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**Assessment of Atlantic Salmon,
(Salmo salar), in the
Margaree River, 1988**

by

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ABSTRACT

Sport catch of 1SW salmon in 1988 as estimated by DFO fisheries officers and Nova Scotia license stub returns exceeded the catch in 1987. DFO estimates were the greatest since 1947 with the exception of 1979, 1981, and 1982. MSW salmon sport catch in 1988 as estimated by DFO fisheries officers and Nova Scotia license stub returns were greater than 1987.

A creel survey of Forks Pool suggested that DFO underestimated and stub returns overestimated 1SW sport catch as in 1987. DFO and stub return estimates of MSW hooked and released were an over estimate of those which would correspond to historical catch/kill records. This result was opposite to that obtained in 1987.

DFO angling statistics adjusted by the creel survey (595 1SW, 368 MSW) were judged to be the most appropriate statistics to use in estimating spawning escapement by angling statistics. This conclusion was supported by population estimates and exploitation rates determined from a mark-recapture experiment. Total returns to the Margaree River in 1988 were estimated as 3673 1SW and 2996 MSW salmon. Exploitation rates were 16% for 1SW and 8% for MSW salmon returning in the fall. These numbers minus removals suggest that spawning requirements were met in 1988.

The contribution of hatchery 1SW and MSW salmon to river returns was less in 1988 than 1987.

MSW salmon returns slightly above 1988 are forecast for 1989.

RESUME

Selon les estimations des agents des pêches du MPO et les talons de permis de pêche de la Nouvelle-Ecosse qui ont été retournés, les prises sportives de saumons unibermarins en 1988 ont dépassé celles de l'année antérieure. En fait, les estimations du MPO étaient les plus élevées depuis 1947, si l'on fait exception de 1979, 1981 et 1982. Par ailleurs, selon les estimations du MPO et les talons des permis de pêche de la Nouvelle-Ecosse retournés, les prises sportives de saumons pluribermarins de 1988 ont également été supérieures à celles de 1987.

D'après les résultats d'un sondage des pêcheurs, effectué au trou à saumon Forks, il apparaît que le MPO a sous-estimé les prises sportives de saumons unibermarins tandis que les évaluations fondées sur les talons retournés les ont surestimées, comme en 1987. En ce qui concerne les pluribermarins capturés et libérés, les évaluations du MPO et celles fondées sur les talons retournés en ont aussi surestimé le nombre par rapport à celui qui correspondrait aux statistiques historiques de saumons capturés et conservés. Le résultat était ici l'inverse de celui de 1987.

Les statistiques de pêche à la ligne du MPO, modifiées d'après les résultats du sondage des pêcheurs (595 unibermarins et 368 pluribermarins), sont apparues les plus adéquates pour l'estimation des échappées de reproducteurs. Cela a été confirmé par les estimations de population et les taux d'exploitation établis à partir d'une expérience de marquage-recapture. On a estimé à 3 673 unibermarins et 2 996 pluribermarins les remontées totales dans la rivière Margaree en 1988. Les taux d'exploitation étaient de 16 % pour les unibermarins et de 8 % pour les pluribermarins des remontées d'automne. Ces chiffres, diminués des retraits, permettent de conclure que les besoins de reproducteurs ont été satisfaits en 1988.

En 1988, l'apport des unibermarins et pluribermarins d'élevage dans les remontées a été inférieur à ce qu'il avait été l'année précédente.

On prévoit pour 1989 des remontées d'pluribermarins légèrement supérieures à celles de 1988.

INTRODUCTION

OBJECTIVES

The purpose of this paper is to provide an assessment of the Margaree River Atlantic salmon stock in 1988. Past assessments have relied exclusively on DFO angling statistics and fixed exploitation rates to determine spawning escapement and forecast returns (Clayton and Chadwick 1985; Clayton and Léger 1986). As a result, these assessments have raised several issues requiring additional information to resolve. These issues include, resolving the difference between angling catch statistics collected by DFO fisheries officers and those from Nova Scotia license stub returns, ensuring that hook-and-release estimates of MSW salmon can be interpreted relative to historical catch-kill records, evaluating the relative contribution of hatchery released salmon to river returns, and finding a reliable method of forecasting returns. In addition, recent information on size-at-age and previous spawners has been deficient for the Margaree River.

