | 0.33 | 0.17 |
|  | Total | 0.91 | 0.91 | 1.00 | 1.00 | 0.96 | 0.58 | 0.58 | 0.72 | 0.75 | 0.66 | 0.74 | 0.74 | 0.86 | 0.87 | 0.80 |
| Stair | 25 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 26 | 1.00 | 1.00 | 0.86 | 0.86 | 0.93 |  |  |  |  |  | 1.00 | 1.00 | 0.86 | 0.86 | 0.93 |
|  | 27 | 1.00 | 0.86 | 1.00 | 1.00 | 0.96 |  |  |  |  |  | 1.00 | 0.86 | 1.00 | 1.00 | 0.96 |
|  | 28 | 0.86 | 1.00 | 1.00 | 1.00 | 0.96 |  |  |  |  |  | 0.86 | 1.00 | 1.00 | 1.00 | 0.96 |
|  | 29 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 31 |  |  |  |  |  | 0.86 | 0.86 | 1.00 | 1.00 | 0.93 | 0.86 | 0.86 | 1.00 | 1.00 | 0.93 |
|  | 32 |  |  |  |  |  | 0.86 | 0.86 | 1.00 | 1.00 | 0.93 | 0.86 | 0.86 | 1.00 | 1.00 | 0.93 |
|  | 33 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 34 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 35 |  |  |  |  |  | 0.83 | 0.83 | 0.67 | 0.67 | 0.75 | 0.83 | 0.83 | 0.67 | 0.67 | 0.75 |
|  | Total | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 | 0.92 | 0.92 | 0.94 | 0.94 | 0.93 | 0.94 | 0.94 | 0.96 | 0.96 | 0.95 |
| Total | 25 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 26 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |  |  |  |  |  | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
|  | 27 | 0.86 | 0.79 | 1.00 | 1.00 | 0.91 |  |  |  |  |  | 0.86 | 0.79 | 1.00 | 1.00 | 0.91 |
|  | 28 | 0.93 | 1.00 | 1.00 | 1.00 | 0.98 |  |  |  |  |  | 0.93 | 1.00 | 1.00 | 1.00 | 0.98 |
|  | 29 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |  |  |  |  |  | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
|  | 30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.75 | 1.00 | 0.94 | 1.00 | 1.00 | 0.93 | 1.00 | 0.98 |
|  | 31 |  |  |  |  |  | 0.93 | 0.93 | 1.00 | 1.00 | 0.96 | 0.93 | 0.93 | 1.00 | 1.00 | 0.96 |
|  | 32 |  |  |  |  |  | 0.93 | 0.93 | 1.00 | 1.00 | 0.96 | 0.93 | 0.93 | 1.00 | 1.00 | 0.96 |
|  | 33 |  |  |  |  |  | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
|  | 34 |  |  |  |  |  | 0.50 | 0.50 | 0.79 | 0.79 | 0.64 | 0.50 | 0.50 | 0.79 | 0.79 | 0.64 |
|  | 35 |  |  |  |  |  | 0.42 | 0.42 | 0.50 | 0.50 | 0.46 | 0.42 | 0.42 | 0.50 | 0.50 | 0.46 |
|  | Total | 0.94 | 0.94 | 0.99 | 0.99 | 0.96 | 0.75 | 0.75 | 0.83 | 0.85 | 0.80 | 0.84 | 0.84 | 0.91 | 0.91 | 0.88 |

Table 5. Adjusted retained catch of small salmon at two creel survey locations at Big Falls, 1997.
Adjustments are based on the proportior of available survey periods actually covered in the Creel survey.
Small Retained

| Location | Week | Fishery |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Retention |  |  |  |  | Release |  |  |  |  | Total |  |  |  |  |
|  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  |
|  |  | A | B | C | D | Total | A | B | C | D | Total | A | B | C | D | Total |
| Boat | 25 | 4 | 3 | 1 | 8 | 16 |  |  |  |  |  | 4 | 3 | 1 | 8 | 16 |
|  | 26 | 83 | 76 | 41 | 54 | 254 |  |  |  |  |  | 83 | 76 | 41 | 54 | 254 |
|  | 27 | 97 | 153 | 27 | 74 | 350 |  |  |  |  |  | 97 | 153 | 27 | 74 | 350 |
|  | 28 | 32 | 28 | 1 | 22 | 83 |  |  |  |  |  | 32 | 28 | 1 | 22 | 83 |
|  | 29 | 8 | 13 | 5 | 27 | 53 |  |  |  |  |  | 8 | 13 | 5 | 27 | 53 |
|  | 30 | 5 | 7 | 5 | 12 | 29 | 0 | 0 | 0 | 0 | 0 | 5 | 7 | 5 | 12 | 29 |
|  | 31 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 32 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Total | 228 | 279 |  | 197 | 785 | 0 | 0 | 0 | 0 | 0 | 228 | 279 | 80 | 197 | 785 |
| Stair | 25 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 |
|  | 26 | 17 | 21 | 8 | 14 | 60 |  |  |  |  |  | 17 | 21 | 8 | 14 | 60 |
|  | 27 | 27 | 40 | 18 | 68 | 153 |  |  |  |  |  | 27 | 40 | 18 | 68 | 153 |
|  | 28 | 5 | 9 | 8 | 34 | 56 |  |  |  |  |  | 5 | 9 | 8 | 34 | 56 |
|  | 29 | 9 | 11 | 4 | 16 | 40 |  |  |  |  |  | 9 | 11 | 4 | 16 | 40 |
|  | 30 | 3 | 7 | 1 | 8 | 19 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 1 | 8 | 19 |
|  | 31 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 32 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Total | 61 | 88 | 39 | 140 | 328 | 0 | 0 | 0 | 0 | 0 | 61 | 88 | 39 | 140 | 328 |
| Total | 25 | 4 | 3 | 1 | 8 | 16 | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 1 | 8 | 16 |
|  | 26 | 100 | 97 | 49 | 68 | 314 | 0 | 0 | 0 | 0 | 0 | 100 | 97 | 49 | 68 | 314 |
|  | 27 | 124 | 192 | 45 | 142 | 503 | 0 | 0 | 0 | 0 | 0 | 124 | 192 | 45 | 142 | 503 |
|  | 28 | 17 17 | 37 | 9 | 56 | 139 | 0 | 0 | 0 | 0 | 0 | 12 17 | 37 | 9 | 56 | 139 |
|  | 29 | 17 | 24 | 9 | 43 | 93 | 0 | 0 | 0 | 0 | 0 | 17 | 24 | 9 | 43 | 93 |
|  | 30 | 8 | 14 | 6 | 20 | 48 | 0 | 0 | 0 | 0 | 0 | 8 | 14 | 6 | 20 | 48 |
|  | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Total | 289 | 367 | 119 | 337 | 1112 | 0 | 0 | 0 | 0 | 0 | 289 | 367 | 119 | 337 | 1112 |

