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STATUS OF THE ATLANTIC SALMON (*Salmo salar* L.) STOCK  
OF PINWARE RIVER, LABRADOR, 1997

by

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## ABSTRACT

This is the second assessment of the status of the Atlantic salmon stock on Pinware River. A minimum of 6,110 ha of lacustrine habitat and 46,691 units of fluvial rearing habitat are available to salmon on this system. The minimum conservation egg deposition requirement is 11,847,390 eggs. It was estimated, based on mark-recapture, that 16% (95% CI 5 – 24%) of the conservation requirement was achieved in 1997. The proportion of large salmon observed at the tagging and recapture traps in 1997 was 40% higher than observed in 1996. This may have been due to the closure of the SFA 14B commercial salmon fishery in 1997. Except for the increase in the proportion of large salmon, the lower commercial effort and lower recreational bag limits since 1992 do not appear to have resulted in an increase in the total number of spawners on this river. Recreational catch and effort statistics were not collected by DFO in 1997. Therefore, it was not possible to accurately compare estimated catches and effort in 1997 with those in previous years.

The low numbers of salmon tagged and recaptured and the incomplete catch and effort statistics increases the uncertainty around the estimate of total returns based on mark-recapture. However, this uncertainty has been incorporated into the population estimate by calculating the probability of a lower or higher population size given the mark-recapture results observed. Based on this analysis, the probability that the conservation requirement was achieved in 1997 is very low.

## RÉSUMÉ

Il s'agit de la deuxième évaluation de l'état du stock de saumon de l'Atlantique de la rivière Pinware. Les saumons de ce bassin disposent, au minimum, de 6 110 ha d'habitat lacustre et de 46 691 unités d'habitat de croissance fluvial. La ponte minimum nécessaire à la conservation est de 11 847 390 oeufs. Il a été estimé, par marquage-recapture, que 16 % (IC de 95 % de 5 – 24 %) des besoins de conservation avaient été atteints en 1997. La proportion de grands saumons observés dans les pièges de marquage-recapture en 1997 était supérieure de 40 % à celle notée en 1996. Cela peut s'expliquer par la fermeture de la ZPS 14B à la pêche commerciale du saumon en 1997. Si l'on fait exception de l'augmentation de la proportion de grands saumons, la réduction de l'effort de pêche commerciale et des limites de capture de la pêche récréative imposée depuis 1992 ne semble pas avoir permis d'accroître le nombre total de géniteurs dans cette rivière. Le MPO n'a pas procédé à l'obtention de statistiques sur les captures et l'effort de la pêche récréative en 1997. Il n'était donc pas possible d'effectuer une comparaison exacte des valeurs estimées pour 1997 avec les valeurs des années antérieures.

Le nombre restreint de saumons marqués et recapturés et les statistiques incomplètes sur les prises et l'effort accroissent l'incertitude liée à l'estimation des remontées totales à partir des données de marquage-recapture. Cette incertitude a cependant été intégrée à l'estimation de population en calculant la probabilité d'un effectif plus ou moins important en fonction des données de marquage-recapture obtenues. Selon cette analyse, la probabilité que les besoins de conservation aient été atteints en 1997 est très faible.

## INTRODUCTION

The Pinware River is the largest of three scheduled rivers in southern Labrador, Salmon Fishing Area (SFA) 14B (Fig. 1). It flows into the Strait of Belle Isle at latitude 51° 39' N and longitude 56° 42' W. It has a drainage area of 2,486 km<sup>2</sup>, from a barren plateau with a basin relief of 427 m and a total length (including tributaries) of 579 km (Anderson, 1985).

Previously in SFA 14B, the status of the salmon stock was assessed on Forteau River in 1994 and 1995 (Lowe and Mullins, MS 1995). That assessment revealed that, in spite of incomplete information on the available salmon rearing habitat, the status of the Forteau River stock had declined in comparison to the 1960s when catch rates, particularly of large salmon, had been much higher. The decline of large salmon stocks has raised a good deal of concern among recreational fishers in southern Labrador. The rivers of SFA 14B had historically produced a relatively high proportion of large salmon. With the closure of the large salmon recreational fishery in Newfoundland in 1984, large salmon in SFA 14B attracted increased angling effort.

Several fisheries management measures have been implemented in order to increase the returns of large salmon to southern Labrador rivers. These include: 1) a reduction in the recreational season bag limit from two large salmon to one in 1996; 2) the commercial season opening date was changed from 6 June in 1994 to 3 July in 1995; 3) the commercial quota was reduced from 8 t in 1994 to 6.5 t in 1995 and 5.0 t in 1996 (3.4 t landed); and 4) bait and spinner fishing in the Forteau River estuary was restricted to the area outside of Buckle's Point due to a high by-catch mortality of salmon smolts and kelts. Repeat spawning one-sea-winter salmon (reconditioned kelts) make up the majority of large salmon returns to the Forteau River. Therefore, their survival is very important to the rebuilding of this stock (Lowe and Mullins, MS 1996).

In spite of some improvement in the returns of large salmon to Forteau River in 1995, the overall trend of low abundance of both small and large salmon did not change (Lowe and Mullins, MS 1996). Based on the low spawning escapements experienced in the early 1990s, returns to this river were not expected to improve in the near future. In order to ensure future growth and stability of this salmon stock, it was recommended that the minimum spawning requirement be achieved each year.

Recreational catch rates had declined on the Pinware River in recent years and it was suspected, as for the Forteau River, that the abundance of salmon had also declined (Fig 2). The present assessment addresses the question of whether or not the same conditions of low overall stock abundance and declining proportion of large salmon (predominantly virgin multi-sea-winter fish) that existed on the Forteau River in 1994-95 also existed on the Pinware River in 1997.

## MATERIALS AND METHODS

### Recreational Fishery

Recreational catch and effort statistics were not collected by Department of Fisheries and Oceans (DFO) River Guardians in 1996-97. In previous years, daily retained and released catches of small (<63 cm fork length) and large salmon ( $\geq 63$  cm fork length) and angling effort in rod days had been recorded and compiled on a weekly basis by River Guardians.

Recreational catch and effort for 1997 were determined from interviews conducted with anglers leaving the four main fishing areas in the lower section of the Pinware River: 1) Tidal Pool; 2) Bridge; 3) Forks Pool; and 4) Chute Pool (Fig. 3). For the purpose of the survey, the fishing day at each location was divided into four time periods of four hours duration: Period A = 0600-1000; Period B = 1000-1400; Period C = 1400-1800; and Period D = 1800-2200 hours. The four periods at each location were monitored on a daily basis by a total of eighteen survey clerks. Each clerk monitored two consecutive time periods per day. Each clerk monitored a different location every day and the two time periods monitored by each clerk changed every four days. The total catch and effort were determined by summing the results from the four sites. The total catch and effort were adjusted for anglers interviewed more than once and for periods not covered in the survey due to occasional absence or illness of some clerks. The number of anglers and catch left on the river after Period D were also recorded and added into the totals for that period.

Recreational catches and effort for 1996 were determined from observations of angling activity recorded by four river monitors employed by the local development association and the records of the three fishing lodges on the river. The catch for days that were not monitored was estimated based on the proportion of available angling days that were worked by the river monitors. Angling activity on the Pinware River is mainly in the lower section of the river. This section of the river is accessed via the main road making it relatively easy to patrol. It was assumed that catches were recorded only once, either by the lodges or the river monitors and that all locations were patrolled.

The recreational catch and effort statistics collected in 1996-97 were not directly comparable to data collected in the past by DFO but assuming that catch and effort were sampled at random each year, the catch-per-unit effort should be comparable across years.

### Returns and Spawning Escapements

A tagging trap similar to the design used on the Humber River (Mullins et al., MS 1997) was operated in the upper estuary of the Pinware River in 1997 (Fig. 3). The trap was checked daily at high tide and all uninjured salmon were tagged with Carlin tags and released. Tags were placed just below the anterior portion of the dorsal fin, using a double stainless steel wire attachment.

A recapture trap was operated approximately 10 km upstream from the estuary and upstream from all angling. The surface water temperature (C) was recorded at each trap.

Returns of small salmon (N) were estimated based on: 1) tag recaptures in the recreational fishery; 2) recaptures in the recapture trap; and 3) combined recaptures in the recreational fishery and in the recapture trap according to:

1) Petersen single-census method (Ricker, 1975):

$$N = M \times C / R$$

Where:

M = number of marked fish in the population

C = total catch of small salmon

R = number of marked fish recaptured

2) Schnabel's multiple census method (Ricker, 1975):

$$N = \sum(M_t C_t) / R$$

Where:

$M_t$  = total number tagged fish at large at the start of the  $t$  th recapture.

$C_t$  = total catch at  $t$  th recapture.

$R = \sum R_t$ , total tags recaptured

The voluntary tag reporting rate of tags recaptured in the recreational fishery was estimated based on the proportion of tags observed by the angler survey clerks that were actually returned by anglers. The proportion of tags lost due to tag shedding was assumed to be equivalent to that determined for the Margaree River (medians days at large \* 0.009) (Chaput et al., MS 1993).

Returns of large salmon were estimated from small salmon based on the relative proportions of small and large salmon captured in the tagging trap.

Spawning escapements of small and large salmon were determined by subtracting angling removals from the total returns. Angling removals included retained catches and an assumed mortality rate of 10% for released salmon.

A measure of the uncertainty around the population estimate of small salmon was derived based on the probability distribution of various population sizes given the mark-recapture results observed. It was assumed that the probability of observing tagged and untagged fish in the population followed a binomial distribution. A measure of the uncertainty around the calculation of egg deposition was derived based on the probability distribution of a lower egg depositions given the uncertainty around the population estimates and around the estimate of the proportion of small and large salmon in the population. It was also assumed that the proportion of small and large salmon in the population followed a binomial distribution.

### **Biological Characteristics**

Biological characteristics, smolt ages and sea ages of small and large salmon on the Pinware River in 1974-97 are given in Appendices 1-3. For small salmon, the mean whole weight of females and percent female used to estimate the potential egg deposition in 1997 were obtained from salmon landed in the recreational fishery in 1992-97. For large salmon, the 1992-96 mean was used as no large salmon were retained in 1997. Sex was not recorded as internal or external for samples collected in 1990. Therefore, female characteristics from 1979-91 may include salmon sexed both internally and externally.

Female characteristics from 1992-96 were from salmon sexed internally only. The relative fecundity used for salmon on Pinware River was 1,783 eggs/kg derived for salmon on Western Arm Brook, SFA 14A (Chadwick et al., MS 1986). This fecundity value represents a maximum value because of the potential for egg loss due to atresia (O'Connell et al., MS 1991). There may be differences in fecundity between Western Arm Brook and Pinware salmon. This is likely to be the case for large salmon because the Pinware stock has two-sea-winter salmon while the Western Arm Brook stock does not (Randall, 1989).

### **Estimation of Conservation Requirements**

The conservation egg deposition requirement for salmon on the Pinware River was estimated based on an optimum egg deposition rate of 2.4 eggs/m<sup>2</sup> (Elson, 1975) for fluvial parr rearing habitat and 105 eggs/ha of lacustrine area (O'Connell et al., MS 1991). The amount of accessible fluvial parr rearing area was based on aerial surveys (Anderson, 1985) and the lacustrine parr rearing area was measured from 1:50,000 scale topographic maps using an appropriate dot grid as a result these are considered to be minimum values. Lacustrine habitat includes all lakes greater than 5 ha in surface area. The conservation egg deposition requirement was expressed in terms of number of spawners required based on biological characteristics observed in 1992-97.

## **RESULTS**

### **Fisheries**

The SFA 14B commercial fishery was closed in 1997 and the recreational fishery for large salmon was restricted to catch and release angling only. The recreational fishery opened on 21 June and closed 14 September. An in-season review indicated overall low returns in 1997. Therefore, the recreational fishery on Pinware River was restricted to catch and release after 14 August on the Forteau River and L'Anse au Loup Brook and was closed completely.

The angler survey on Pinware River began on 27 June and ended on 3 September. The catch was minimal in the six days prior to the start of the survey. A total of 2,319 anglers were interviewed at the four fishing locations (Table 1). After adjustment for anglers interviewed more than once and anglers and catch left on the river after the last survey period of the day, the total angling effort was 2,194 rod days and 6,322 hours fishing. Angling effort peaked in mid-July and was almost negligible during the catch and release fishery (Fig. 4a). The catch of small salmon observed was 279 retained and 117 released. The catch of large salmon was 119 released. Catches of small salmon peaked in mid-July while catches of large salmon peaked in early July (Figs. 4c-d). Anglers caught 0.23 fish per rod day and fished an average of 12.3 hours per fish in 1997 (Table 1). The catch per rod day was the third lowest on record (Fig. 2). A summary of historical catch and effort information on the Pinware River is given in Appendix 1 and a summary of the information collected for 1996 is given in Appendix 2.

A total of 95.7% of the retention fishery and 94% of the total fishery were monitored in 1997 (Table 2). Some scheduled survey days and periods were not surveyed due to either clerk illness or clerks finding other employment. However, these occasions were 6% or less of the total periods available to be surveyed. After adjustment for the survey coverage, the creel survey results were 2,334 rod days, 292 small salmon retained, 124 small salmon released, and 127 large salmon released.

Several local anglers reported that angling catches on the Pinware River in 1997 were very poor in comparison to recent years, especially for large salmon.