In 1988, three programs begun in 1987 were expanded to address the above concerns. Firstly, a creel survey at Forks Pool, the major angling pool, was conducted for the summer as well as fall season, and secondly, the number of voluntary angling logbooks was increased to provide a more representative sample of anglers than was obtained in 1987. Thirdly, a mark-recapture program to estimate fall population size, exploitation rate and biological characteristics using estuarine trapnets was conducted. The development of these programs and their use in resolving the above issues are described in the following sections.

BACKGROUND

The Margaree River is located on Cape Breton Island, Inverness County, Nova Scotia. Two principal branches, the Northeast Margaree and Southwest Margaree, meet at Margaree Forks to form the Main Margaree which flows into the Gulf of St. Lawrence. Most of the Atlantic salmon angling occurs in the Main Margaree and Northeast Margaree rivers. Margaree River salmon stocks are composed of two runs: the summer run enters the river up to the end of August; and the fall run, after September 1.

Since 1979, efforts to increase the summer component of the Atlantic salmon stock have consisted of regulatory restrictions and introduction of hatchery-reared progeny from early-run fish. Anglers have been required to release MSW salmon during the early-run (before September 1) since 1979. From 1985-1988, all MSW salmon were released regardless of date caught. In 1984, there was a reduction in the Salmon Fishing Area 18 commercial fishery from eight to three weeks. There was no Salmon Fishing Area 18 commercial fishery from 1985-1988.

METHODS

LANDINGS

Angling records from 1947-1988 were provided by fishery officers, Department of Fisheries and Oceans, Margaree Forks, Nova Scotia. These records are subsequently referred to as DFO statistics. Sport catches for 1984-1986 were also obtained from Nova Scotia license stub returns (O'Neil et al. 1985, 1986, 1987). Final 1987, and preliminary 1988 as of November 7, Nova Scotia license stub returns were obtained from S. O'Neil, DFO Halifax, Nova Scotia. Commercial landings for Salmon Fishing Area 18 (1967-1984) are also reported (Clayton and Chadwick 1985).

FORKS POOL CREEL SURVEY

A creel survey was conducted at Forks Pool (Fig. 1) from June 1 - October 15 to estimate catch and effort for this portion of the sports fishery. Creel periods were stratified into AM (0600-1330) and PM (1330-2100) and weekday and weekend (including holidays) periods. Weekdays sampled were 63/94 available days (67%) and 29/43 (67%) of the available weekend days. Each day within a weekday-weekend stratum was assigned a consecutive number and was selected for the creel using a random number table. Once these days were selected, a random number table was used to determine whether a day would be an AM or PM creel. An odd number selected AM and even PM. Days and time periods are given in Fig. 2.

During the creel period numbers of 1SW salmon kept, and 1SW and MSW salmon hooked and released, as well as method of release were noted (Fig. 3). The release methods were defined as:

- 1) remove hook (RH), fish was handled by angler and hook removed by hand;
- 2) cut line (CL), fish was not handled but leader was intentionally cut or broken by angler;
- 3) lost (LO), fish took fly, but dislodged hook and broke line before it could be intentionally released.

As anglers left the pool they were interviewed to obtain the time they started and completed fishing, numbers and types of fish kept or released, and method of release. Forms used for interview are provided in Fig. 3. Sampling from all 1SW kept included fork length (nearest cm), scales, sex, and presence or absence of adipose clips and wire nose tags. Sex was determined internally from kept fish.

The observed catch and effort data from each stratum was used to estimate total catch and effort at Forks Pool from June 1 - October 15 in the following manner. Total effort at Forks Pool was estimated by calculating mean effort in hours/day and rod-days/day (rod-day is one angler

fishing for any portion of one day) and multiplying by the number of available days in each stratum. These estimates of effort were then multiplied by observed catch/effort to determine estimated catch in each stratum. Estimated catches were divided into 1SW and MSW salmon on a proportional basis within each stratum. The estimated catches and efforts were then summed to determine the overall estimated catch/effort. Confidence limits were calculated using the method described by Jessop (1980). Estimates of 1SW and MSW salmon catches for the entire Margaree River were calculated using the percentage of total summer and fall 1SW and MSW salmon catch taken at Forks Pool, based on DFO statistics, as an adjustment factor.