Table 6. Adjusted released catch of small salmon at two creel survey locations at Eig Falls, 19917.
Adjustments are based on the proportior of available survey periods actually covered in the Creel survey.
Small Released

| Location | Week | Fishery |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Retention |  |  |  |  | Release |  |  |  |  | Total |  |  |  |  |
|  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  |
|  |  | A | B | C | D | Total | A | B | C | D | Total | A | B | C | D | Total |
| Boat | 25 | 2 | 4 | 1 | 0 | 7 |  |  |  |  |  | 2 | 4 | 1 | 0 | 7 |
|  | 26 | 55 | 82 | 15 | 42 | 194 |  |  |  |  |  | 55 | 82 | 15 | 42 | 194 |
|  | 27 | 35 | 140 | 24 | 21 | 220 |  |  |  |  |  | 35 | 140 | 24 | 21 | 220 |
|  | 28 | 4 | 11 | 1 | 7 | 23 |  |  |  |  |  | 4 | 11 | 1 | 7 | 23 |
|  | 29 | 0 | 2 | 0 | 4 | 6 |  |  |  |  |  | 0 | 2 | 0 | 4 | 6 |
|  | 30 | 0 | 4 | 0 | 6 | 10 | 0 |  |  | 0 | 0 | 0 | 4 | 0 | 6 | 10 |
|  | 31 |  |  |  |  |  | 3 | 6 | 1 | 2 | 12 | 3 | 6 | 1 | 2 | 12 |
|  | 32 |  |  |  |  |  | 0 | 3 | 0 | 2 | 5 | 0 | 3 | 0 | 2 | 5 |
|  | 33 |  |  |  |  |  | 0 | 3 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 3 |
|  | 34 |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Total | 96 | 243 | 41 | 80 | 460 | 3 | 12 | 1 | 4 | 20 | 99 | 254 | 42 | 84 | 479 |
| Stair | 25 | 0 | 0 | 0 | 0 |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 |
|  | 26 | 11 | 7 | 5 | 22 | 45 |  |  |  |  |  | 11 | 7 | 5 | 22 | 45 |
|  | 27 | 8 | 20 | 13 | 17 | 58 |  |  |  |  |  | 8 | 20 | 13 | 17 | 58 |
|  | 28 | 1 | 7 | 3 | 8 | 19 |  |  |  |  |  | 1 | 7 | 3 | 8 | 19 |
|  | 29 | 1 | 0 | 1 | 11 | 13 |  |  |  |  |  | 1 | 0 | 1 | 11 | 13 |
|  | 30 | 0 | 1 | 1 | 21 | 23 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 1 | 23 | 25 |
|  | 31 |  |  |  |  |  | 1 | 1 | 0 | 10 | 12 | 1 | 1 | 0 | 10 | 12 |
|  | 32 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Total | 21 | 35 | 23 | 79 | 158 | 1 | 1 | 0 | 12 | 14 | 22 | 36 | 23 | 91 | 172 |
| Total | 25 |  | 4 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 1 | 0 | 7 |
|  | 26 | 66 | 89 | 20 | 64 | 238 | 0 | 0 | 0 | 0 | 0 | 66 | 89 | 20 | 64 | 238 |
|  | 27 | 43 | 160 | 37 | 38 | 278 | 0 | 0 | 0 | 0 | 0 | 43 | 160 | 37 | 38 | 278 |
|  | 28 | 5 | 18 | 4 | 15 | 42 | 0 | 0 | 0 | 0 | 0 | 5 | 18 | 4 | 15 | 42 |
|  | 29 | 1 | 2 | 1 | 15 | 19 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 15 | 19 |
|  | 30 | 0 | 5 | 1 | 27 | 33 | 0 | 0 | 0 | 2 | 2 | 0 | 5 | 1 | 29 | 35 |
|  | 31 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 1 | 12 | 24 | 4 | 7 | 1 | 12 | 24 |
|  | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 5 | 0 | 3 | 0 | 2 | 5 |
|  | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 3 |
|  | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | Total | 117 | 278 | 64 | 159 | 617 | 4 | 13 | 1 | 16 | 34 | 121 | 290 | 65 | 175 | 651 |

Table 7. Adjusted released catch of large salmon at two creel survey locations at Big Falls, 1997.
Adjustme:nts are based on the proportior of available survey periods actually covered in the Creel survey.
Large Released

| Location | Week | Fishery |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Retention |  |  |  |  | Release |  |  |  |  | Total |  |  |  |  |
|  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  | PERIOD |  |  |  |  |
|  |  | A | B | C | D | Total | A | B | C | D | Total | A | B | C | D | Total |
| Boat | 25 | 0 | 0 | 1 | 0 | 1 |  |  |  |  |  | 0 | 0 | 1 | 0 |  |
|  | 26 | 7 | 2 | 0 | 1 | 10 |  |  |  |  |  | 7 | 2 | 0 | 1 | 10 |
|  | 27 | 1 | 10 | 0 | 0 | 11 |  |  |  |  |  | 1 | 10 | 0 | 0 | 11 |
|  | 28 | 0 | 1 | 0 | 0 | 1 |  |  |  |  |  | 0 | 1 | 0 | 0 | 1 |
|  | 29 | 0 | 0 | 0 | 5 | 5 |  |  |  |  |  | 0 | 0 | 0 | 5 | 5 |
|  | 30 | 0 | 1 | 0 | 5 | 6 | 0 |  |  | 0 | 0 | 0 | 1 | 0 | 5 | 6 |
|  | 31 |  |  |  |  |  | 1 | 1 | 0 | 1 | 3 | 1 | 1 | 0 | 1 | 3 |
|  | 32 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  |  |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | 8 | 14 | 1 | 11 | 35 | 1 | 1 | 0 | 1 | 3 | 9 | 15 | 1 | 12 | 38 |
| Stair | 25 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 |
|  | 26 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 |
|  | 27 | 1 | 2 | 0 | 2 | 5 |  |  |  |  |  | 1 | 2 | 0 | 2 | 5 |
|  | 28 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 |
|  | 29 | 0 | 2 | 0 | 0 | 2 |  |  |  |  |  | 0 | 2 | 0 | 0 | 2 |
|  | 30 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
|  | 31 |  |  |  |  |  | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
|  | 32 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 |  |  |  |  |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | 1 | 5 | 0 | 2 | 8 | 1 | 0 | 0 | 0 | 1 | 2 | 5 | 0 | 2 | 10 |
| Total | 25 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
|  | 26 | 7 | 2 | 0 | 1 | 10 | 0 | 0 | 0 | 0 | 0 | 7 | 2 | 0 | 1 | 10 |
|  | 27 | 2 | 12 | 0 | 2 | 17 | 0 | 0 | 0 | 0 | 0 | 2 | 12 | 0 | 2 | 17 |
|  | 28 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
|  | 29 | 0 | 2 | 0 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 7 |
|  | 30 | 0 | 2 | 0 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 7 |
|  | 31 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 4 | 2 | 1 | 0 | 1 | 4 |
|  | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  | 9 | 19 | 1 | 13 | 43 | 2 | 1 | 0 | 1 | 4 | 12 | 20 | 1 | 14 | 47 |