### Returns and Spawning Escapements

A total of 83 small and 17 large salmon were captured in the tagging trap from 1 July and 22 September (Table 3). Of these, 6% of small salmon and 18% of large salmon captured were grilse repeat spawners. A total of 68 small and 13 large were tagged and released (Table 4). Catches started from the first day of operation so it is possible that part of the run was not sampled and it appeared that few new fish entered the system after the end of July (Fig. 5a). Except for the first day of tagging, salmon were not tagged at surface water temperatures above 18 C (Fig. 5b). A total of 73 small and 15 large salmon were captured in the recapture trap between 7 August and 23 September (Table 3; Fig. 6a). All catches in the recapture trap were at water temperatures less than 18 C (Fig. 6b). Salmon were not tagged in the recapture trap as no angling occurred above this trap in 1997.

The proportion of large salmon (0.1702; 32/188) observed at the tagging and recapture traps in 1997 (Table 3) was 40% higher than observed in the tagging recapture traps in 1996 (0.1214; 17/140). This may have been due to the closure of the commercial salmon fishery in SFA 14B.

Anglers voluntarily returned seven tags from retained small salmon and one from released small salmon but no tags were returned from released large salmon (Table 5). Four small and one large salmon were recaptured in the recapture trap (Table 5).

The first angling recaptures of tagged small salmon were on 20 July (Table 6). Angled and retained small salmon were at large for 9-16 days (median=13 days) before recapture. The four small salmon and one large salmon recaptured in the recapture trap were at large for 21-28 days (median=26 days). The tags returned voluntarily from retained small salmon included four of six tags that were observed by the survey clerks for a reporting rate of 0.6667. The survey clerks did not observe all the tags returned by anglers. This was because their primary task was collection of catch and effort information and the collection of biological information and examination of fish for tags were secondary. This applied, particularly on occasions when the number of anglers made it impossible to actually speak with each one individually. In these cases, the clerks would note the starting time for each angler and record their retained and released catches without actually interviewing each individual angler. Nevertheless, most clerks tried to accomplish all tasks. However, there was some resistance on the part of some anglers to being questioned by the survey clerks. Therefore, some clerks were reluctant to approach anglers directly. In addition, anglers sometimes continued fishing after the last survey period of the day. These catches were minimal but would not have been recorded by the survey clerks. Hence, the number of tagged salmon observed by the clerks did not represent the total number recaptured.

After adjustment for reporting rate, 10 tags were estimated as recaptured by anglers. This number appears reasonable given that a total of nine tags were actually observed by the survey clerks and/or returned by anglers.

Of the 68 small salmon tagged in total, there were 62 tagged before the end of the retention fishery on 14 August and 66 tagged in time to be available to the recapture trap based on the date of tagging. After adjustment for tag loss based on 13 and 26 days at large before recapture in angling and in the recapture trap, respectively (Table 6), 55 tagged small salmon were available to the retention fishery and 51 were available to the recapture trap.

No angling recaptures were recorded during the peak of the retention fishery (Fig. 7). Retained catches of small salmon occurred in what appeared to be two main pulses with tag recaptures occurring only in the second pulse which started at approximately 18 July. This indicates that tagged fish may not have had sufficient time to distribute randomly in the population in order to be available to the fishery at the same time as untagged fish. The angling catch from 18 July to 14 August was 108 small salmon retained.

Of the three methods used to derive the population estimate, the method which yielded the tightest 95% confidence interval was the one based on the combined recaptures from angling and the recapture trap (Tables 7a-c). This was probably due to the larger sample size that resulted when recaptures were combined. The population estimate based on the combined data was 874 (95% CI=411-1,255) small and 179 (95% CI=84-257) large salmon. This population size would mean that the retention fishery in 1997 harvested approximately 33% (95% CI=23-71%) of the total population of small salmon (Table 7c).

The conservation egg deposition requirement for the Pinware River, based on preliminary measurements of the accessible parr rearing habitat, is 11,847,390 eggs (Table 8). Based on biological characteristics of female salmon observed in 1992-97, spawners in 1997 would have achieved only 16% (95% CI=5-24%) of this requirement (Table 8). Estimates of returns and spawning escapements in previous years based on the 1998 angling exploitation rate indicate that the status of the stock in 1998 may be the lowest on record (Table 9).

The probability distribution of population sizes that would yield the mark-recapture results observed in 1997 is shown in Fig. 8. Given the number of small salmon tagged, the number angled and retained and the number recaptured in 1997, the population size with the highest probability of occurrence was very similar to that of Schnabel's multiple census technique. Given the probability of occurrence of the various population sizes and assuming that the proportion of small and large salmon in the population followed a binomial distribution, there was only an approximate 25% probability that the potential egg deposition in 1998 was less than the estimate of 1.8 million. In other words, there was a better than 75% chance that egg depositions were higher but given a 95% confidence interval of 1.0 – 3.1 million eggs, it is highly unlikely that the conservation requirement was achieved in 1997 (Fig. 9).

### **Conservation Spawner Requirement**

Expressed in terms of number of spawners, the conservation requirement is approximately 4,654 small and 817 large salmon (Table 10). These values are based on the biological characteristics and relative percentage of small and large salmon observed in 1992-97. As such, the percentage of large salmon represents a minimum value because of the lower abundance of large salmon in recent years. A small change in the contribution of eggs from large salmon would result in a larger change in the contribution from small salmon.

### **Forteau River**

Counts of small and large salmon at the counting fence on Forteau River indicated that this stock was also at an extremely low level as well in 1997. However, based on the daily counts and run-timing in previous years it is possible that salmon could have entered the river before the counting fence was installed. In addition, the local river guardian reported that 55 small salmon were retained and 9 were



released above the counting fence in 1997 indicating that some fish were not counted at the counting fence.

Hence, the total returns to the river in 1997 were estimated based on the angling catch. The catch based on license stub return information was 136 small salmon retained and released (97 retained and 39 released) and 12 large released in 1997. Based on an angling exploitation rate of 0.6095 for retained and released small salmon observed in 1995 when the counting fence was in the same location as in 1997 (Lowe and Mullins, MS 1996), the total return of small salmon in 1997 was 223 fish. Based on the proportion of small (0.80) observed in 1994-95, the return of large salmon in 1997 was 55 fish. Spawning escapements would have been 122 small and 55 large salmon after adjustment for angling removals. Given that the conservation requirement on the Forteau River is 361 small and 140 large this stock was at an extremely low level in 1997.

| Year | Fence Count |       | Returns    |           |            | Prop. Small | Small Ret. & Rel. | Angling ER for Small |
|------|-------------|-------|------------|-----------|------------|-------------|-------------------|----------------------|
|      | Small       | Large | Small      | Large     | Total      |             |                   |                      |
| 1994 | 228         | 74    | 458        | 77        | 535        | 0.8561      | 327               |                      |
| 1995 | 315         | 136   | 461        | 147       | 608        | 0.7582      | 281               | 0.6095               |
| 1996 | 74 (p)      |       |            |           |            |             |                   |                      |
| 1997 | 50 (p)      | 21    | <b>223</b> | <b>56</b> | <b>289</b> |             | <b>136</b>        |                      |

Note: Conservation Requirement: 361 small and 140 large.

## DISCUSSION

In spite of the commercial fishery closure in 1997 and the restrictions on retention of large salmon, the estimated spawning escapements of small and large salmon on the Pinware River and Forteau River were probably at or near their lowest level ever. Even if there had been no retention or catch and release fisheries on the river in 1997, the conservation requirement would not have been achieved.

The proportion of large salmon observed in 1997 was 40% higher than observed in the tagging and recapture traps operated in 1996, possibly due to the commercial fishery closure.

The prospects for 1998 are not good given that the stock has been experiencing a declining trend that would have resulted in low spawning escapements. However, provided marine survival does not decline and if the current restrictions on recreational harvests are not relaxed, the contribution of large salmon, which are predominantly female, to the total egg deposition should greatly help the stock to improve in the long term.

The mark-recapture method used to estimate the population size of small salmon on the Pinware River in 1997 has a wide confidence interval. This is because of the small number of tags applied and the low number of recaptures. However, nine of an estimated ten tags recaptured by angling were either observed by the survey clerks or returned by anglers suggesting that the estimate of the number of tag recaptures by angling was correct. If the angling catch were underestimated in 1997 this would also have introduced some uncertainty in the population estimate. However, given that the number of tags available in the population was fixed, a doubling of total angling catch of small salmon (584) would have given a population estimate that would have resulted in only 32% of the conservation requirement being achieved. In fact, given the number of tags available and the number of recaptures observed, the angling catch would have needed to be 2,055 small salmon retained in order to give a population estimate that would

have resulted in 100% of the conservation requirement being achieved. In which case the population estimate would have been approximately 5,733 small and 1,176 large salmon. This population size was highly unlikely given the mark-recapture results observed.

If instead, the angling catch had been estimated correctly but the angling tag recaptures were in fact higher than estimated, the population estimate and the percentage of the conservation requirement achieved would have been even lower.

The estimate of the number of large salmon in the population was based on the relative proportions of small and large salmon observed in the tagging and recapture traps in 1997. This method of calculating large salmon introduces some added uncertainty in the estimate of potential egg deposition. This is of particular importance because large salmon on the Pinware River are predominantly female. Hence, the calculation of the potential egg deposition is very sensitive to small changes in the number of large salmon spawners. The proportion of large salmon in 1997 was higher than observed on the Pinware River in 1996 and higher than observed on the Forteau River in 1994-95, probably because of selectivity in the commercial fishery in those years. If this proportion were in fact higher than observed, then the estimate of the potential egg deposition in 1997 would also be higher. However, given that the 95% confidence interval of probable egg depositions for 1997 was 1.0 – 3.1 million eggs, it is highly unlikely that the conservation requirement of 11.8 million eggs would have been achieved.

The method used to calculate the conservation egg deposition requirement and spawner requirements for the Pinware River has a number of limitations that are difficult to quantify. The amount of juvenile rearing habitat available in the Pinware River is based on helicopter surveys and, as for the Forteau River, may be under-estimated. Habitat availability is affected by water level, which changes from year to year. Salmon parr were found above one obstruction in 1996 that had previously been judged to be inaccessible to Atlantic salmon based on helicopter surveys. Habitat preference by juvenile salmon, the atresia of eggs in the ovary, the degree of dispersion of juveniles from the spawning grounds and the possible interaction of anadromous and landlocked forms are also potential limitations to full utilization and seeding of the available habitat. These limitations are discussed in detail in O'Connell et al. (MS 1991). However, the method used is accepted as a reasonable standard for the evaluation of stock status.

In addition to the low stock size on the Forteau River, of particular concern is the angling by-catch of salmon parr and smolts in the estuary. The trout season opened on 17 May 1997 but when the salmon season opened on 21 June trout anglers moved into the scheduled portion of the river to fly-fish for trout. This caused a great deal of concern among local conservationists and fisheries officers because the by-catch mortality of parr and kelts was high. Because of the low returns to the Forteau River in recent years, all angling mortality should be kept to a minimum. In 1998, even if the rest of the river is open for catch and release angling on salmon, the estuary should remain closed until at least 7 July in order to allow sufficient time for smolts to move out of the estuary and eliminate the problem of by-catch.

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Table 1. Results of angler survey on Pinware River in 1997.

| Location   | Angling Effort    |                          |                  |                             |              |                 | Catch* |      |       |       | Hours<br>per<br>Fish | Catch<br>per<br>Rod |
|------------|-------------------|--------------------------|------------------|-----------------------------|--------------|-----------------|--------|------|-------|-------|----------------------|---------------------|
|            | No.<br>Interviews | No.<br>Interviewed<br>>1 | Total<br>Anglers | Anglers<br>left<br>on river | Rod<br>Days* | Hours<br>Fished | Small  |      | Large |       |                      |                     |
|            |                   |                          |                  |                             |              |                 | Ret.   | Rel. | Rel.  | Total |                      |                     |
| Tidal Pool | 451               | 50                       | 401              | 7                           | 408          | 1170            | 56     | 31   | 10    | 97    | 12.1                 | 0.24                |
| Bridge     | 710               | 74                       | 636              | 34                          | 670          | 1542            | 81     | 15   | 22    | 118   | 13.1                 | 0.18                |
| Forks Pool | 521               | 61                       | 460              | 38                          | 498          | 1790            | 97     | 37   | 48    | 182   | 9.8                  | 0.37                |
| Chute Pool | 637               | 58                       | 579              | 39                          | 618          | 1820            | 45     | 34   | 39    | 118   | 15.4                 | 0.19                |
| Total      | 2319              | 243                      | 2076             | 118                         | 2194         | 6322            | 279    | 117  | 119   | 515   | 12.3                 | 0.23                |

\* Includes numbers left on the river after the last survey period of the day.

Table 2. Number and percentage of scheduled angler survey periods that were actually surveyed in 1997.

| Month             | PERIOD |     |     |     | Total | Periods Available | % Coverage |
|-------------------|--------|-----|-----|-----|-------|-------------------|------------|
|                   | A      | B   | C   | D   |       |                   |            |
| Retention Fishery |        |     |     |     |       |                   |            |
| June              | 16     | 16  | 15  | 15  | 62    | 64                | 96.9       |
| July              | 119    | 119 | 119 | 119 | 476   | 496               | 96.0       |
| August            | 52     | 52  | 54  | 54  | 212   | 224               | 94.6       |
| September         | .      | .   | .   | .   | .     | .                 | .          |
| Total             | 187    | 187 | 188 | 188 | 750   | 784               | 95.7       |
| Release Fishery   |        |     |     |     |       |                   |            |
| June              | .      | .   | .   | .   | .     | .                 | .          |
| July              | .      | .   | .   | .   | .     | .                 | .          |
| August            | 65     | 65  | 63  | 63  | 256   | 272               | 94.1       |
| September         | 10     | 10  | 6   | 6   | 32    | 48                | 66.7       |
| Total             | 75     | 75  | 69  | 69  | 288   | 320               | 90.0       |
| TOTAL             | 262    | 262 | 257 | 257 | 1038  | 1104              | 94.0       |

Table 3. Condition of small and large salmon captured.