The Forks Pool creel provides two comparisons to DFO sport catch statistics, 1) estimates of total Forks Pool catch by creel and DFO, and 2) estimates of total river catch based on Forks Pool creel and DFO. In 1987 it was suggested that DFO underestimated sport catch (Claytor et al. 1988). The creel survey conducted in 1988, provides comparisons to DFO statistics for both summer and fall periods. This complete coverage of the angling season allows the consistency of the creel methodology to be tested.

VOLUNTEER LOGBOOKS

Sixty anglers were contacted to keep a logbook of each fishing trip on the Margaree River. As of Nov. 3, 1988, 22 of these anglers had returned their logbooks. Anglers contacted were chosen randomly from groups fishing <10 rod-days, 10-30 rod-days, and >30 rod-days as indicated by license stub returns in 1987. This method was used to try and obtain a representative sample of all anglers fishing the Margaree River. Anglers were requested to note the start and finish times for each fishing trip, pools fished, numbers kept, hooked and released, and method of release (Fig. 4). In addition, they collected scale samples, determined sex, and collected noses or heads from all hatchery fish kept for wire nose tag detection. It was assumed that catch is reported accurately and that tag returns are 100% reported in this angling group.

FALL POPULATION ESTIMATE (MARK-RECAPTURE)

Two trapnets were used in this experiment. The first was located 0.75 km upstream from the Margaree Harbour Bridge and was placed in the channel on the eastern side of the river. The first trap was a box trapnet with two leaders, one tied to shore 90 m (300') long, the second 30 m (100') long extended into the channel. The trap portion was 15.24 m (50') long X 3.65 m (12') wide X 3.65 m (12') deep with an apron in front extending to the bottom of the river. The trap portion was divided into two compartments the first 3 m (10') long and the second 12 m (40') long. The trap was made from 3.49 cm (1 3/8") knotless nylon mesh and the leader was 7.62 cm (3") knotted nylon mesh. The trap and leader were supported by pickets. This trap was fished from September 2 - October 22, 1988.

The second trap was located in the channel 1.5 km upstream from the first with the leader tied to the western shore (Fig. 1). It was the same design as a commercial salmon Miramichi box trapnet. Its dimensions and materials have been described in Claytor et al. 1987, except this year a 5.72 cm (2¼") knotless nylon mesh leader was used and it was 45 m (150') long. This trap was fished from August 30 - October 22, 1988.

A numbered carlin tag was attached to all fish captured in each trap with the exception of mortalities and weak fish. Fork length (nearest cm) was measured and a scale sample removed from all fish captured. Sex was determined externally. All hatchery released fish have the adipose fin removed. Wild were distinguished from hatchery returns by the presence of the adipose fin.

A population estimate of salmon returning to the Margaree River was obtained using Schaefer's method for stratified populations (Ricker 1975) based on fish tagged in the lower net and tag recoveries and catch in the upper net. A second estimate using this method was made using tags applied at both nets and tag recoveries and catch from logbook anglers. Data from logbook anglers were used because it can be assumed that catch of these anglers is reported without bias and tag reporting would be 100%. Catch from logbook anglers was determined from numbers reported for 1SW salmon kept and released by hand or cutting line and MSW salmon released by hand or cutting line.

Because tag returns from 1SW and MSW salmon were not sufficient for separate estimates, returns from these groups were combined. Numbers of 1SW and MSW salmon were then determined using the proportion of each age group caught in the trapnets.

Tagging and recovery periods were divided into two equal strata covering the time period both nets were fishing. Smaller strata led to periods with zero recoveries. The period from September 2 - October 15 was divided in half producing two tagging periods from September 2 - September 23 and September 24 - October 14. Recovery periods were lagged one day September 3 - September 24 and September 25 - October 15 because one day was the minimum time period between tagging and recovery from these fishing methods.