Table 8. Number of bright Atlantic salmon captured in Humber River tagging traps, 1989-1997.

| Year | Lower Estuary Trap |  |  | Upper Estuary Trap |  |  | Total |  |  | Prop. Small | Prop. <br> Large |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Small | Large | Total | Small | Large | Total | Small | Large | Total |  |  |
| 1989 | 2 | 5 | 7 | . | . | . | 2 | 5 | 7 | . | . |
| 1990 | 257 | 22 | 279 | . | . | . | 257 | 22 | 279 | 0.9211 | 0.0789 |
| 1991 | 104 | 4 | 108 | . | . | . | 104 | 4 | 108 | 0.9630 | 0.0370 |
| 1992 | 181 | 29 | 210 |  | . | . | 181 | 29 | 210 | 0.8619 | 0.1381 |
| 1993 | 699 | 45 | 744 | 244 | 11 | 255 | 943 | 56 | 999 | 0.9439 | 0.0561 |
| 1994* | 438 | 79 | 517 | 187 | 3 | 190 | 625 | 82 | 707 | 0.8840 | 0.1160 |
| 1995 | 844 | 104 | 948 | 1115 | 39 | 1154 | 1959 | 143 | 2102 | 0.9320 | 0.0680 |
| 1996 | 516 | 63 | 579 | 461 | 23 | 484 | 977 | 86 | 1063 | 0.9191 | 0.0809 |
| 1997 | 248 | 47 | 295 | 136 | 20 | 156 | 384 | 67 | 451 | 0.8514 | 0.1486 |
| Mean (92-96) | 536 | 64 | 600 | . | . | . | 937 | 79 | 1016 | 0.9221 | 0.0918 |

* Upper trap fished 10 km upstream.

Table 9. Number and condition of small and large salmon captured in the two tagging traps in 1997.
Note: Week refers to week of tagging.


Table 10. Recapture week and location of small salmon on Humber River in 1997.
Note: Week refers to week of recapture.


Table 11. Tagged small Atlantic salmon observed and reported at Big Falls, 1997.

| Tag <br> Number | Fork Length (cm) | Date <br> Tagged | Date Recaptured | No. Days at Large | Tags Observed by Creel Survey Clerks |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Observed | Returned |
| Angled-Released wo tag |  |  |  |  |  |  |
| 3562 | 61.3 | 11 June | 5 July | 24 | * | * |
| Angled-Retained |  |  |  |  |  |  |
| 4762 | 55.8 | 17 June | 27 June | 10 | * | * |
| 4766 | 51.5 | 17 June | 9 July | 22 |  |  |
| 4768 | 56.8 | 17 June | 11 July | 24 | * | * |
| 4777 | 55.5 | 17 June | 7 July | 20 |  |  |
| 4790 | 54.8 | 17 June | 2 July | 15 |  |  |
| 4805 | 55.3 | 17 June | 2 July | 15 |  |  |
| 4812 | 54.3 | 17 June | 12 July | 25 |  |  |
| 4823 | 50.5 | 17 June | 7 July | 20 |  |  |
| 4861 | 52.8 | 17 June | 27 June | 10 | * | * |
| 4862 | 56.4 | 17 June |  |  | * |  |
| 4877 | 54.3 | 17 June | 29 June | 12 |  |  |
| 4885 | 52.8 | 17 June | 2 July | 15 |  |  |
| 4889 | 53.7 | 17 June | 3 July | 16 | * | * |
| 5009 | 56.4 | 20 June |  |  | * | * |
| 5088 | 56.8 | 23 June | 3 July | 16 | * | * |
| 5120 | 55.2 | 25 June | 2 July | 15 |  |  |
| 5143 | 52.3 | 27 June |  |  | * |  |
| Angled-Unknown Ret./Rel. |  |  |  |  |  |  |
| 4873 | 57.2 | 17 June |  |  | * |  |
| 4992 | 58.1 | 20 June |  |  | * |  |
| Total |  |  |  |  | 11 | 7 |
| Tag Reporting Rate |  |  |  |  |  | 0.6364 |

Table 12. Estimation of angling exploitation rate for retained small salmon based on tags available from the two tagging traps in 1997. Adjustments are made for tag loss and reporting rate.

| Week Tagged |  | Median <br> Days <br> to <br> Recapture <br> $(\times 2)$ | Proportion of Tags Retained ( $x_{3=1-1-\left(x^{2} \cdot 0.009\right)}$ | Adjusted Tags Available ( $\mathrm{X}=\times \mathrm{A}_{1} \times \times 3$ ) | Tags Returned (Ret) | Tag Reporting Rate (X6) | Adjusted Tags Recaptured (X7=X5/X6) | Adjusted Angling ER $\qquad$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 23 | 1 |  | 1.000 | 1 |  |  |  |  |
| 24 | 99 | 16 | 0.856 | 85 | 16 | 0.6364 | 25 | 0.2941 |
| 25 | 157 | 16 | 0.856 | 134 | 11 | 0.6364 | 17 | 0.1269 |
| 26 | 58 | 7 | 0.937 | 54 | 3 | 0.6364 | 5 | 0.0926 |
| 27 | 39 | 5 | 0.955 | 37 | 3 | 0.6364 | 5 | 0.1351 |
| 28 | 4 |  | 1.000 | 4 |  |  |  | . |
| 29 | 3 |  | 1.000 | 3 |  |  |  |  |
| 30 | 8 |  | 1.000 | 8 |  |  |  | . |
| Overall | 369 | 16 | 0.856 | 316 | 33 | 0.6364 | 52 | 0.1646 |

[^0]Table 13. Estimated total catch of retained small Atlantic salmon on the Humber River, 1997. Numbers in parentheses are estimated 95\% confidence limits.

```
SMALL CATCH (Ret.) = Adjusted Catch at Big Falls
    Prop. Humber Catch from Big Falls
    = 1112
    0.4545
    = 2,447(1,748-3,670)
    Where:
Prop. Humber Catch = Big Falls Tags (Retained Small) = 15 = 0.4545
    taken at Big Falls Humber Tags (Retained Small)}3
```