Note: Tagging date (TAGDATE) is month x 100 + day (701=1 July).

| TAGDATE | Large   |           |        |       | Small     |        |       | Total |
|---------|---------|-----------|--------|-------|-----------|--------|-------|-------|
|         | Injured | Mortality | Tagged | Total | Mortality | Tagged | Total |       |
|         | N       | N         | N      | N     | N         | N      | N     |       |
| 701     | .       | .         | 1      | 1     | 1         | 3      | 4     | 5     |
| 702     | .       | .         | 1      | 1     | 2         | 2      | 4     | 5     |
| 703     | 1       | .         | .      | 1     | 7         | 2      | 9     | 10    |
| 704     | 1       | 1         | 2      | 4     | 5         | 7      | 12    | 16    |
| 706     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 707     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 708     | .       | .         | .      | .     | .         | 3      | 3     | 3     |
| 709     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 711     | .       | .         | .      | .     | .         | 4      | 4     | 4     |
| 712     | .       | .         | .      | .     | .         | 2      | 2     | 2     |
| 713     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 714     | .       | .         | .      | .     | .         | 7      | 7     | 7     |
| 715     | .       | .         | 1      | 1     | .         | 8      | 8     | 9     |
| 718     | .       | .         | 1      | 1     | .         | 2      | 2     | 3     |
| 720     | .       | .         | .      | .     | .         | 2      | 2     | 2     |
| 722     | .       | .         | 1      | 1     | .         | .      | .     | 1     |
| 725     | .       | .         | .      | .     | .         | 2      | 2     | 2     |
| 726     | .       | .         | 2      | 2     | .         | 4      | 4     | 6     |
| 727     | .       | .         | .      | .     | .         | 5      | 5     | 5     |
| 730     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 801     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 806     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 809     | .       | .         | .      | .     | .         | 2      | 2     | 2     |
| 814     | 1       | .         | .      | 1     | .         | 1      | 1     | 2     |
| 816     | .       | .         | 1      | 1     | .         | .      | .     | 1     |
| 819     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 823     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 826     | .       | .         | 1      | 1     | .         | .      | .     | 1     |
| 903     | .       | .         | .      | .     | .         | 1      | 1     | 1     |
| 917     | .       | .         | .      | .     | .         | 2      | 2     | 2     |
| 922     | .       | .         | 2      | 2     | .         | .      | .     | 2     |
| Total   | 3       | 1         | 13     | 17    | 15        | 68     | 83    | 100   |

Table 4. Age composition of salmon captured in the tagging and recapture traps.  
 Note1: MSW='multi-sea-winter'; 1SW='one-sea-winter'; CS='consecutive spawner'.  
 Note2: Tagging date (TAGDATE) is month x 100 + day (701=1 July).

| TAGDATE | Location     |     |    |       |    |       |                |     |    |       |
|---------|--------------|-----|----|-------|----|-------|----------------|-----|----|-------|
|         | Tagging Trap |     |    |       |    |       | Recapture Trap |     |    |       |
|         | Large        |     |    | Small |    |       | Small          |     |    |       |
|         | MSW          | 1SW | CS | MSW   | CS | Total | 1SW            | 1SW | CS | Total |
|         | N            | N   | N  | N     | N  | N     | N              | N   | N  | N     |
| 701     | 1            | .   | .  | .     | 1  | 4     | .              | 4   | .  | .     |
| 702     | 1            | .   | .  | .     | 1  | 4     | .              | 4   | .  | .     |
| 703     | 1            | .   | .  | .     | 1  | 9     | .              | 9   | .  | .     |
| 704     | 3            | 1   | .  | .     | 4  | 12    | .              | 12  | .  | .     |
| 706     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 707     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 708     | .            | .   | .  | .     | .  | 3     | .              | 3   | .  | .     |
| 709     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 711     | .            | .   | .  | .     | .  | 4     | .              | 4   | .  | .     |
| 712     | .            | .   | .  | .     | .  | 2     | .              | 2   | .  | .     |
| 713     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 714     | .            | .   | .  | .     | .  | 7     | .              | 7   | .  | .     |
| 715     | 1            | .   | .  | .     | 1  | 8     | .              | 8   | .  | .     |
| 718     | 1            | .   | .  | .     | 1  | 2     | .              | 2   | .  | .     |
| 720     | .            | .   | .  | .     | .  | 2     | .              | 2   | .  | .     |
| 722     | .            | .   | 1  | .     | 1  | .     | .              | .   | .  | .     |
| 725     | .            | .   | .  | .     | .  | 2     | .              | 2   | .  | .     |
| 726     | 1            | 1   | .  | .     | 2  | 3     | 1              | 4   | .  | .     |
| 727     | .            | .   | .  | .     | .  | 2     | 3              | 5   | .  | .     |
| 730     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 801     | .            | .   | .  | .     | .  | .     | 1              | 1   | .  | .     |
| 806     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 809     | .            | .   | .  | .     | .  | 2     | .              | 2   | .  | .     |
| 810     | .            | .   | .  | .     | .  | .     | .              | 10  | 10 | .     |
| 811     | .            | .   | .  | .     | .  | .     | .              | 19  | 19 | .     |
| 814     | 1            | .   | .  | .     | 1  | 1     | .              | 1   | .  | .     |
| 816     | .            | 1   | .  | .     | 1  | .     | .              | .   | .  | .     |
| 819     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 823     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 826     | 1            | .   | .  | .     | 1  | .     | .              | .   | .  | .     |
| 903     | .            | .   | .  | .     | .  | 1     | .              | 1   | .  | .     |
| 917     | .            | .   | .  | .     | .  | 2     | .              | 2   | .  | .     |
| 922     | 2            | .   | .  | .     | 2  | .     | .              | .   | .  | .     |
| Total   | 13           | 3   | 1  | .     | 17 | 78    | 5              | 83  | 29 | 29    |



Table 5. Recaptures of tagged salmon in all gear types.

Note: Tagging date (TAGDATE) and recapture date (RECDATE) are month x 100 + day (701=1 July).

|         |         | Tag Recaptures       |                                |                |       |
|---------|---------|----------------------|--------------------------------|----------------|-------|
|         |         | Angled<br>(Retained) | Angled<br>(Released<br>w. Tag) | Recapture Trap |       |
|         |         | Small                | Small                          | Large          | Small |
|         |         | N                    | N                              | N              | N     |
| TAGDATE | RECDATE |                      |                                |                |       |
| 708     | 722     | 1                    | .                              | .              | .     |
|         | 720     | 1                    | .                              | .              | .     |
| 711     | 726     | 1                    | .                              | .              | .     |
| 712     | 726     | 1                    | .                              | .              | .     |
| 713     | 721     | 1                    | .                              | .              | .     |
| 714     | 730     | 1                    | .                              | .              | .     |
|         | 811     | .                    | .                              | .              | 1     |
| 715     | 806     | .                    | 1                              | .              | .     |
|         | 811     | .                    | .                              | .              | 1     |
| 718     | 813     | .                    | .                              | 1              | 1     |
| 720     | 810     | .                    | .                              | .              | 1     |
| 727     | 811     | 1                    | .                              | .              | .     |
| Total   |         | 7                    | 1                              | 1              | 4     |

Table 6. Recaptures of Atlantic salmon tagged on Pinware River, 1997.

| Tag No.                | Fork Length (cm) | Date Tagged | Date Recaptured | No. Days at Large | Recapture Location | Tags Observed by Creel Survey Clerks |          |
|------------------------|------------------|-------------|-----------------|-------------------|--------------------|--------------------------------------|----------|
|                        |                  |             |                 |                   |                    | Observed                             | Reported |
| <b>Angled-Retained</b> |                  |             |                 |                   |                    |                                      |          |
| 1                      | 55.0             | 8 July      | 22 July         | 14                | Forks              | *                                    | *        |
| 2                      | 53.3             | 8 July      | 20 July         | 12                | Tidal              |                                      | *        |
| 3                      | 53.0             | 11 July     | 26 July         | 15                | Tidal              | *                                    | *        |
| 4                      | 56.5             | 11 July     | 20 July         | 9                 | Forks              | *                                    |          |
| 5                      | 53.5             | 12 July     | 26 July         | 14                | Bridge             | *                                    | *        |
| 6                      | 52.0             | 13 July     | 21 July         | 8                 | Tidal              |                                      | *        |
| 7                      | 54.7             | 14 July     | 25 July         | 11                | Bridge             | *                                    |          |
| 8                      | 52.5             | 14 July     | 30 July         | 16                | Chute              | *                                    | *        |
| 9                      | 52.5             | 27 July     | 11 Aug.         | 15                |                    |                                      | *        |
| Median Days at large:  |                  |             |                 | 13                |                    |                                      |          |
| <b>Angled-Released</b> |                  |             |                 |                   |                    |                                      |          |
| 10                     | 48.7             | 15 July     | 6 Aug.          | 22                | Pinware            |                                      | *        |
| 11                     | <63.0            |             | 12 July         |                   | Tidal              | *                                    |          |
| <b>Recapture Trap</b>  |                  |             |                 |                   |                    |                                      |          |
| 1                      | 50.5             | 18 July     | 13 Aug.         | 26                | Trap-2             |                                      |          |
| 2                      | 53.5             | 20 July     | 10 Aug.         | 21                | Trap-2             |                                      |          |
| 3                      | 53.0             | 14 July     | 11 Aug.         | 28                | Trap-2             |                                      |          |
| 4                      | 60.0             | 15 July     | 11 Aug.         | 27                | Trap-2             |                                      |          |
| 5                      | 74.0             | 18 July     | 13 Aug.         | 26                | Trap-2             |                                      |          |
| Median Days at large:  |                  |             |                 | 26                |                    |                                      |          |

**Table 7a. Estimated returns and spawning escapement of Atlantic salmon on the Pinware River, 1997 based on tag recaptures by anglers.**

| ESTIMATED PARAMETERS:  | Parameter | Pop.     | 95% CI (Ricker, 1975) |        |         |
|--|-----------|----------|-----------------------|--------|---------|
|  | Values    | Est. (N) | Lower                 | Upper  | UCL-LCL |
| Tags Applied (1 July-9 Aug.)                                   | 62        |          |                       |        |         |
| Tag Retention Rate*  | 0.8830    |          |                       |        |         |
| Tags Available to Angling (M)                                  | 55        |          |                       |        |         |
| Tags Returned in Angling (Retained)                            | 7         |          |                       |        |         |
| Estimated Reporting Rate                                       | 0.6667    |          |                       |        |         |
| Tags Recaptured (R)  | 10        |          |                       |        |         |
| (8 of these were actually observed and/or returned by anglers) |           |          |                       |        |         |
| Small Retained (18 July-14 Aug.)(C)                            | 108       |          |                       |        |         |
| Total Small Retained   | 292       |          |                       |        |         |
| Total Small Released   | 124       |          |                       |        |         |
| Total Large Released   | 127       |          |                       |        |         |
| Assumed catch & release mortality rate                         | 10%       |          |                       |        |         |
| Proportion Small Salmon in Population                          | 0.8298    |          |                       |        |         |
| <b>RETURNS:</b>  |           |          |                       |        |         |
| (Petersen - single census estimate)                            |           |          |                       |        |         |
| SMALL  |           | 778      | 323                   | 1,264  | 941     |
| LARGE  |           | 160      | 66                    | 259    | 193     |
| TOTAL  |           | 938      | 389                   | 1,523  | 1,134   |
| Angling Exploitation Rate Small (Ret.)                         |           | 0.3753   | 0.2310                | 0.9045 |         |
| <b>POTENTIAL SPAWNERS:</b>                                     |           |          |                       |        |         |
| (adjusted for catch & release mortality)                       |           |          |                       |        |         |
| SMALL  |           | 474      | 18                    | 959    | 941     |
| LARGE  |           | 147      | 54                    | 247    | 193     |
| TOTAL  |           | 620      | 72                    | 1,206  | 1,134   |

\* Based on 1-(0.009 tags per day at large).

**Table 7b. Estimated returns and spawning escapement of Atlantic salmon on the Pinware River, 1997 based on tag recaptures in the recapture trap.**

| ESTIMATED PARAMETERS:                    | Parameter | Pop.     | 95% CI (Ricker, 1975) |        |         |
|--|-----------|----------|-----------------------|--------|---------|
|  | Values    | Est. (N) | Lower                 | Upper  | UCL-LCL |
| Total Tags Applied (1 July-3 Sept.)      | 66        |          |                       |        |         |
| Tag Retention Rate*                      | 0.7660    |          |                       |        |         |
| Tags Available for Recapture (M)         | 51        |          |                       |        |         |
| Tags Recaptured (R)                      | 4         |          |                       |        |         |
| Total Fish Captured (C)                  | 73        |          |                       |        |         |
| Total Small Retained                     | 292       |          |                       |        |         |
| Total Small Released                     | 124       |          |                       |        |         |
| Total Large Released                     | 127       |          |                       |        |         |
| Assumed catch & release mortality rate   | 10%       |          |                       |        |         |
| Proportion Small Salmon in Population    | 0.8298    |          |                       |        |         |
| <b>RETURNS:</b>                          |           |          |                       |        |         |
| (Petersen - single census estimate)      |           |          |                       |        |         |
| SMALL                                    |           | 931      | 365                   | 3,723  | 3,358   |
| LARGE                                    |           | 191      | 75                    | 764    | 689     |
| TOTAL                                    |           | 1,122    | 440                   | 4,487  | 4,047   |
| Angling Exploitation Rate Small (Ret.)   |           | 0.3137   | 0.0784                | 0.8000 |         |
| <b>POTENTIAL SPAWNERS:</b>               |           |          |                       |        |         |
| (adjusted for catch & release mortality) |           |          |                       |        |         |
| SMALL                                    |           | 626      | 61                    | 3,419  | 3,358   |
| LARGE                                    |           | 178      | 62                    | 751    | 689     |
| TOTAL                                    |           | 805      | 123                   | 4,170  | 4,047   |

\* Based on 1-(0.009 tags per day at large).