Removal of tags from those available to be recovered may occur from tag loss, mortality, or fish leaving the river system. An estimate of tag removal from the angling fishery was made by comparing the ratios of recaptures/total captures from the lower to upper net, and from lower net to logbook anglers. Because logbook anglers and trap recoveries have a 100% reporting rate the ratio of these values should represent tags removed from those available to anglers. The calculation is described below:

Tagging-Recovery Locations	Recaptures	Captures	R/C
Lower-Upper Nets	7	133	0.053
Lower Net - Logbook Anglers	3	77	0.039

Hence, $0.039/0.053 = 0.736$, $1-0.736 = 0.264$ or proportion of tags removed = 26%.

If tag removals are assumed to be related to days available then the rates of the average number of days between tagging and recapture in the angling and upper trap can be used to provide a factor for tag removal between the lower and upper traps. The average length of time between tagging and recapture from the lower to upper trap was 8.7 days and 15.0 days from lower trap to anglers. Hence, $8.7/15 = 0.58$; $26\% \times 0.58 = 15.08$. Therefore the tag removal rate between lower to upper trap is 15%.

A non-reporting rate for tags was calculated using tag returns during Forks Creel periods and those returned from Forks Pool when creels were not conducted. It is assumed that tags recovered during creel/observed creel catch = total tags recovered forks pool/estimated forks catch. That is, $1/14 = X/43$; $X = 43/14 = 3$. Two tags in total were returned. Therefore reporting rate is $2/3$ or 67% and non-reporting rate is 33%.

Finally the estimate obtained from the Schaefer method was compared to a Peterson estimate (Ricker 1975) using trapnet and logbook returns.

SPAWNING REQUIREMENTS

The required number of spawners was calculated using the method (Method 2) recommended by Randall (1985) for the Miramichi River. The number of spawners required to meet egg deposition requirements was calculated presuming that all egg deposition came from MSW salmon. The numbers of 1SW salmon required were calculated assuming that at least one male spawner was needed for each female MSW salmon.

The characteristics used to determine the spawning requirements were essentially those given by Gray and Chadwick (1984) and are repeated below:

Egg deposition rate	=	2.4 eggs/m ² (Elson 1975)
Rearing area	=	2,797,600 m ² (Marshall 1982)
Fecundity MSW	=	1,764 eggs/kg (Elson 1975)
1SW	=	1,764 eggs/kg (Elson 1975)
Mean weight MSW	=	4.9 kg (Marshall 1982)
1SW	=	1.7 kg (Marshall 1982)
Sex ratio male/female MSW	=	25:75 (Marshall 1982)
1SW	=	89:11 (Marshall 1982)
Eggs per MSW	=	6,482 eggs = 1,764 X 4.9 X .75
1SW	=	330 eggs = 1,764 X 1.7 X .11

EGG DEPOSITION

In previous assessments (Claytor and Chadwick 1985; Claytor and Leger 1986; Claytor et al. 1987). Total egg deposition from 1SW and MSW salmon was calculated as described below:

$$\frac{\text{Sport catch (SC)}}{\text{Sport catch (SC) + Spawners}} = \text{Exploitation rate (ER)}$$
$$\frac{\text{SC (1 - ER)}}{\text{ER}} = \text{Spawners}$$

Exploitation rates for 1SW and MSW salmon 20.6 and 37.9%, were those determined by Hayes (1949).

For years in which there were hook-and-release regulations, 1979-1988, the MSW salmon caught and released were added to the number of spawners calculated as above. This factor assumes there is no mortality as a result of hook and release.

For all years, egg deposition was calculated as the number of 1SW or MSW spawners times the eggs per 1SW or MSW fish (see above). The eggs obtained from broodstock collections were subtracted from the above egg deposition values.

In 1988, egg deposition can also be estimated from returns estimated from the mark-recapture experiment.

HATCHERY RETURNS

Proportions of hatchery and wild fish returning to the Margaree River were determined from angler logbooks, Forks Pool creel, angler spot checks, broodstock collections (Hatchery and McKenzie pools, Fig. 1), and trapnet captures. All hatchery fish released to the Margaree River were adipose fin clipped, allowing hatchery or wild origin to be readily identified.