Table 14. Estimated returns and spawning escapement of Atlantic salmon on the Humber River, 1997.

| ESTIMATED PARAMETERS: | Parameter Value | 95\% C.I. |  |
| :---: | :---: | :---: | :---: |
|  |  | Lower | Upper |
| Tags Recaptured (R)* | 52 | 36 | 91 |
| Tags Available to Retention Fishery (M)** | 316 | 299 | 334 |
| Estimated Exploitation on Small salmon (er) | 0.1646 | 0.1204 | 0.2725 |
| Estimated Total Small Retained (C) | 2,447 | 1,748 | 3,670 |
| Proportion Small Retained | 0.6307 |  |  |
| Total Small Released | 1,433 | 1,024 | 2,149 |
| Total Large Released | 133 |  |  |
| Assumed catch \& release mortality rate | 10\% |  |  |
| Proportion Small in Population | 0.8514 | 0.8180 | 0.8820 |
| (Petersen - single census estimate (95\% Cl's for small are from Ricker, 1975)) |  |  |  |
|  |  |  |  |  |
| SMALL | 14,866 | 11,340 | 19,501 |
| LARGE | 2,595 | 2,523 | 4,339 |
| TOTAL | 17,461 | 13,863 | 23,840 |
| POTENTIAL SPAWNERS: <br> (adjusted for catch \& release mortality) <br> SMALL <br> LARGE TOTAL |  |  |  |
|  | 12,276 | 8,750 | 16,911 |
|  | 2,582 | 2,510 | 4,326 |
|  | 14,857 | 11,259 | 21,237 |

* Adjusted for mean reporting rate of 0.6364
** Adjusted for tag loss based on 0.009 tags/day.

Table 15. Estimation of the percentage of the conservation egg deposition requirement achieved in the Humber River, 1997.

## Habitat:

| Fluvial Rearing Units (100 sq. m): Lacustrine Area: |  | $\begin{aligned} & 115,307 \text { units } \\ & 1,751 \text { ha } \end{aligned}$ | (Porter and Chadwick, MS 1983) <br> (Mullins and Chaput, MS 1994) |
| :---: | :---: | :---: | :---: |
| Minimum Egg Deposition Rate: |  |  |  |
| Fluvial |  | 240 eggs per | Rearing Unit |
| Lacustrine |  | 368 eggs per | ha of Lacustrine Area |
| Biological Characteristics, 1997: |  |  |  |
| Fecundity: |  | 1,540 eggs / kg |  |
| Small: | \% overall | 85.1 | (tagging trap, 1997) |
| (<63 cm) | \% female | 59.6 ( $\mathrm{n}=114$ ) | (recreational, 1997) |
|  | mean wt females | $2.0 \mathrm{~kg}(\mathrm{n}=34)$ | (recreational, 1997) |
| Large: | \% overall | 14.9 | (tagging trap, 1997) |
| (>=63 cm) | \% female | 68.6 | (commercial, 1991) |
|  | mean wt females | $3.7+\mathrm{kg}$ | (Porter and Chadwick, MS 1983) |

$=$ potential egg depositions $/$ minimum conservation requirement $X 100$
small spawners x (eggs per small spawner) + large spawners x (eggs per large spawner)

(Rearing Units $\times 240$ eggs / unit) + (Lacustrine Area $\times 368$ eggs / ha)
Where:


Table 16. Summary of Atlantic salmon spawning escapement and the percentage of the conservation egg deposition requirement achieved on the Humber River, 1990-1997. Catch is based on creel survey results.
Conservation egg deposition requirement: 28.3 million eggs

| Year | Estimated Returns |  |  | Angling Catch |  |  | Spawning Escapement* |  |  | $\begin{array}{r} \hline \text { \% Egg } \\ \text { Requirement } \\ \text { Achieved** } \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Small |  | Large |  |  |  |  |
|  | Small | Large | Total | Retained | Released | Released | Small | Large | Total |  |
| 1990 | 12,216 | 855 | 13,071 | 3,054 |  | 75 | 9,162 | 848 | 10,010 | 60 |
| 1991 | 5,724 | 401 | 6,125 | 1,431 |  | 11 | 4,293 | 400 | 4,693 | 27 |
| 1992 | 17,571 | 2,945 | 20,516 | 4,349 | 317 | 177 | 13,191 | 2,927 | 16,118 | 117 |
| 1993 | 18,477 | 636 | 19,113 | 4,161 | 303 | 125 | 14,286 | 624 | 14,909 | 96 |
| 1994 | 7,995 | 1,030 | 9,025 | 2,523 | 1,438 | 166 | 5,328 | 1,013 | 6,342 | 40 |
| 1995 | 27,898 | 2,064 | 29,963 | 5,150 | 1,881 | 233 | 22,560 | 2,041 | 24,601 | 128 |
| 1996 | 30,445 | 2,679 | 33,125 | 4,740 | 3,016 | 237 | 25,404 | 2,655 | 28,059 | 186 |
| 1997 | 14,866 | 2,595 | 17,461 | 2,447 | 1,433 | 133 | 12,276 | 2,582 | 14,857 | 115 |
| Mean (92-96) | 20,477 | 1,871 | 22,348 | 4,185 | 1,391 | 188 | 16,154 | 1,852 | 18,006 | 113 |

* Spawning escapements are adjusted from previous reports to account for $10 \%$ mortality on released fish.
** Percentage egg requirement achieved in 1990 is based on biological characteristics from Porter and Chadwick, 1983


Figure 1. Location of Atlantic salmon tagging traps operated in the estuary of the Humber River in 1997.


Figure 2. River segments of the Humber River, upstream of Deer Lake and showing the Big Falls Creel Survey location.
A. Lower Tagging Trap



Figure 3. Distribution of counts of small and large salmon caught in the Lower and Upper tagging traps in 1997.


Figure 4. Run timing of small and large Atlantic salmon at the Lower tagging trap on the Humber River, 1989-97. Symbols represent the 25,50 and 75 percent of the run for each year.

## A. Tags Applied



## B. Tags Recaptured From Retained Small Salmon



## C. Angled Tagged and Untagged Small Salmon



Figure 5. Weekly distribution of tag applications and recaptures in angling of tagged and untagged retained small salmon on the Humber River in 1997.



Figure 6. Estimated small and large Atlantic salmon spawners on the Humber River. Horizontal lines represent the estimated conservation spawner requirements.