**Table 7c. Estimated returns and spawning escapement of Atlantic salmon on the Pinware River, 1997 based on tag recaptures by anglers and in the recapture trap.**

| ESTIMATED PARAMETERS:                    | Values  |      | Pop.<br>Est. (N) | 95% CI (Ricker, 1975) |        |         |
|--|---------|------|------------------|-----------------------|--------|---------|
|  | Angling | Trap |                  | Lower                 | Upper  | UCL-LCL |
| Total Tags in Population* (M)            | 55      | 51   |                  |                       |        |         |
| Total Catch of Small salmon (C)          | 108     | 73   |                  |                       |        |         |
| Total Tags Recaptured (R)                | 10      | 4    |                  |                       |        |         |
| Total Small Retained                     | 292     |      |                  |                       |        |         |
| Total Small Released                     | 124     |      |                  |                       |        |         |
| Total Large Released                     | 127     |      |                  |                       |        |         |
| Assumed catch & release mortality rate   | 10%     |      |                  |                       |        |         |
| Proportion Small in Population           | 0.8298  |      |                  |                       |        |         |
| <b>RETURNS:</b>                          |         |      |                  |                       |        |         |
| (Schnabel - multiple census estimate)    |         |      |                  |                       |        |         |
| SMALL                                    |         |      | 874              | 411                   | 1,255  | 844     |
| LARGE                                    |         |      | 179              | 84                    | 257    | 173     |
| TOTAL                                    |         |      | 1,054            | 496                   | 1,512  | 1,017   |
| Angling Exploitation Rate Small (Ret.)   |         |      | 0.3340           | 0.2327                | 0.7101 |         |
| <b>POTENTIAL SPAWNERS:</b>               |         |      |                  |                       |        |         |
| (adjusted for catch & release mortality) |         |      |                  |                       |        |         |
| SMALL                                    |         |      | 570              | 107                   | 951    | 844     |
| LARGE                                    |         |      | 167              | 72                    | 245    | 173     |
| TOTAL                                    |         |      | 736              | 178                   | 1,195  | 1,017   |

\* Based on 1-(0.009 tags per day at large).

**Table 8. Estimation of the percentage of the conservation egg deposition requirement achieved in the Pinware River, 1997.**

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**Conservation Egg Deposition Requirement:**

|                                   |        |                                |
|-----------------------------------|--------|--------------------------------|
| Fluvial Rearing Units (100 sq. m) | 46,691 | (this document)                |
| Lacustrine Area (ha)              | 6,110  | (this document)                |
| Minimum Egg Deposition Rate       | 240    | eggs per Rearing Unit          |
|                                   | 105    | eggs per ha of Lacustrine Area |

Conservation Requirement **11,847,390** eggs  
*(Rearing Units x 240 eggs / unit) + (Lacustrine Area x 368 eggs / ha)*

**Potential Eggs Deposited per Spawner in 1997:**

Small (< 63 cm)

|                  |                 |                        |
|------------------|-----------------|------------------------|
| Fecundity        | 1,783 eggs / kg |                        |
| % female         | 47.2 (n=248)    | (Recreational 1992-97) |
| Mean wt females  | 1.79 kg (n=96)  | (Recreational 1992-97) |
| Eggs per spawner | <b>1,506</b>    |                        |

Large (> =63cm)

|                  |                 |                        |
|------------------|-----------------|------------------------|
| Fecundity        | 1,783 eggs / kg |                        |
| % female         | 71.4 (n=42)     | (Recreational 1992-96) |
| Mean wt females  | 4.65 kg (n=24)  | (Recreational 1992-96) |
| Eggs per spawner | <b>5,920</b>    |                        |

**Percent Egg Deposition Requirement Achieved in 1997:**

*(# small X eggs per spawner) + (# large X eggs per spawner) / conservation requirement X 100*

|                | <u>Schnabel</u> | Lower     | Upper      |
|----------------|-----------------|-----------|------------|
|                | <u>Estimate</u> | <u>CL</u> | <u>CL</u>  |
| Small Spawners | 570             | 107       | 951        |
| Large Spawners | 167             | 72        | 245        |
| Total          | 736             | 178       | 1,195      |
|                | <b>16%</b>      | <b>5%</b> | <b>24%</b> |

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**Table 9. Summary of Atlantic salmon spawning escapement and percent of target requirements achieved on the Pinware River, 1974-97.**

**Conservation egg deposition requirement = 11,847,390 eggs**

| Year         | Returns* |       |       | Removals** |       | Spawners |       | % Egg Req. Achieved*** |
|--------------|----------|-------|-------|------------|-------|----------|-------|------------------------|
|              | Small    | Large | Total | Small      | Large | Small    | Large |                        |
| 1974         | 1,443    | 829   | 2,272 | 482        | 277   | 961      | 552   | 40                     |
| 1975         | 2,350    | 440   | 2,790 | 785        | 147   | 1,565    | 293   | 35                     |
| 1976         | 5,030    | 871   | 5,901 | 1,680      | 291   | 3,350    | 580   | 72                     |
| 1977         | 3,144    | 1,680 | 4,823 | 1,050      | 561   | 2,094    | 1,119 | 83                     |
| 1978         | 1,225    | 491   | 1,716 | 409        | 164   | 816      | 327   | 27                     |
| 1979         | 1,518    | 275   | 1,793 | 507        | 92    | 1,011    | 183   | 22                     |
| 1980         | 1,793    | 916   | 2,710 | 599        | 306   | 1,194    | 610   | 46                     |
| 1981         | 3,467    | 590   | 4,057 | 1,158      | 197   | 2,309    | 393   | 49                     |
| 1982         | 2,138    | 198   | 2,335 | 714        | 66    | 1,424    | 132   | 25                     |
| 1983         | 3,749    | 347   | 4,096 | 1,252      | 116   | 2,497    | 231   | 43                     |
| 1984         | 1,751    | 500   | 2,251 | 585        | 167   | 1,166    | 333   | 31                     |
| 1985         | 1,979    | 263   | 2,243 | 661        | 88    | 1,318    | 175   | 26                     |
| 1986         | 2,036    | 467   | 2,503 | 680        | 156   | 1,356    | 311   | 33                     |
| 1987         | 3,437    | 578   | 4,015 | 1,148      | 193   | 2,289    | 385   | 48                     |
| 1988         | 2,467    | 674   | 3,141 | 824        | 225   | 1,643    | 449   | 43                     |
| 1989         | 2,042    | 138   | 2,180 | 682        | 46    | 1,360    | 92    | 22                     |
| 1990         | 1,958    | 272   | 2,231 | 654        | 91    | 1,304    | 181   | 26                     |
| 1991         | 2,482    | 135   | 2,617 | 829        | 45    | 1,653    | 90    | 26                     |
| 1992         | 1,880    | 647   | 2,527 | 632        | 229   | 1,248    | 418   | 37                     |
| 1993         | 1,958    | 445   | 2,403 | 688        | 202   | 1,270    | 243   | 28                     |
| 1994         | 1,117    | 271   | 1,388 | 380        | 98    | 737      | 173   | 18                     |
| 1995         | 1,665    | 590   | 2,254 | 576        | 198   | 1,089    | 392   | 33                     |
| 1996         | 3,084    | 426   | 3,510 | 363        | 83    | 2,721    | 343   | 52                     |
| 1997         | 874      | 179   | 1,053 | 304        | 13    | 570      | 167   | 16                     |
| Mean (92-96) | 1,941    | 476   | 2,416 | 527        | 162   | 1,413    | 314   | 34                     |
| Mean (84-91) | 2,269    | 378   | 2,647 | 758        | 126   | 1,511    | 252   | 32                     |

\* Total returns for 1997 based on exploitation rate of 0.3340 and proportion small and large in tagging traps.

Total returns for 1996 based on exploitation rate of 0.1070 and proportion small and large in tagging traps. The exploitation rate for 1996 is likely an underestimation.

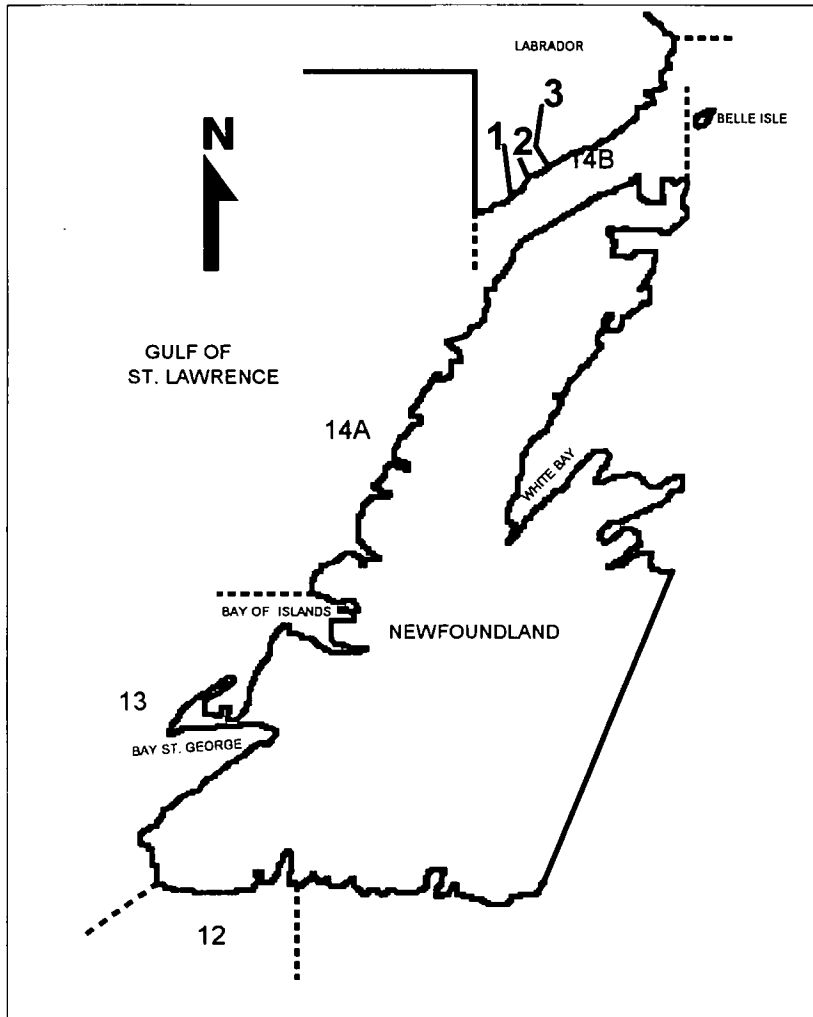
Total returns for 1974-95 based on exploitation rate of 0.3340 and proportion of small and large salmon in recreational fishery.

\*\* Angling removals include 10% mortality for released fish.

\*\*\* Percentage achieved based on biological characteristics in 1992-97.







**Legend:**

- 1. Forteau River
- 2. L'anse au Loup River
- 3. Pinware River

Figure 1. Location of scheduled Atlantic salmon rivers in Salmon Fishing Area 14B, southern Labrador.

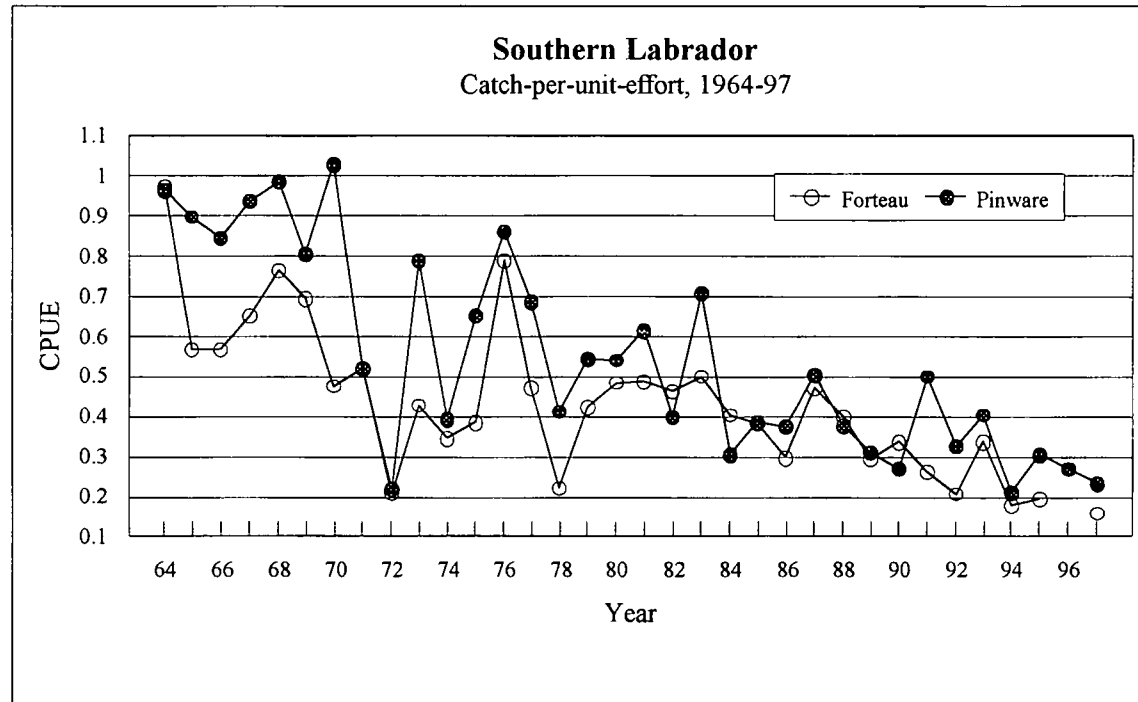


Figure 2. Catch-per-unit-effort (rod days) of Atlantic salmon on Pinware River and Forteau River, 1964-97. Values for 1996-97 were based on angler surveys.