FORECAST

The number of 1SW and MSW salmon, both hatchery and wild, caught in the fall segment of the season since 1983 were used in an attempt to forecast returns in 1989. A regression of 1SW year (i) against MSW year (i+1) was attempted for this purpose. Considering years since 1983 has the advantage of using only data collected after the implementation of hook and release requirements to calculate forecasts. Data collected before 1983 indicated a significant correlation between 1SW and MSW returns but the r-squared value was very low.

RESULTS AND DISCUSSION

LANDINGS

Commercial landings for Salmon Fishing Area 18 (1967-1984) are presented in Table 1, DFO Sport catch statistics (1947-1988) in Table 2, and Nova Scotia license stubs (1984-1988) in Table 3. 1SW salmon sport catch based on license stub estimates was 1.5-2.5 times DFO statistics from 1984-1987. MSW salmon sport catch based on license stub estimates was 2.5-4.5 times DFO statistics from 1984-1987 (Tables 2, 3). 1SW salmon sport catch in 1988 (DFO) was the greatest since 1947, with the exceptions of 1979, 1981, and 1982. MSW salmon sport catch in 1988 (DFO) was the third highest since 1947 and 42% greater than 1987 (Table 2).

MSW salmon catch was equally divided between summer and fall. This high proportion of summer caught MSW salmon is unusual but has occurred previously (Chaput and Claytor 1988). Since 1947 the mean percentage of MSW salmon caught in the fall has been 64% ranging from 27-99% (Table 4). In contrast, the percentage of 1SW salmon caught in the summer (66%) is within the range reported since 1984, (Table 4).

Observed catch, effort and catch per unit effort used to calculate estimated values for Forks Pool are given in Table 5. In general catch per unit effort was slightly higher in the summer than fall as was catch of both 1SW and MSW salmon. Catch per unit effort in fall 1988 was half that of 1987 (Table 5).

Estimated catch, rod-days, and hours are provided in Table 6. The MSW:1SW ratio was very different in fall 1988 (0.59) compared to fall 1987 (7.87) (Table 6).

The percentages of total catch taken at Forks Pool, DFO statistics, (Table 7) were used to adjust Forks creel estimates to total river catches (Table 8).

The ratio of Forks Creel 1SW catch:DFO Forks 1SW catch for the summer was $69/54 = 1.3:1$, while for the fall it was $27/18 = 1.5:1$ (Table 8). This 1988 fall value was similar to the fall 1987 Creel:DFO 1SW salmon ratio (1.2:1) (Claytor et al. 1987). The similarity among these ratios suggests that DFO is consistently underestimating 1SW catch by a factor of 1.2 - 1.5.

The ratio of Forks Creel MSW:DFO Forks MSW catch was similar for summer $28/43 (0.65:1)$ and fall $16/26 (0.62:1)$ (Table 8). However, these values are very different from the 1987 fall ratio of 2:1 (Claytor et al. 1987). While the 1987 ratio suggested that DFO was underestimating MSW catch, the 1988 ratios suggests overestimation.

In 1988, 22 logbook anglers responded with completed forms. The catch per unit effort was greater in the fall than summer for these anglers. This catch per unit effort relationship was opposite to the Forks Pool Creel Survey (Tables 5, 9). These data may differ because logbook returns include reports from all areas of the river, rather than a single pool.

ADJUSTMENTS TO SPORT CATCH

Ratios of MSW:1SW salmon caught from angling logbooks were used to adjust MSW catch reported on stub returns in 1987. This adjustment was made assuming 1SW stub return catches were correct and that logbook anglers were representative of the sport fishery. We suggest that the logbook ratio was not the most appropriate. In 1987, the logbook ratio was 4:1. However the MSW:1SW salmon ratio in the trapnet for the fall was 6.6:1 (Table 10). The closest catch ratio to the trap was that from the river creel estimate, 5.74:1 (Table 10). In 1988, the river creel estimate was also the nearest to the fall trap ratio (Table 10).