Figure 7. Relationship between total spawners in Year i and spawner recruits adjusted for year-class (wtd spawners).


Figure 8. Relationship between 1SW salmon spawners and recruits on the Humber River.

Appendix 1. Mean fork length, weight and sex composition of small and large female
Atlantic salmon of the Humber River, 1988-1996. Sex is determined from internal examination.

|  |  | FORK LENGTH (cm) |  |  |  |  | WHOLE WEIGHT FEMALES (kg) |  |  |  |  | NO. | PERCENT <br> FEMALE |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | N | MEAN | MIN | MAX | STD | N | MEAN | MIN | MAX | STD | SEXED | N | \% |
| Large | YY | 1 |  |  |  |  | 0 |  |  |  |  |  |  |  |
|  |  | 1 |  |  | 63.2 |  | 0 |  | - | . |  | 0 | 0 | 100.0 |
|  | 92 | 3 | 63.0 | 63.0 | 63.0 | 0.0 | 1 | 2.7 | 2.7 | 2.7 |  | 2 | 1 | 50.0 |
|  | 93 | 1 | 63.0 | 63.0 | 63.0 |  | 1 | 2.4 | 2.4 | 2.4 |  | 1 | 1 | 100.0 |
|  | 94 | 3 | 63.0 | 63.0 | 63.0 | 0.0 | 0 | . | . | . | . | 0 | 0 | . |
|  | 96 | 6 | 69.7 | 63.0 | 93.5 | 12.2 | 2 | 2.2 | 2.0 | 2.3 | 0.2 | 5 | 3 | 60.0 |
|  | 97 | 4 | 63.3 | 63.0 | 64.0 | 0.5 | 0 | . | . | . | . | 2 | 0 | . |
|  | 1984-91 | 2 | 63.4 | 63.2 | 63.5 | 0.2 | 0 | . | . | . |  | 1 | 1 | 100.0 |
|  | 1992-96 | 13 | 66.1 | 63.0 | 93.5 | 8.6 | 4 | 2.4 | 2.0 | 2.7 | 0.3 | 8 | 5 | 62.5 |
|  | Total | 19 | 65.2 | 63.0 | 93.5 | 7.2 | 4 | 2.4 | 2.0 | 2.7 | 0.3 | 11 | 6 | 54.5 |
| Small | YY |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 88 | 72 | 55.7 | 48.0 | 62.0 | 3.0 | 0 | . | . | . |  | 0 | 0 | . |
|  | 89 | 149 | 54.3 | 43.3 | 62.0 | 3.0 | 9 | 1.4 | 1.0 | 1.8 | 0.3 | 86 | 37 | 43.0 |
|  | 90 | 54 | 56.4 | 49.0 | 62.5 | 3.3 | 0 | . | . | . | . | 27 | 19 | 70.4 |
|  | 91 | 164 | 54.3 | 45.7 | 62.0 | 2.7 | 65 | 1.6 | 1.2 | 2.5 | 0.2 | 130 | 66 | 50.8 |
|  | 92 | 357 | 56.1 | 48.5 | 62.5 | 2.6 | 57 | 1.9 | 1.5 | 2.5 | 0.3 | 254 | 138 | 54.3 |
|  | 93 | 127 | 55.6 | 48.0 | 62.5 | 2.9 | 49 | 1.7 | 1.0 | 2.4 | 0.3 | 83 | 56 | 67.5 |
|  | 94 | 372 | 55.6 | 48.0 | 62.8 | 2.9 | 21 | 1.7 | 1.3 | 2.4 | 0.3 | 112 | 57 | 50.9 |
|  | 95 | 119 | 55.5 | 48.0 | 62.0 | 2.7 | 18 | 1.6 | 1.2 | 1.9 | 0.2 | 73 | 37 | 50.7 |
|  | 96 | 294 | 55.6 | 47.0 | 62.5 | 2.7 | 109 | 1.8 | 1.1 | 2.8 | 0.3 | 187 | 112 | 59.9 |
|  | 97 | 173 | 56.8 | 47.0 | 62.5 | 2.8 | 34 | 2.0 | 1.1 | 3.0 | 0.4 | 114 | 68 | 59.6 |
|  | 1984-91 | 439 | 54.8 | 43.3 | 62.5 | 3.0 | 74 | 1.6 | 1.0 | 2.5 | 0.2 | 243 | 122 | 50.2 |
|  | 1992-96 | 1269 | 55.7 | 47.0 | 62.8 | 2.8 | 254 | 1.8 | 1.0 | 2.8 | 0.3 | 709 | 400 | 56.4 |
|  | Total | 1881 | 55.6 | 43.3 | 62.8 | 2.9 | 362 | 1.8 | 1.0 | 3.0 | 0.3 | 1066 | 590 | 55.3 |

Appendix 2. Mean fork length, weight and sex composition of small and large female
Atlantic salmon of the Humber River, 1988-1996. Sex is determined from internal examination.
Tagging Traps