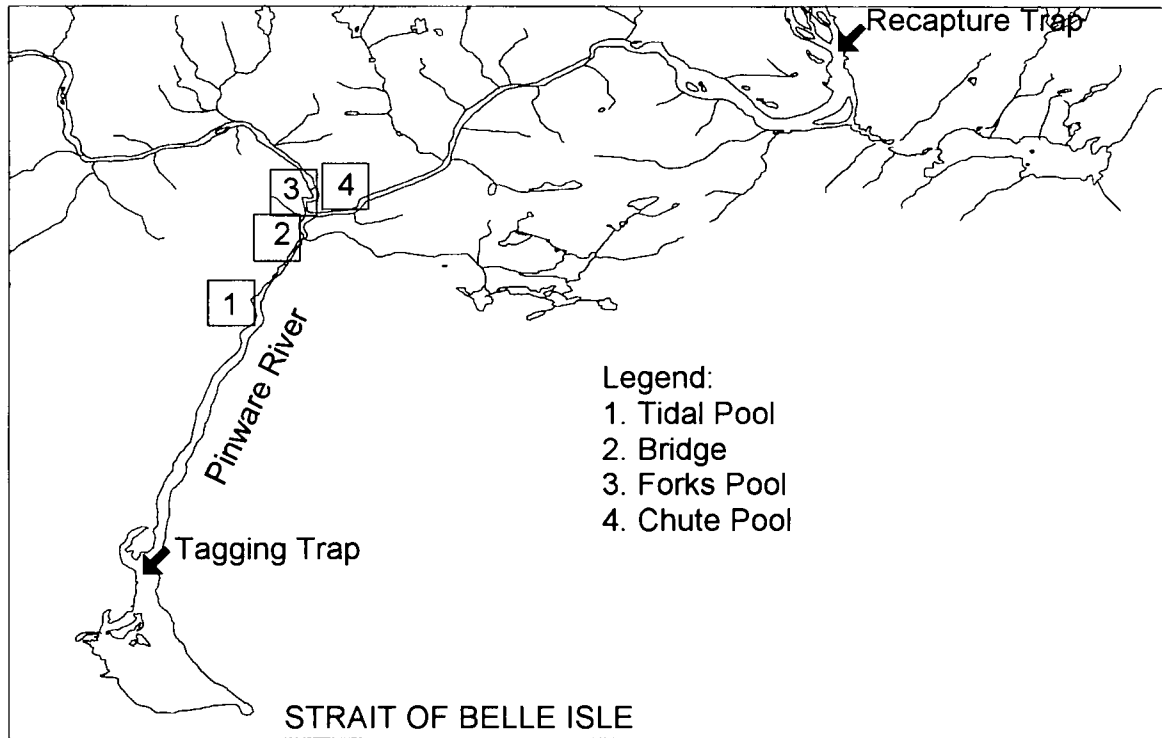


Figure 3. Location of Atlantic salmon tagging and recapture traps and angling locations on Pinware River.

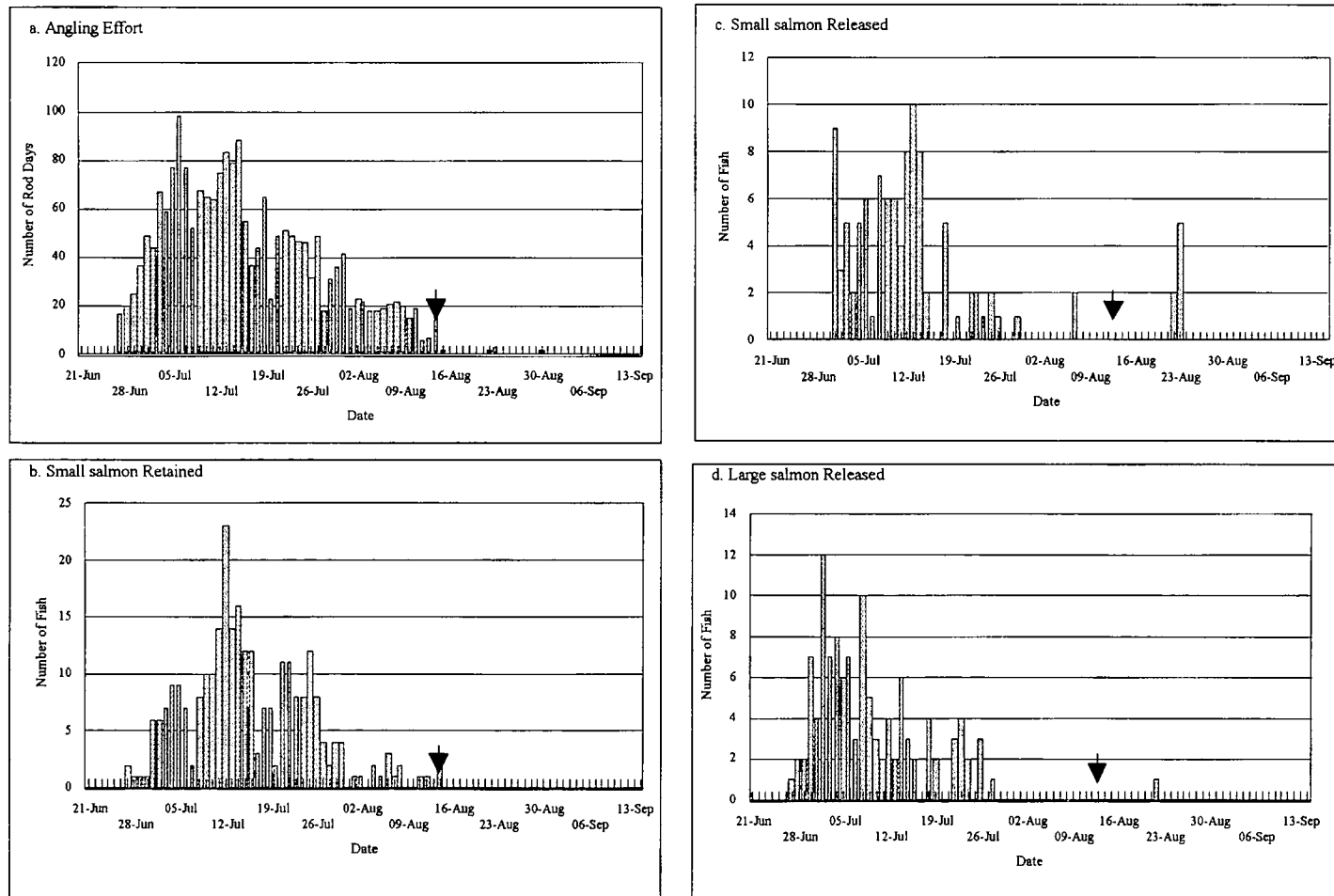


Figure 4. Recreational catches and effort on the Pinware River in 1997. Arrows indicate the start of the catch and release fishery.

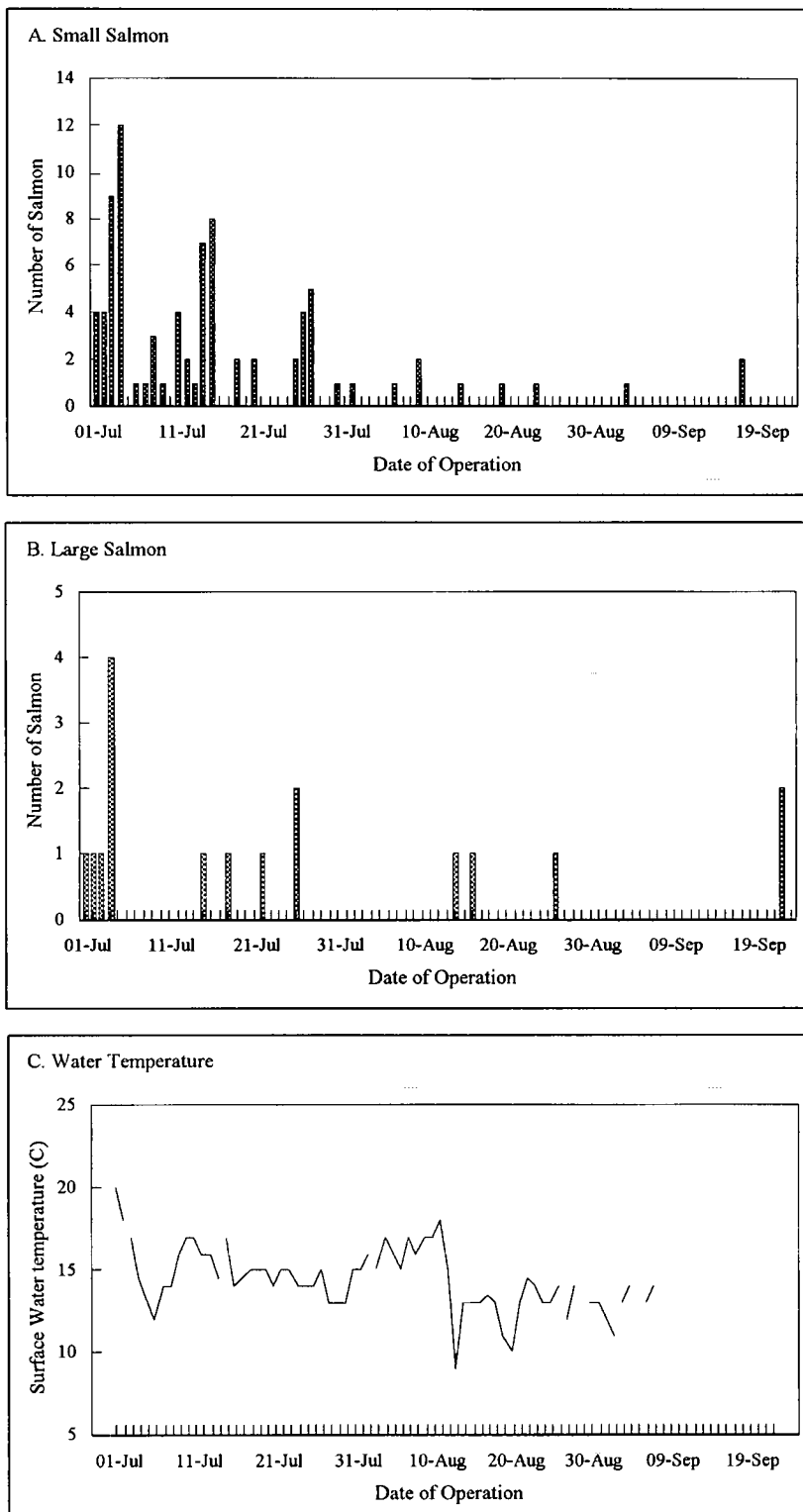


Figure 5. Catches of small and large Atlantic salmon and surface water temperatures recorded at the tagging trap on Pinware River, 1997.

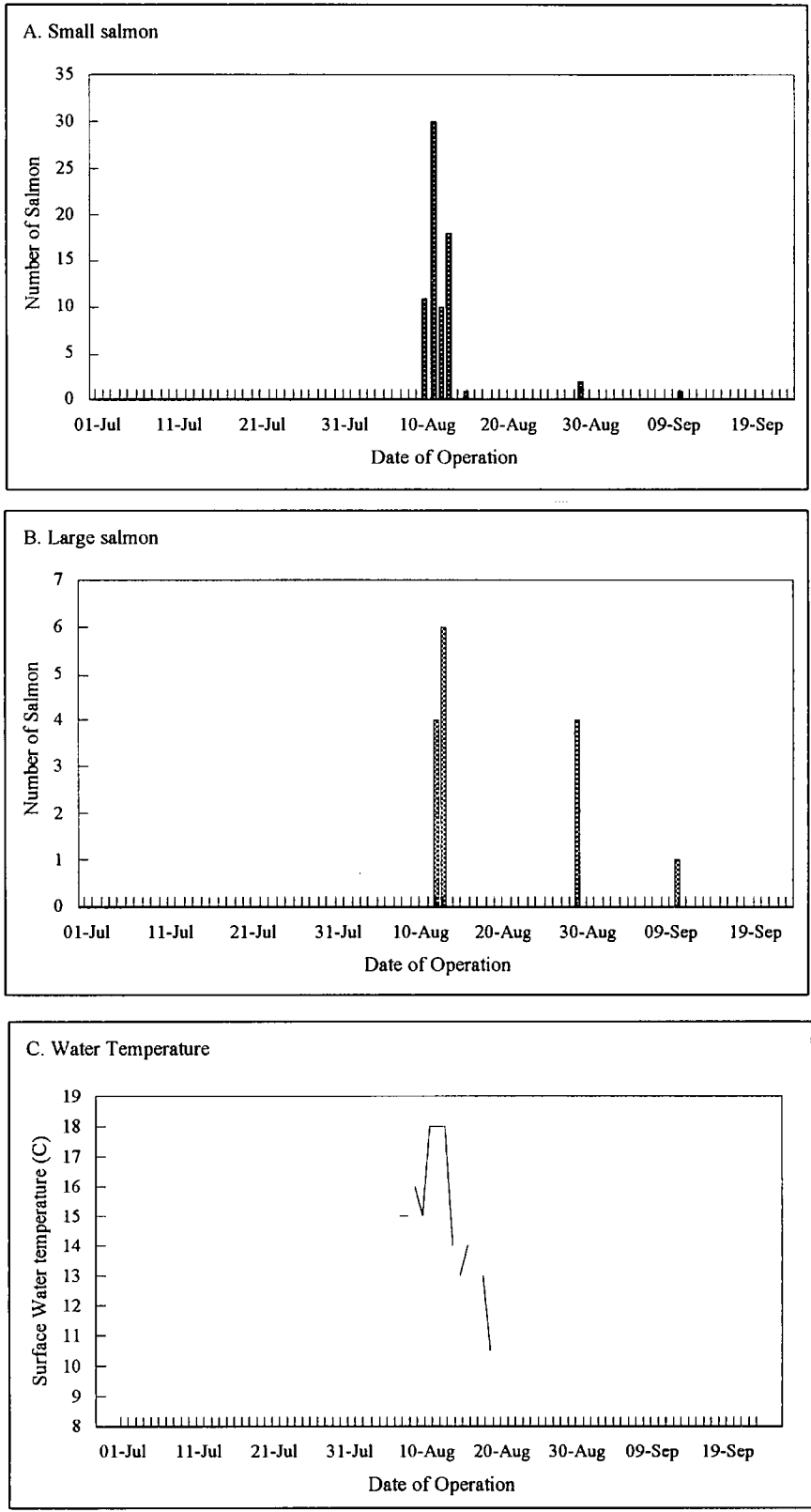


Figure 6. Catches of small and large Atlantic salmon and surface water temperatures recorded at the recapture trap on Pinware River, 1997.