|  |  |  | FORK LENGTH (cm) |  |  |  | WHOLE WEIGHT FEMALES |  |  |  | kg) | NO. | PERCENT <br> FEMALE |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | N | MEAN | MIN | MAX | STD | N | MEAN | MIN | MAX | STD | SEXED | N | \% |
| Large | YY |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 89 | 5 | 75.6 | 71.5 | 77.5 | 2.4 | 0 | . | . | . | - | 5 | 5 | 100.0 |
|  | 90 | 22 | 72.6 | 63.0 | 92.0 | 8.3 | 0 | . | - | - | . | 0 | 0 | . |
|  | 91 | 4 | 77.5 | 75.5 | 80.0 | 2.1 | 0 | . | . | - |  | 0 | 0 |  |
|  | 92 | 29 | 75.2 | 63.6 | 91.0 | 5.2 | 0 | . |  | . |  | 0 | 0 |  |
|  | 93 | 56 | 72.6 | 63.2 | 90.6 | 6.0 | 1 | 5.0 | 5.0 | 5.0 |  | 1 | 1 | 100.0 |
|  | 94 | 82 | 74.1 | 63.0 | 88.5 | 5.8 | 0 | . | . | . |  | 0 | 0 | . |
|  | 95 | 143 | 75.8 | 63.1 | 115.0 | 5.9 | 0 | - | - | - |  | 0 | 0 |  |
|  | 96 | 86 | 75.8 | 63.5 | 93.1 | 6.3 | 0 | . | . | . | - | 0 | 0 | - |
|  | 97 | 73 | 75.5 | 63.5 | 89.2 | 5.3 | 0 | - | - | . | . | 0 | 0 | . |
|  | 1984-91 | 31 | 73.7 | 63.0 | 92.0 | 7.3 | 0 | . |  | . |  | 5 | 5 | 100.0 |
|  | 1992-96 | 396 | 74.9 | 63.0 | 115.0 | 6.0 | 1 | 5.0 | 5.0 | 5.0 |  | 1 | 1 | 100.0 |
|  | Total | 500 | 75.0 | 63.0 | 115.0 | 6.0 | 1 | 5.0 | 5.0 | 5.0 | - | 6 | 6 | 100.0 |
| Small | YY |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 89 | 2 | 52.5 | 51.4 | 53.5 | 1.5 | 0 | - | . | . | . | 0 | 0 |  |
|  | 90 | 255 | 54.7 | 43.9 | 62.8 | 3.7 | 0 | . | - | . | . | 29 | 21 | 72.4 |
|  | 91 | 102 | 52.3 | 37.3 | 61.3 | 3.5 | 24 | 1.3 | 0.9 | 1.9 | 0.2 | 39 | 27 | 69.2 |
|  | 92 | 181 | 53.7 | 34.7 | 62.0 | 3.3 | 14 | 1.8 | 1.0 | 2.8 | 0.5 | 22 | 17 | 77.3 |
|  | 93 | 937 | 53.4 | 38.3 | 62.6 | 2.9 | 37 | 1.4 | 1.0 | 2.6 | 0.3 | 59 | 40 | 67.8 |
|  | 94 | 624 | 53.2 | 44.0 | 62.8 | 2.8 | 4 | 2.0 | 1.5 | 2.3 | 0.4 | 9 | 4 | 44.4 |
|  | 95 | 1958 | 52.9 | 39.4 | 62.9 | 2.6 | 0 | . | . |  | . | 5 | 3 | 60.0 |
|  | 96 | 977 | 53.4 | 40.0 | 62.8 | 2.8 | 3 | 2.2 | 1.8 | 2.7 | 0.5 | 5 | 3 | 60.0 |
|  | 97 | 404 | 54.5 | 45.7 | 62.7 | 2.8 | 0 | . | . | . | . | 0 | 0 | . |
|  | 1984-91 | 359 | 54.0 | 37.3 | 62.8 | 3.8 | 24 | 1.3 | 0.9 | 1.9 | 0.2 | 68 | 48 | 70.6 |
|  | 1992-96 | 4677 | 53.2 | 34.7 | 62.9 | 2.8 | 58 | 1.6 | 1.0 | 2.8 | 0.4 | 100 | 67 | 67.0 |
|  | Total | 5440 | 53.3 | 34.7 | 62.9 | 2.9 | 82 | 1.5 | 0.9 | 2.8 | 0.4 | 168 | 115 | 68.5 |

Appendix 3. Smolt-age distribution of small and large Atlantic salmon of the Humber River.
Virgin spawners only.

## Angling

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \multicolumn{2}{|l|}{\multirow[t]{3}{*}{}} \& \multicolumn{12}{|c|}{SMOLT-AGE} \& \multicolumn{3}{|c|}{\multirow[b]{2}{*}{Total}} <br>
\hline \& \& \multicolumn{3}{|c|}{2} \& \multicolumn{3}{|c|}{3} \& \multicolumn{3}{|c|}{4} \& \multicolumn{3}{|c|}{5} \& \& \& <br>
\hline \& \& N \& \% \& MEAN \& N \& \% \& MEAN \& N \& \% \& MEAN \& N \& \% \& MEAN \& N \& \% \& | MEAN <br>
\hline \multirow[t]{23}{*}{Large

Small} \& YY
88 \& \& \& \& 1 \& 100.0 \& 3.0 \& \& \& \& \& \& \& 1 \& 100.0 \& 3.0 <br>
\hline \& 90 \& . \& . \& . \& 1 \& 100.0 \& 3.0 \& . \& . \& . \& . \& . \& \& 1 \& 100.0 \& 3.0 <br>
\hline \& 92 \& . \& . \& . \& 2 \& 66.7 \& 3.0 \& 1 \& 33.3 \& 4.0 \& . \& - \& \& 3 \& 100.0 \& 3.3 <br>
\hline \& 94 \& . \& - \& - \& 2 \& 66.7 \& 3.0 \& 1 \& 33.3 \& 4.0 \& - \& - \& \& 3 \& 100.0 \& 3.3 <br>
\hline \& 96 \& . \& . \& . \& 3 \& 100.0 \& 3.0 \& . \& . \& . \& . \& . \& \& 3 \& 100.0 \& 3.0 <br>
\hline \& 97 \& . \& - \& - \& 1 \& 33.3 \& 3.0 \& 2 \& 66.7 \& 4.0 \& - \& - \& \& 3 \& 100.0 \& 3.7 <br>
\hline \& 1984-91 \& - \& - \& - \& 2 \& 100.0 \& 3.0 \& . \& \& . \& - \& . \& \& 2 \& 100.0 \& 3.0 <br>
\hline \& 1992-96 \& - \& - \& - \& 7 \& 77.8 \& 3.0 \& 2 \& 22.2 \& 4.0 \& - \& . \& \& 9 \& 100.0 \& 3.2 <br>
\hline \& Total \& \& \& - \& 10 \& 71.4 \& 3.0 \& 4 \& 28.6 \& 4.0 \& - \& . \& \& 14 \& 100.0 \& 3.3 <br>
\hline \& YY \& \& \& \& \& \& \& \& \& \& \& \& \& \& \& <br>
\hline \& 88 \& 2 \& 2.6 \& 2.0 \& 48 \& 62.3 \& 3.0 \& 27 \& 35.1 \& 4.0 \& . \& . \& - \& 77 \& 100.0 \& 3.3 <br>
\hline \& 89 \& 7 \& 5.6 \& 2.0 \& 95 \& 75.4 \& 3.0 \& 23 \& 18.3 \& 4.0 \& 1 \& 0.8 \& 5.0 \& 126 \& 100.0 \& 3.1 <br>
\hline \& 90 \& 2 \& 3.6 \& 2.0 \& 32 \& 58.2 \& 3.0 \& 21 \& 38.2 \& 4.0 \& . \& . \& . \& 55 \& 100.0 \& 3.3 <br>
\hline \& 91 \& 10 \& 6.0 \& 2.0 \& 132 \& 78.6 \& 3.0 \& 26 \& 15.5 \& 4.0 \& . \& . \& \& 168 \& 100.0 \& 3.1 <br>
\hline \& 92 \& 9 \& 2.6 \& 2.0 \& 282 \& 82.7 \& 3.0 \& 50 \& 14.7 \& 4.0 \& . \& . \& \& 341 \& 100.0 \& 3.1 <br>
\hline \& 93 \& 2 \& 1.6 \& 2.0 \& 97 \& 75.2 \& 3.0 \& 30 \& 23.3 \& 4.0 \& . \& . \& - \& 129 \& 100.0 \& 3.2 <br>
\hline \& 94 \& 4 \& 1.2 \& 2.0 \& 183 \& 55.6 \& 3.0 \& 141 \& 42.9 \& 4.0 \& 1 \& 0.3 \& 5.0 \& 329 \& 100.0 \& 3.4 <br>
\hline \& 95 \& . \& . \& . \& 60 \& 54.5 \& 3.0 \& 50 \& 45.5 \& 4.0 \& . \& \& . \& 110 \& 100.0 \& 3.5 <br>
\hline \& 96 \& - \& . \& \& 145 \& 50.7 \& 3.0 \& 133 \& 46.5 \& 4.0 \& 8 \& 2.8 \& 5.0 \& 286 \& 100.0 \& 3.5 <br>
\hline \& 97 \& 2 \& 1.2 \& 2.0 \& 124 \& 74.3 \& 3.0 \& 38 \& 22.8 \& 4.0 \& 3 \& 1.8 \& 5.0 \& 167 \& 100.0 \& 3.3 <br>
\hline \& 1984-91 \& 21 \& 4.9 \& 2.0 \& 307 \& 72.1 \& 3.0 \& 97 \& 22.8 \& 4.0 \& 1 \& 0.2 \& 5.0 \& 426 \& 100.0 \& 3.2 <br>
\hline \& 1992-96 \& 15 \& 1.3 \& 2.0 \& 767 \& 64.2 \& 3.0 \& 404 \& 33.8 \& 4.0 \& 9 \& 0.8 \& 5.0 \& 1195 \& 100.0 \& 3.3 <br>
\hline \& Total \& 38 \& 2.1 \& 2.0 \& 1198 \& 67.0 \& 3.0 \& 539 \& 30.1 \& 4.0 \& 13 \& 0.7 \& 5.0 \& 1788 \& 100.0 \& 3.3 <br>
\hline
\end{tabular}