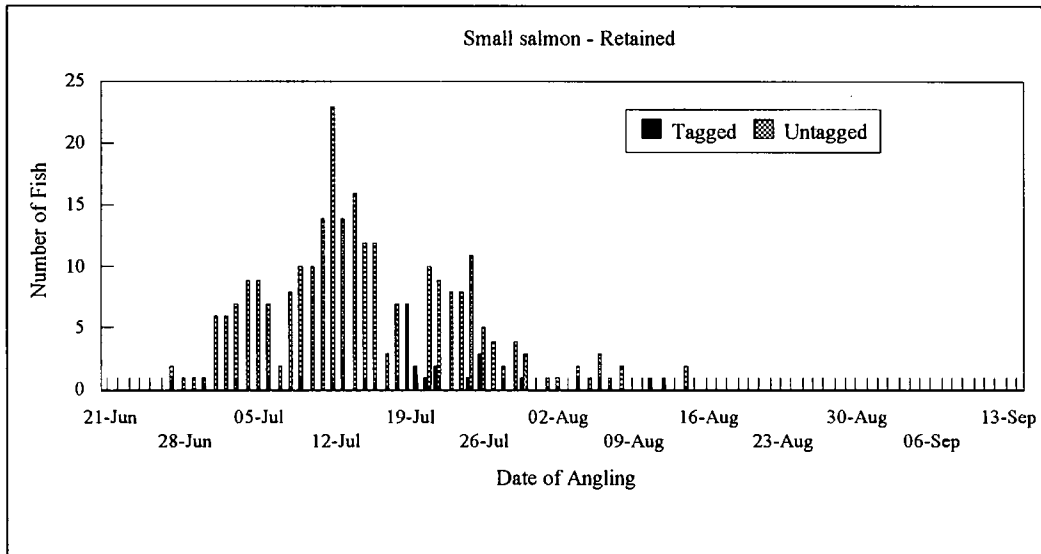


Figure 7. Recreational catches of tagged and untagged small salmon in the retention fishery on Pinware River, 1997. Arrow indicates date tagged salmon first available to angling based on dates of recapture.

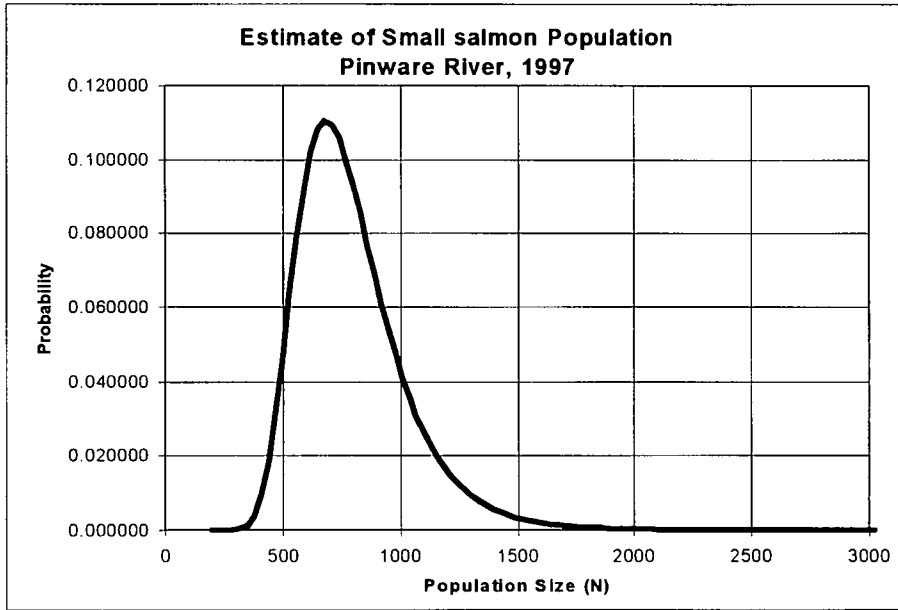


Figure 8. Probability distribution of Atlantic salmon population sizes on Pinware River, 1997.

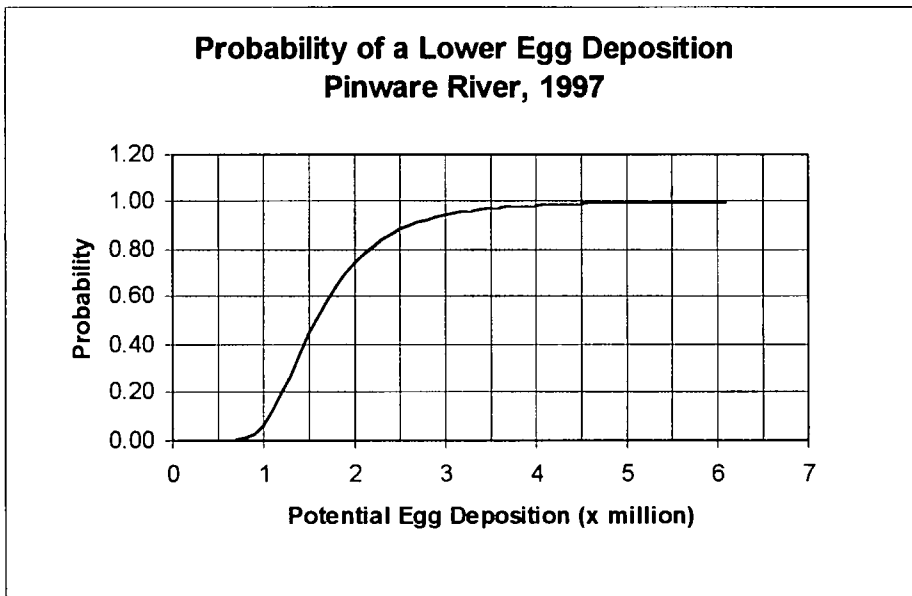


Figure 9. Cumulative probability of a lower egg deposition by Atlantic salmon on Pinware River, 1997.



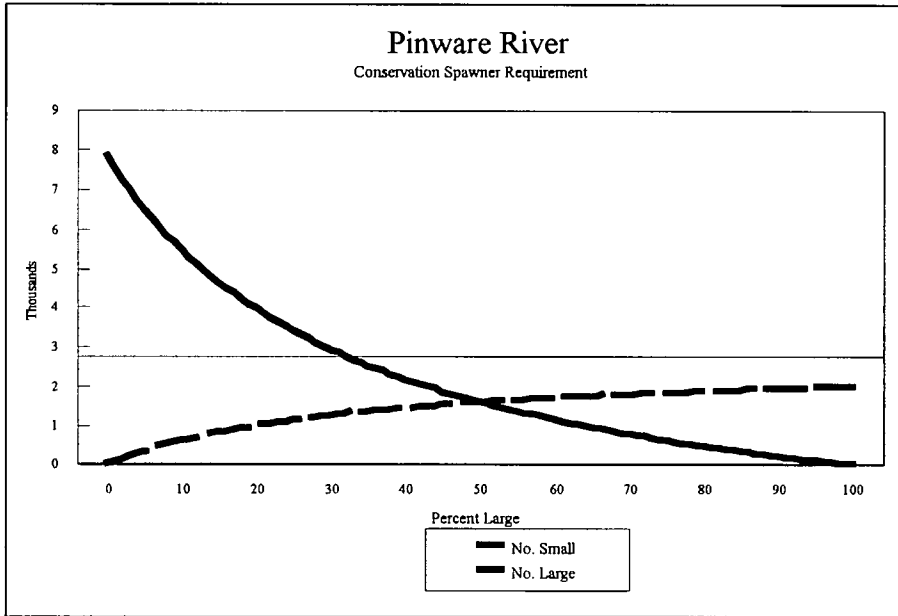


Figure 10. Conservation requirements for Pinware River in terms of small and large salmon based on the percentage of large salmon in the population.

## Appendix 1. Recreational catch and effort for Atlantic salmon on the Pinware River, 1964-97.

Note: Recreational effort, 1976-95, includes only rod days recorded from the date on which the first salmon was caught.

| Year          | Effort<br>Rod days | Small    |          |       | Large    |          |       | Total    |          |       | Prop.<br>Large | CPUE |
|---------------|--------------------|----------|----------|-------|----------|----------|-------|----------|----------|-------|----------------|------|
|               |                    | Retained | Released | Total | Retained | Released | Total | Retained | Released | Total |                |      |
| 1964          | 672                | 443      | .        | 443   | 206      | .        | 206   | 649      | .        | 649   | 0.32           | 0.97 |
| 1965          | 859                | 465      | .        | 465   | 307      | .        | 307   | 772      | .        | 772   | 0.40           | 0.90 |
| 1966          | 1274               | 871      | .        | 871   | 207      | .        | 207   | 1078     | .        | 1078  | 0.19           | 0.85 |
| 1967          | 964                | 662      | .        | 662   | 241      | .        | 241   | 903      | .        | 903   | 0.27           | 0.94 |
| 1968          | 1335               | 1077     | .        | 1077  | 238      | .        | 238   | 1315     | .        | 1315  | 0.18           | 0.99 |
| 1969          | 1154               | 740      | .        | 740   | 190      | .        | 190   | 930      | .        | 930   | 0.20           | 0.81 |
| 1970          | 1207               | 937      | .        | 937   | 308      | .        | 308   | 1245     | .        | 1245  | 0.25           | 1.03 |
| 1971          | 1556               | 585      | .        | 585   | 223      | .        | 223   | 808      | .        | 808   | 0.28           | 0.52 |
| 1972          | 1471               | 245      | .        | 245   | 75       | .        | 75    | 320      | .        | 320   | 0.23           | 0.22 |
| 1973          | 1738               | 957      | .        | 957   | 412      | .        | 412   | 1369     | .        | 1369  | 0.30           | 0.79 |
| 1974          | 1928               | 482      | .        | 482   | 277      | .        | 277   | 759      | .        | 759   | 0.36           | 0.39 |
| 1975          | 1432               | 785      | .        | 785   | 147      | .        | 147   | 932      | .        | 932   | 0.16           | 0.65 |
| 1976          | 2284               | 1680     | .        | 1680  | 291      | .        | 291   | 1971     | .        | 1971  | 0.15           | 0.86 |
| 1977          | 2338               | 1050     | .        | 1050  | 561      | .        | 561   | 1611     | .        | 1611  | 0.35           | 0.69 |
| 1978          | 1394               | 409      | .        | 409   | 164      | .        | 164   | 573      | .        | 573   | 0.29           | 0.41 |
| 1979          | 1105               | 507      | .        | 507   | 92       | .        | 92    | 599      | .        | 599   | 0.15           | 0.54 |
| 1980          | 1677               | 599      | .        | 599   | 306      | .        | 306   | 905      | .        | 905   | 0.34           | 0.54 |
| 1981          | 2194               | 1158     | .        | 1158  | 197      | .        | 197   | 1355     | .        | 1355  | 0.15           | 0.62 |
| 1982          | 1961               | 714      | .        | 714   | 66       | .        | 66    | 780      | .        | 780   | 0.08           | 0.40 |
| 1983          | 1929               | 1252     | .        | 1252  | 116      | .        | 116   | 1368     | .        | 1368  | 0.08           | 0.71 |
| 1984          | 2441               | 585      | .        | 585   | 167      | .        | 167   | 752      | .        | 752   | 0.22           | 0.31 |
| 1985          | 1932               | 661      | .        | 661   | 88       | .        | 88    | 749      | .        | 749   | 0.12           | 0.39 |
| 1986          | 2229               | 680      | .        | 680   | 156      | .        | 156   | 836      | .        | 836   | 0.19           | 0.38 |
| 1987          | 2666               | 1148     | .        | 1148  | 193      | .        | 193   | 1341     | .        | 1341  | 0.14           | 0.50 |
| 1988          | 2780               | 824      | .        | 824   | 225      | .        | 225   | 1049     | .        | 1049  | 0.21           | 0.38 |
| 1989          | 2344               | 682      | .        | 682   | 46       | .        | 46    | 728      | .        | 728   | 0.06           | 0.31 |
| 1990          | 2758               | 654      | .        | 654   | 91       | .        | 91    | 745      | .        | 745   | 0.12           | 0.27 |
| 1991          | 1753               | 829      | .        | 829   | 45       | .        | 45    | 874      | .        | 874   | 0.05           | 0.50 |
| 1992          | 2746               | 628      | 38       | 666   | 229      | 0        | 229   | 857      | 38       | 895   | 0.26           | 0.33 |
| 1993          | 3016               | 654      | 336      | 990   | 199      | 26       | 225   | 853      | 362      | 1215  | 0.19           | 0.40 |
| 1994          | 2613               | 373      | 68       | 441   | 97       | 10       | 107   | 470      | 78       | 548   | 0.20           | 0.21 |
| 1995          | 3329               | 556      | 195      | 751   | 190      | 76       | 266   | 746      | 271      | 1017  | 0.26           | 0.31 |
| 1996*         | 2782               | 330      | 327      | 657   | 82       | 14       | 96    | 412      | 341      | 753   | 0.13           | 0.27 |
| 1997**        | 2334               | 292      | 124      | 416   | .        | 127      | 127   | 292      | 251      | 543   | 0.23           | 0.23 |
| Mean(92-96)   | 2897               | 508      | 193      | 701   | 159      | 25       | 185   | 668      | 218      | 886   | 0.21           | 0.30 |
| 95% CL= $\pm$ | 350                | 184      | 173      | 246   | 81       | 37       | 96    | 264      | 187      | 315   | 0.07           | 0.09 |
| N             | 5                  | 5        | 5        | 5     | 5        | 5        | 5     | 5        | 5        | 5     | 5              | 5    |
| Mean(84-91)   | 2363               | 758      | .        | 758   | 126      | .        | 126   | 884      | .        | 884   | 0.14           | 0.38 |
| 95% CL= $\pm$ | 402                | 170      | .        | 170   | 61       | .        | 69    | 190      | .        | 205   | 0.06           | 0.08 |
| N             | 8                  | 8        | .        | 8     | 8        | .        | 8     | 8        | .        | 8     | 8              | 8    |

\* Catch and effort in 1996 collected by river monitors and fishing lodges.

\*\*Catch and effort in 1997 based on an angler survey.

Appendix 2a. Summary of recreational catch and effort recorded by river monitors and lodges on the Pinware River in 1996.

| Source of Information | # Fishers   | Small      |            |            | Large     |           |           | Unknown    |           |            | Total      |            |            |
|-----------------------|-------------|------------|------------|------------|-----------|-----------|-----------|------------|-----------|------------|------------|------------|------------|
|                       |             | Retained   | Released   | Total      | Retained  | Released  | Total     | Retained   | Released  | Total      | Retained   | Released   | Total      |
| <b>MONITORS</b>       |             |            |            |            |           |           |           |            |           |            |            |            |            |
| Observed              | 2144        | 74         | 6          | 80         | 25        | 0         | 25        | 173        | 56        | 229        | 272        | 62         | 334        |
| Estimated             | 472         | 16         | 1          | 18         | 6         | 0         | 6         | 38         | 12        | 50         | 60         | 14         | 73         |
| <b>Total</b>          | <b>2616</b> | <b>90</b>  | <b>7</b>   | <b>98</b>  | <b>31</b> | <b>0</b>  | <b>31</b> | <b>211</b> | <b>68</b> | <b>279</b> | <b>332</b> | <b>76</b>  | <b>407</b> |
| <b>LODGES</b>         | <b>166</b>  | <b>63</b>  | <b>255</b> | <b>318</b> | <b>7</b>  | <b>11</b> | <b>18</b> | <b>10</b>  | <b>0</b>  | <b>0</b>   | <b>80</b>  | <b>266</b> | <b>346</b> |
| <b>TOTAL</b>          | <b>2782</b> | <b>153</b> | <b>262</b> | <b>416</b> | <b>38</b> | <b>11</b> | <b>49</b> | <b>221</b> | <b>68</b> | <b>279</b> | <b>412</b> | <b>342</b> | <b>753</b> |

Appendix 2b. Estimate of proportion catch observed by monitors.

|                    | Start  | Finish | Total | Covered | Prop.  |
|--------------------|--------|--------|-------|---------|--------|
| <b>Days</b>        | 27-Jun | 26-Aug | 61    | 50      | 0.8197 |
| <b>Shifts</b>      | 27-Jun | 26-Aug | 122   | 87      | 0.7131 |
| <b>Total Hours</b> | 27-Jun | 26-Aug | 976   | 696     | 0.7131 |

## Appendix 3. Mean fork length, weight and sex composition of small and large Atlantic salmon on the Pinware River.

Note: Sex determined by internal and external examination.

Angled Samples

|       |         | FORK LENGTH (cm) |       |      |      |      | WHOLE WEIGHT (kg) |      |     |     |      | WHOLE WEIGHT FEMALES (kg) |      |     |     |      | NO.  | PERCENT FEMALE |       |   |
|-------|---------|------------------|-------|------|------|------|-------------------|------|-----|-----|------|---------------------------|------|-----|-----|------|------|----------------|-------|---|
|       |         | N                | MEAN  | MIN  | MAX  | STD  | N                 | MEAN | MIN | MAX | STD  | N                         | MEAN | MIN | MAX | STD  |      | SEXED          | N     | % |
|       |         |                  |       |      |      |      |                   |      |     |     |      |                           |      |     |     |      |      |                |       |   |
| LARGE | YY      |                  |       |      |      |      |                   |      |     |     |      |                           |      |     |     |      |      |                |       |   |
|       | 74      | 0                | .     | .    | .    | .    | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 67   | 54             | 80.6  |   |
|       | 80      | 32               | 74.22 | 64.0 | 94.0 | 5.36 | 34                | 4.74 | 3.5 | 8.5 | 1.00 | 24                        | 4.71 | 3.5 | 6.8 | 0.86 | 30   | 24             | 80.0  |   |
|       | 81      | 92               | 75.44 | 63.0 | 86.0 | 3.59 | 92                | 4.68 | 3.0 | 7.0 | 0.70 | 70                        | 4.68 | 3.0 | 7.0 | 0.73 | 90   | 70             | 77.8  |   |
|       | 82      | 29               | 73.49 | 68.0 | 87.5 | 3.84 | 29                | 4.35 | 3.0 | 7.9 | 0.92 | 20                        | 4.51 | 3.1 | 7.9 | 0.99 | 27   | 20             | 74.1  |   |
|       | 85      | 4                | 67.38 | 63.0 | 71.0 | 3.30 | 4                 | 3.30 | 2.9 | 3.5 | 0.27 | 4                         | 3.30 | 2.9 | 3.5 | 0.27 | 4    | 4              | 100.0 |   |
|       | 88      | 15               | 79.67 | 71.1 | 91.4 | 4.91 | 11                | 5.20 | 4.1 | 5.9 | 0.51 | 10                        | 5.13 | 4.1 | 5.7 | 0.48 | 15   | 14             | 93.3  |   |
|       | 90      | 2                | 77.20 | 72.9 | 81.5 | 6.08 | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 2    | 2              | 100.0 |   |
|       | 91      | 3                | 76.00 | 72.0 | 78.0 | 3.46 | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 2    | 2              | 100.0 |   |
|       | 92      | 2                | 76.50 | 76.0 | 77.0 | 0.71 | 2                 | 4.30 | 4.3 | 4.3 | 0.00 | 1                         | 4.30 | 4.3 | 4.3 | .    | 2    | 1              | 50.0  |   |
|       | 93      | 16               | 77.64 | 63.0 | 86.0 | 5.27 | 14                | 4.71 | 2.3 | 6.5 | 1.07 | 8                         | 4.31 | 2.3 | 5.7 | 1.07 | 16   | 10             | 62.5  |   |
|       | 94      | 8                | 78.30 | 69.9 | 86.0 | 5.52 | 6                 | 4.08 | 1.6 | 7.3 | 2.30 | 0                         | .    | .   | .   | .    | 1    | 0              | .     |   |
|       | 95      | 27               | 76.93 | 70.2 | 86.0 | 3.87 | 20                | 4.90 | 3.9 | 7.0 | 0.67 | 6                         | 4.90 | 4.3 | 5.7 | 0.58 | 13   | 10             | 76.9  |   |
|       | 96      | 13               | 76.73 | 72.0 | 80.0 | 2.90 | 13                | 4.83 | 4.0 | 7.0 | 0.75 | 9                         | 4.81 | 4.0 | 7.0 | 0.90 | 10   | 9              | 90.0  |   |
|       | 1984-91 | 24               | 76.96 | 63.0 | 91.4 | 6.30 | 15                | 4.69 | 2.9 | 5.9 | 0.98 | 14                        | 4.61 | 2.9 | 5.7 | 0.95 | 23   | 22             | 95.7  |   |
|       | 1992-96 | 66               | 77.22 | 63.0 | 86.0 | 4.19 | 55                | 4.72 | 1.6 | 7.3 | 1.05 | 24                        | 4.65 | 2.3 | 7.0 | 0.88 | 42   | 30             | 71.4  |   |
|       | PRE-84  | 153              | 74.82 | 63.0 | 94.0 | 4.12 | 155               | 4.63 | 3.0 | 8.5 | 0.82 | 114                       | 4.66 | 3.0 | 7.9 | 0.80 | 214  | 168            | 78.5  |   |
|       | Total   | 243              | 75.68 | 63.0 | 94.0 | 4.52 | 225               | 4.66 | 1.6 | 8.5 | 0.89 | 152                       | 4.65 | 2.3 | 7.9 | 0.82 | 279  | 220            | 78.9  |   |
| SMALL | YY      |                  |       |      |      |      |                   |      |     |     |      |                           |      |     |     |      |      |                |       |   |
|       | 74      | 0                | .     | .    | .    | .    | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 120  | 13             | 10.8  |   |
|       | 80      | 100              | 54.82 | 40.4 | 62.5 | 4.03 | 102               | 1.97 | 1.0 | 8.0 | 0.74 | 34                        | 1.93 | 1.4 | 4.1 | 0.54 | 70   | 34             | 48.6  |   |
|       | 81      | 389              | 52.63 | 43.0 | 61.0 | 2.57 | 389               | 1.77 | 1.0 | 3.0 | 0.32 | 133                       | 1.77 | 1.0 | 3.0 | 0.38 | 377  | 133            | 35.3  |   |
|       | 82      | 262              | 53.61 | 37.5 | 62.0 | 3.45 | 261               | 1.70 | 1.2 | 2.8 | 0.25 | 73                        | 1.65 | 1.2 | 2.5 | 0.22 | 213  | 73             | 34.3  |   |
|       | 85      | 27               | 53.89 | 50.0 | 57.5 | 2.40 | 26                | 1.66 | 1.1 | 2.3 | 0.25 | 5                         | 1.90 | 1.4 | 2.3 | 0.32 | 27   | 5              | 18.5  |   |
|       | 88      | 9                | 56.93 | 52.7 | 61.0 | 3.06 | 3                 | 1.50 | 1.4 | 1.6 | 0.10 | 1                         | 1.50 | 1.5 | 1.5 | .    | 8    | 4              | 50.0  |   |
|       | 89      | 16               | 54.83 | 45.0 | 60.0 | 3.13 | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 15   | 4              | 26.7  |   |
|       | 90      | 15               | 56.21 | 49.9 | 60.4 | 2.50 | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 15   | 9              | 60.0  |   |
|       | 91      | 4                | 54.50 | 53.0 | 58.0 | 2.38 | 0                 | .    | .   | .   | .    | 0                         | .    | .   | .   | .    | 4    | 2              | 50.0  |   |
|       | 92      | 3                | 55.33 | 54.0 | 56.0 | 1.15 | 3                 | 1.83 | 1.7 | 2.0 | 0.15 | 1                         | 1.80 | 1.8 | 1.8 | .    | 3    | 1              | 33.3  |   |
|       | 93      | 61               | 55.22 | 47.7 | 60.0 | 2.44 | 60                | 1.71 | 0.9 | 2.3 | 0.28 | 18                        | 1.69 | 1.0 | 2.2 | 0.28 | 58   | 19             | 32.8  |   |
|       | 94      | 36               | 54.88 | 48.5 | 59.0 | 2.48 | 32                | 1.79 | 1.1 | 2.4 | 0.32 | 1                         | 1.80 | 1.8 | 1.8 | .    | 1    | 1              | 100.0 |   |
|       | 95      | 124              | 54.84 | 49.0 | 61.5 | 2.89 | 85                | 1.77 | 1.3 | 2.6 | 0.29 | 18                        | 1.78 | 1.4 | 2.6 | 0.31 | 48   | 22             | 45.8  |   |
|       | 96      | 152              | 56.37 | 50.0 | 62.5 | 2.64 | 128               | 1.85 | 0.9 | 2.8 | 0.36 | 43                        | 1.83 | 1.0 | 2.5 | 0.35 | 106  | 54             | 50.9  |   |
|       | 97      | 157              | 55.61 | 41.0 | 62.8 | 2.92 | 124               | 1.81 | 1.0 | 2.7 | 0.27 | 15                        | 1.81 | 1.4 | 2.1 | 0.23 | 32   | 20             | 62.5  |   |
|       | 1984-91 | 71               | 55.01 | 45.0 | 61.0 | 2.85 | 29                | 1.64 | 1.1 | 2.3 | 0.25 | 6                         | 1.83 | 1.4 | 2.3 | 0.33 | 69   | 24             | 34.8  |   |
|       | 1992-96 | 376              | 55.53 | 47.7 | 62.5 | 2.75 | 308               | 1.79 | 0.9 | 2.8 | 0.32 | 81                        | 1.79 | 1.0 | 2.6 | 0.32 | 216  | 97             | 44.9  |   |
|       | PRE-84  | 751              | 53.26 | 37.5 | 62.5 | 3.21 | 752               | 1.77 | 1.0 | 8.0 | 0.40 | 240                       | 1.75 | 1.0 | 4.1 | 0.38 | 780  | 253            | 32.4  |   |
|       | Total   | 1355             | 54.25 | 37.5 | 62.8 | 3.23 | 1213              | 1.78 | 0.9 | 8.0 | 0.37 | 342                       | 1.77 | 1.0 | 4.1 | 0.36 | 1097 | 394            | 35.9  |   |

## Appendix 4. Smolt-age distribution of small and large Atlantic salmon on the Pinware River.

Note: Virgin spawners only.