Appendix 4. Smolt-age distribution of small and large Atlantic salmon of the Humber River.
Virgin spawners only.
Tagging Traps

|  |  | SMOLT-AGE |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Total |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 2 |  |  | 3 |  |  | 4 |  |  | 5 |  |  | 6 |  |  |  |  |  |
|  |  | N | \% | MEAN | N | \% | MEAN | N | \% | MEAN | N | \% | MEAN | N | \% | MEAN | N | \% | MEAN |
| Large | YY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 89 |  |  | . | 2 | 100.0 | 3.0 | . |  | . | . | - | . | . | . | . | 2 | 100.0 | 3.0 |
|  | 90 | 1 | 7.7 | 2.0 | 9 | 69.2 | 3.0 | 3 | 23.1 | 4.0 | . | . | - | . | - | - | 13 | 100.0 | 3.2 |
|  | 92 | 2 | 9.1 | 2.0 | 19 | 86.4 | 3.0 | 1 | 4.5 | 4.0 | . | . | . | . | . |  | 22 | 100.0 | 3.0 |
|  | 93 | 4 | 13.8 | 2.0 | 22 | 75.9 | 3.0 | 3 | 10.3 | 4.0 | . | . | . | . | - |  | 29 | 100.0 | 3.0 |
|  | 94 | . | . | . | 16 | 55.2 | 3.0 | 13 | 44.8 | 4.0 | . | . | . | . | . |  | 29 | 100.0 | 3.4 |
|  | 95 | . | . | - | 29 | 47.5 | 3.0 | 32 | 52.5 | 4.0 | . | . | - | . | - |  | 61 | 100.0 | 3.5 |
|  | 96 | . | . | . | 22 | 61.1 | 3.0 | 14 | 38.9 | 4.0 | . | - | . | . | - |  | 36 | 100.0 | 3.4 |
|  | 97 | 1 | 6.7 | 2.0 | 11 | 73.3 | 3.0 | 3 | 20.0 | 4.0 | . | . | . | . | . |  | 15 | 100.0 | 3.1 |
|  | 1984-91 | 1 | 6.7 | 2.0 | 11 | 73.3 | 3.0 | 3 | 20.0 | 4.0 | . | . | . | . | . |  | 15 | 100.0 | 3.1 |
|  | 1992-96 | 6 | 3.4 | 2.0 | 108 | 61.0 | 3.0 | 63 | 35.6 | 4.0 | . | . | . | . | . |  | 177 | 100.0 | 3.3 |
|  | Total | 8 | 3.9 | 2.0 | 130 | 62.8 | 3.0 | 69 | 33.3 | 4.0 | - | - | - | - | . |  | 207 | 100.0 | 3.3 |
| Small | YY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 90 | 8 | 3.3 | 2.0 | 210 | 86.8 | 3.0 | 24 | 9.9 | 4.0 | - | . | - | . | - | . | 242 | 100.0 | 3.1 |
|  | 91 | 2 | 2.1 | 2.0 | 89 | 93.7 | 3.0 | 4 | 4.2 | 4.0 | . | - | . | . | . |  | 95 | 100.0 | 3.0 |
|  | 92 | 6 | 3.4 | 2.0 | 130 | 74.7 | 3.0 | 38 | 21.8 | 4.0 | . | . | - | . | . | . | 174 | 100.0 | 3.2 |
|  | 93 | 28 | 3.1 | 2.0 | 752 | 84.3 | 3.0 | 112 | 12.6 | 4.0 | . | . | . | . | . | . | 892 | 100.0 | 3.1 |
|  | 94 | 5 | 0.8 | 2.0 | 341 | 56.4 | 3.0 | 257 | 42.5 | 4.0 | 2 | 0.3 | 5.0 | . | . | . | 605 | 100.0 | 3.4 |
|  | 95 | 1 | 0.1 | 2.0 | 519 | 39.2 | 3.0 | 766 | 57.8 | 4.0 | 37 | 2.8 | 5.0 | 2 | 0.2 | 6.0 | 1325 | 100.0 | 3.6 |
|  | 96 | 1 | 0.1 | 2.0 | 475 | 50.6 | 3.0 | 448 | 47.8 | 4.0 | 14 | 1.5 | 5.0 | . | . |  | 938 | 100.0 | 3.5 |
|  | 97 |  |  |  | 329 | 88.0 | 3.0 | 45 | 12.0 | 4.0 | . | . | . | . | . |  | 374 | 100.0 | 3.1 |
|  | 1984-91 | 10 | 3.0 | 2.0 | 299 | 88.7 | 3.0 | 28 | 8.3 | 4.0 | . | . | . | - | - |  | 337 | 100.0 | 3.1 |
|  | 1992-96 | 41 | 1.0 | 2.0 | 2217 | 56.4 | 3.0 | 1621 | 41.2 | 4.0 | 53 | 1.3 | 5.0 | 2 | 0.1 | 6.0 | 3934 | 100.0 | 3.4 |
|  | Total | 51 | 1.1 | 2.0 | 2845 | 61.2 | 3.0 | 1694 | 36.5 | 4.0 | 53 | 1.1 | 5.0 | 2 | 0.0 | 6.0 | 4645 | 100.0 | 3.4 |

Appendix 5. Sea-age distribution of small and large Atlantic salmon of the Humber River
Angling

|  |  | SEA-AGE |  |  |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1SW |  |  |  |  |  |
|  |  | N | \% | N | \% | N | \% |
| SIZE: | YY |  |  |  |  |  |  |
| Large | 88 | 1 | 100.0 | - | . | 1 | 100.0 |
|  | 90 | 1 | 100.0 | . | . | 1 | 100.0 |
|  | 92 | 3 | 100.0 | - | . | 3 | 100.0 |
|  | 93 | . | . | 1 | 100.0 | 1 | 100.0 |
|  | 94 | 3 | 100.0 | . | . | 3 | 100.0 |
|  | 96 | 3 | 50.0 | 3 | 50.0 | 6 | 100.0 |
|  | 97 | 3 | 75.0 | 1 | 25.0 | 4 | 100.0 |
|  | 1984-91 | 2 | 100.0 | . |  | 2 | 100.0 |
|  | 1992-96 | 9 | 69.2 | 4 | 30.8 | 13 | 100.0 |
|  | Total | 14 | 73.7 | 5 | 26.3 | 19 | 100.0 |
| Small | YY |  |  |  |  |  |  |
|  | 88 | 77 | 100.0 | - | - | 77 | 100.0 |
|  | 89 | 126 | 100.0 | . | . | 126 | 100.0 |
|  | 90 | 55 | 98.2 | 1 | 1.8 | 56 | 100.0 |
|  | 91 | 170 | 98.8 | 2 | 1.2 | 172 | 100.0 |
|  | 92 | 342 | 99.7 | 1 | 0.3 | 343 | 100.0 |
|  | 93 | 130 | 98.5 | 2 | 1.5 | 132 | 100.0 |
|  | 94 | 331 | 99.1 | 3 | 0.9 | 334 | 100.0 |
|  | 95 | 110 | 99.1 | 1 | 0.9 | 111 | 100.0 |
|  | 96 | 289 | 99.0 | 3 | 1.0 | 292 | 100.0 |
|  | 97 | 168 | 100.0 | . | . | 168 | 100.0 |
|  | 1984-91 | 428 | 99.3 | 3 | 0.7 | 431 | 100.0 |
|  | 1992-96 | 1202 | 99.2 | 10 | 0.8 | 1212 | 100.0 |
|  | Total | 1798 | 99.3 | 13 | 0.7 | 1811 | 100.0 |

Appendix 6. Sea-age distribution of small and large Atlantic salmon of the Humber River
Tagging Traps

|  |  | SEA-AGE |  |  |  |  |  |  |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1SW |  | 2SW |  | 1SW |  | 2SW RS |  |  |  |
|  |  | N | \% | N | \% | N | \% | N | \% | N | \% |
| SIZE: | YY |  |  |  |  |  |  |  |  |  |  |
| Large | 89 |  | . | 2 | 40.0 | 3 | 60.0 | - |  | 5 | 100.0 |
|  | 90 | 6 | 28.6 | 7 | 33.3 | 7 | 33.3 | 1 | 4.8 | 21 | 100.0 |
|  | 91 | . |  | - |  | 4 | 100.0 | . |  | 4 | 100.0 |
|  | 92 | 1 | 3.6 | 21 | 75.0 | 6 | 21.4 | . |  | 28 | 100.0 |
|  | 93 | 1 | 1.8 | 28 | 50.0 | 10 | 17.9 | 17 | 30.4 | 56 | 100.0 |
|  | 94 | 7 | 8.6 | 23 | 28.4 | 50 | 61.7 | 1 | 1.2 | 81 | 100.0 |
|  | 95 | 4 | 2.9 | 57 | 40.7 | 77 | 55.0 | 2 | 1.4 | 140 | 100.0 |
|  | 96 | 1 | 1.2 | 35 | 41.2 | 45 | 52.9 | 4 | 4.7 | 85 | 100.0 |
|  | 97 | . |  | 15 | 21.1 | 53 | 74.6 | 3 | 4.2 | 71 | 100.0 |
|  | 1984-91 | 6 | 20.0 | 9 | 30.0 | 14 | 46.7 | 1 | 3.3 | 30 | 100.0 |
|  | 1992-96 | 14 | 3.6 | 164 | 42.1 | 188 | 48.2 | 24 | 6.2 | 390 | 100.0 |
|  | Total | 20 | 4.1 | 188 | 38.3 | 255 | 51.9 | 28 | 5.7 | 491 | 100.0 |
| Small | YY |  |  |  |  |  |  |  |  |  |  |
|  | 90 | 242 | 95.3 | - | - | 12 | 4.7 | - |  | 254 | 100.0 |
|  | 91 | 95 | 92.2 | . | . | 8 | 7.8 | . |  | 103 | 100.0 |
|  | 92 | 175 | 96.7 | . | . | 6 | 3.3 | . |  | 181 | 100.0 |
|  | 93 | 904 | 96.4 | 1 | 0.1 | 33 | 3.5 | . |  | 938 | 100.0 |
|  | 94 | 608 | 97.9 | . | . | 13 | 2.1 | . |  | 621 | 100.0 |
|  | 95 | 1327 | 99.5 | . | . | 7 | 0.5 | . |  | 1334 | 100.0 |
|  | 96 | 942 | 97.8 | - | . | 21 | 2.2 | - |  | 963 | 100.0 |
|  | 97 | 375 | 92.8 | - |  | 29 | 7.2 | - |  | 404 | 100.0 |
|  | 1984-91 | 337 | 94.4 | - | . | 20 | 5.6 | . |  | 357 | 100.0 |
|  | 1992-96 | 3956 | 98.0 | 1 | 0.0 | 80 | 2.0 | . |  | 4037 | 100.0 |
|  | Total | 4668 | 97.3 | 1 | 0.0 | 129 | 2.7 | $\cdot$ |  | 4798 | 100.0 |


[^0]:    * Not adjusted for tags destined for Hughes Brook.