Angled Samples

|       |         | SMOLT-AGE |       |      |     |       |      |     |       |      |    |     |      | Total |       |      |
|-------|---------|-----------|-------|------|-----|-------|------|-----|-------|------|----|-----|------|-------|-------|------|
|       |         | 3         |       |      | 4   |       |      | 5   |       |      | 6  |     |      |       |       |      |
|       |         | N         | %     | MEAN | N   | %     | MEAN | N   | %     | MEAN | N  | %   | MEAN | N     | %     | MEAN |
| LARGE | YY      |           |       |      |     |       |      |     |       |      |    |     |      |       |       |      |
|       | 74      | 4         | 6.0   | 3.0  | 34  | 50.7  | 4.0  | 25  | 37.3  | 5.0  | 4  | 6.0 | 6.0  | 67    | 100.0 | 4.4  |
|       | 80      | 7         | 22.6  | 3.0  | 19  | 61.3  | 4.0  | 5   | 16.1  | 5.0  | .  | .   | .    | 31    | 100.0 | 3.9  |
|       | 81      | 17        | 19.5  | 3.0  | 59  | 67.8  | 4.0  | 11  | 12.6  | 5.0  | .  | .   | .    | 87    | 100.0 | 3.9  |
|       | 82      | .         | .     | .    | 18  | 75.0  | 4.0  | 6   | 25.0  | 5.0  | .  | .   | .    | 24    | 100.0 | 4.3  |
|       | 85      | .         | .     | .    | 1   | 25.0  | 4.0  | 3   | 75.0  | 5.0  | .  | .   | .    | 4     | 100.0 | 4.8  |
|       | 88      | 1         | 10.0  | 3.0  | 8   | 80.0  | 4.0  | 1   | 10.0  | 5.0  | .  | .   | .    | 10    | 100.0 | 4.0  |
|       | 90      | 1         | 50.0  | 3.0  | 1   | 50.0  | 4.0  | .   | .     | .    | .  | .   | .    | 2     | 100.0 | 3.5  |
|       | 91      | .         | .     | .    | 2   | 66.7  | 4.0  | 1   | 33.3  | 5.0  | .  | .   | .    | 3     | 100.0 | 4.3  |
|       | 92      | 2         | 100.0 | 3.0  | .   | .     | .    | .   | .     | .    | .  | .   | .    | 2     | 100.0 | 3.0  |
|       | 93      | 5         | 38.5  | 3.0  | 8   | 61.5  | 4.0  | .   | .     | .    | .  | .   | .    | 13    | 100.0 | 3.6  |
|       | 94      | .         | .     | .    | 6   | 85.7  | 4.0  | 1   | 14.3  | 5.0  | .  | .   | .    | 7     | 100.0 | 4.1  |
|       | 95      | 1         | 3.7   | 3.0  | 20  | 74.1  | 4.0  | 6   | 22.2  | 5.0  | .  | .   | .    | 27    | 100.0 | 4.2  |
|       | 96      | .         | .     | .    | 9   | 69.2  | 4.0  | 4   | 30.8  | 5.0  | .  | .   | .    | 13    | 100.0 | 4.3  |
|       | 1984-91 | 2         | 10.5  | 3.0  | 12  | 63.2  | 4.0  | 5   | 26.3  | 5.0  | .  | .   | .    | 19    | 100.0 | 4.2  |
|       | 1992-96 | 8         | 12.9  | 3.0  | 43  | 69.4  | 4.0  | 11  | 17.7  | 5.0  | .  | .   | .    | 62    | 100.0 | 4.0  |
|       | PRE-84  | 28        | 13.4  | 3.0  | 130 | 62.2  | 4.0  | 47  | 22.5  | 5.0  | 4  | 1.9 | 6.0  | 209   | 100.0 | 4.1  |
|       | Total   | 38        | 13.1  | 3.0  | 185 | 63.8  | 4.0  | 63  | 21.7  | 5.0  | 4  | 1.4 | 6.0  | 290   | 100.0 | 4.1  |
| SMALL | YY      |           |       |      |     |       |      |     |       |      |    |     |      |       |       |      |
|       | 74      | 3         | 2.5   | 3.0  | 46  | 38.0  | 4.0  | 64  | 52.9  | 5.0  | 8  | 6.6 | 6.0  | 121   | 100.0 | 4.6  |
|       | 80      | 11        | 10.8  | 3.0  | 77  | 75.5  | 4.0  | 14  | 13.7  | 5.0  | .  | .   | .    | 102   | 100.0 | 4.0  |
|       | 81      | 12        | 3.1   | 3.0  | 228 | 58.8  | 4.0  | 143 | 36.9  | 5.0  | 5  | 1.3 | 6.0  | 388   | 100.0 | 4.4  |
|       | 82      | 18        | 6.9   | 3.0  | 175 | 66.8  | 4.0  | 67  | 25.6  | 5.0  | 2  | 0.8 | 6.0  | 262   | 100.0 | 4.2  |
|       | 85      | .         | .     | .    | 13  | 50.0  | 4.0  | 12  | 46.2  | 5.0  | 1  | 3.8 | 6.0  | 26    | 100.0 | 4.5  |
|       | 88      | .         | .     | .    | .   | .     | .    | 3   | 100.0 | 5.0  | .  | .   | .    | 3     | 100.0 | 5.0  |
|       | 89      | 1         | 6.3   | 3.0  | 14  | 87.5  | 4.0  | 1   | 6.3   | 5.0  | .  | .   | .    | 16    | 100.0 | 4.0  |
|       | 90      | .         | .     | .    | 10  | 71.4  | 4.0  | 4   | 28.6  | 5.0  | .  | .   | .    | 14    | 100.0 | 4.3  |
|       | 91      | .         | .     | .    | 4   | 100.0 | 4.0  | .   | .     | .    | .  | .   | .    | 4     | 100.0 | 4.0  |
|       | 92      | .         | .     | .    | 1   | 100.0 | 4.0  | .   | .     | .    | .  | .   | .    | 1     | 100.0 | 4.0  |
|       | 93      | 12        | 19.7  | 3.0  | 42  | 68.9  | 4.0  | 7   | 11.5  | 5.0  | .  | .   | .    | 61    | 100.0 | 3.9  |
|       | 94      | .         | .     | .    | 28  | 82.4  | 4.0  | 6   | 17.6  | 5.0  | .  | .   | .    | 34    | 100.0 | 4.2  |
|       | 95      | 3         | 2.3   | 3.0  | 106 | 82.8  | 4.0  | 19  | 14.8  | 5.0  | .  | .   | .    | 128   | 100.0 | 4.1  |
|       | 96      | 3         | 2.0   | 3.0  | 119 | 79.3  | 4.0  | 25  | 16.7  | 5.0  | 3  | 2.0 | 6.0  | 150   | 100.0 | 4.2  |
|       | 97      | 5         | 3.4   | 3.0  | 125 | 83.9  | 4.0  | 19  | 12.8  | 5.0  | .  | .   | .    | 149   | 100.0 | 4.1  |
|       | 1984-91 | 1         | 1.6   | 3.0  | 41  | 65.1  | 4.0  | 20  | 31.7  | 5.0  | 1  | 1.6 | 6.0  | 63    | 100.0 | 4.3  |
|       | 1992-96 | 18        | 4.8   | 3.0  | 296 | 79.1  | 4.0  | 57  | 15.2  | 5.0  | 3  | 0.8 | 6.0  | 374   | 100.0 | 4.1  |
|       | PRE-84  | 44        | 5.0   | 3.0  | 526 | 60.3  | 4.0  | 288 | 33.0  | 5.0  | 15 | 1.7 | 6.0  | 873   | 100.0 | 4.3  |
|       | Total   | 68        | 4.7   | 3.0  | 988 | 67.7  | 4.0  | 384 | 26.3  | 5.0  | 19 | 1.3 | 6.0  | 1459  | 100.0 | 4.2  |

## Appendix 5. Sea-age distribution of small and large Atlantic salmon on the Pinware River.

## Angled Samples

|       |         | SEA-AGE |       |        |     |        |      |        |      |        |     |     |       |     |      | Total |       |
|-------|---------|---------|-------|--------|-----|--------|------|--------|------|--------|-----|-----|-------|-----|------|-------|-------|
|       |         | 1SW     |       | CS 1SW |     | AS 1SW |      | CS 2SW |      | AS 2SW |     | 2SW |       | 3SW |      |       |       |
|       |         | N       | %     | N      | %   | N      | %    | N      | %    | N      | %   | N   | %     | N   | %    | N     | %     |
| LARGE | YY      |         |       |        |     |        |      |        |      |        |     |     |       |     |      |       |       |
|       | 74      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 66  | 98.5  | 1   | 1.5  | 67    | 100.0 |
|       | 80      | .       | .     | .      | .   | 1      | 2.9  | .      | .    | 2      | 5.9 | 31  | 91.2  | .   | .    | 34    | 100.0 |
|       | 81      | .       | .     | 2      | 2.2 | 2      | 2.2  | 1      | 1.1  | .      | .   | 87  | 94.6  | .   | .    | 92    | 100.0 |
|       | 82      | 1       | 3.4   | 1      | 3.4 | 3      | 10.3 | .      | .    | 1      | 3.4 | 23  | 79.3  | .   | .    | 29    | 100.0 |
|       | 85      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 4   | 100.0 | .   | .    | 4     | 100.0 |
|       | 88      | .       | .     | .      | .   | 1      | 9.1  | .      | .    | .      | .   | 10  | 90.9  | .   | .    | 11    | 100.0 |
|       | 90      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 2   | 100.0 | .   | .    | 2     | 100.0 |
|       | 91      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 3   | 100.0 | .   | .    | 3     | 100.0 |
|       | 92      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 2   | 100.0 | .   | .    | 2     | 100.0 |
|       | 93      | 1       | 6.7   | .      | .   | 2      | 13.3 | .      | .    | .      | .   | 12  | 80.0  | .   | .    | 15    | 100.0 |
|       | 94      | .       | .     | .      | .   | .      | .    | 1      | 12.5 | .      | .   | 7   | 87.5  | .   | .    | 8     | 100.0 |
|       | 95      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 24  | 88.9  | 3   | 11.1 | 27    | 100.0 |
|       | 96      | .       | .     | .      | .   | .      | .    | .      | .    | .      | .   | 13  | 100.0 | .   | .    | 13    | 100.0 |
|       | 1984-91 | .       | .     | .      | .   | 1      | 5.0  | .      | .    | .      | .   | 19  | 95.0  | .   | .    | 20    | 100.0 |
|       | 1992-96 | 1       | 1.5   | .      | .   | 2      | 3.1  | 1      | 1.5  | .      | .   | 58  | 89.2  | 3   | 4.6  | 65    | 100.0 |
|       | PRE-84  | 1       | 0.5   | 3      | 1.4 | 6      | 2.7  | 1      | 0.5  | 3      | 1.4 | 207 | 93.2  | 1   | 0.5  | 222   | 100.0 |
|       | Total   | 2       | 0.7   | 3      | 1.0 | 9      | 2.9  | 2      | 0.7  | 3      | 1.0 | 284 | 92.5  | 4   | 1.3  | 307   | 100.0 |
| SMALL | YY      |         |       |        |     |        |      |        |      |        |     |     |       |     |      |       |       |
|       | 74      | 121     | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 121   | 100.0 |
|       | 80      | 100     | 98.0  | .      | .   | .      | .    | .      | .    | .      | .   | 2   | 2.0   | .   | .    | 102   | 100.0 |
|       | 81      | 387     | 99.5  | 1      | 0.3 | .      | .    | .      | .    | .      | .   | 1   | 0.3   | .   | .    | 389   | 100.0 |
|       | 82      | 262     | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 262   | 100.0 |
|       | 85      | 26      | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 26    | 100.0 |
|       | 88      | 3       | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 3     | 100.0 |
|       | 89      | 16      | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 16    | 100.0 |
|       | 90      | 14      | 93.3  | 1      | 6.7 | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 15    | 100.0 |
|       | 91      | 4       | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 4     | 100.0 |
|       | 92      | 2       | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 2     | 100.0 |
|       | 93      | 61      | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 61    | 100.0 |
|       | 94      | 33      | 91.7  | .      | .   | .      | .    | .      | .    | .      | .   | 3   | 8.3   | .   | .    | 36    | 100.0 |
|       | 95      | 131     | 99.2  | .      | .   | .      | .    | .      | .    | .      | .   | 1   | 0.8   | .   | .    | 132   | 100.0 |
|       | 96      | 150     | 99.3  | 1      | 0.7 | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 151   | 100.0 |
|       | 97      | 149     | 100.0 | .      | .   | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 149   | 100.0 |
|       | 1984-91 | 63      | 98.4  | 1      | 1.6 | .      | .    | .      | .    | .      | .   | .   | .     | .   | .    | 64    | 100.0 |
|       | 1992-96 | 377     | 98.7  | 1      | 0.3 | .      | .    | .      | .    | .      | .   | 4   | 1.0   | .   | .    | 382   | 100.0 |
|       | PRE-84  | 870     | 99.5  | 1      | 0.1 | .      | .    | .      | .    | .      | .   | 3   | 0.3   | .   | .    | 874   | 100.0 |
|       | Total   | 1459    | 99.3  | 3      | 0.2 | .      | .    | .      | .    | .      | .   | 7   | 0.5   | .   | .    | 1469  | 100.0 |