Assuming the trapnet catch is the most representative sample of MSW:1SW ratio entering the river, then the consistency in agreement of MSW:1SW between the trapnet and river creel estimates strongly suggest that the river creel estimate is the best ratio to use in adjusting catch by the MSW:1SW ratio method. This ratio can be applied to DFO 1SW salmon catch adjusted for underestimations and license stub returns taken at face value. MSW salmon catches adjusted by this ratio are given in Table 11.

These adjusted values can be compared with adjusted MSW catch values made by using the Forks creel adjustment value. For 1987 this was 2:1 and 1988 0.62:1 for fall and 0.65:1 for summer. These values are given in Table 11 and suggest close agreement between catches adjusted by creel correction factors and creel MSW:1SW ratio.

As a result, DFO 1SW and MSW statistics adjusted by creel correction factors most accurately reflect 1SW removals, and MSW catch that most closely corresponds to historical catch/kill records. 1SW removals are 595 salmon and MSW catch equivalent to catch/kill records is 368 salmon. This conclusion is tested below using population estimates and exploitation rates determined from the mark-recapture experiment.

1SW salmon statistics collected by DFO and stub returns represent kept fish. The relationship between creel estimates and DFO statistics was consistent for 1987 and 1988. Similarly, 1SW catch estimated from stub returns is similar to creel corrected removals. This consistency suggests that DFO statistics and license stub returns are good indices of abundance from year to year for kept fish. However, it should be noted that DFO statistics will consistently underestimate while stub returns overestimate actual abundance.

Thus historical catch/kill records or hooked and released values which are equivalent to these records may be used to determine returns if exploitation rates do not vary significantly among years. This assumption will be evaluated by an additional year of a mark-recapture experiment.

MSW salmon statistics, since 1984, represent hooked and released fish. The relationship between creel estimates and DFO statistics was inconsistent for 1987 and 1988. Similarly, license stub MSW hooked and released estimates were 80% above creel corrected catch/kill values. Thus, DFO and stub returns hooked and released statistics may not be a reliable index of abundance. However, DFO MSW statistics collected prior to 1984 are based on kept fish. Hence, this problem may only apply since the requirement to

release MSW salmon came into effect in 1984. An expanded creel design is necessary to obtain catch statistics for hooked and released MSW salmon which is equivalent to historical catch/kill records.

POPULATION ESTIMATES, MARK-RECAPTURE

Fall population estimates based on Schaefer's method applied to trapnet recaptures is 2797 fish. Peterson's estimate for trapnet data is 2529 (1405-7226;99% C.I.). Estimates based on recaptures by logbook anglers is 2560 with a Peterson estimate of 2440 (1303-7765;99% C.I.) (Table 12). That fewer fish are estimated from angling returns than trapnet indicates that dilution of fish from summer season may be small.

Applying appropriate proportions of 1SW:MSW salmon to these estimates provides a 1SW estimate of 1359 and a MSW estimate of 1438 for the fall period (Table 13).

Applying appropriate tag loss rates to (26%) angling fishery and non-reporting rate (33%) to tags returned from non-logbook anglers indicates that exploitation rate on fish entering the river from August 30 - October 14 varies from 3 to 29% for 1SW and 1 to 21% for MSW salmon. Higher exploitation rates applied to those entering earliest in the fall. The overall exploitation rate for 1SW salmon is 16% and 8% for MSW salmon returning during the fall (Table 14,15).

In contrast exploitation rates for 1SW and MSW salmon calculated using these tag removal rates and non-reporting rates for 1987 were 19% for each. Tag returns from 1987 included fish from the summer run and may account for the higher exploitation rate.

Applying 16% exploitation rate to the 1SW salmon estimate would give a fall 1SW angling catch of 217 (1359×0.16). Applying 8% to MSW salmon estimate would give a fall MSW angling catch of 115. Of all catch statistics available these figures are closest to DFO statistics adjusted by creel (Table 11).

DFO catches adjusted by creel are most similar to catches calculated from fall population estimates and exploitation rates from tag recaptures. This agreement provides further support for the acceptance of creel adjusted DFO statistics as catch figures for 1988. DFO statistics adjusted by creel correction factors rather than ratio are favored because they are derived independently and do not depend on MSW:1SW ratios.

A further check on these values can be made by calculating total returns based on proportions of DFO adjusted 1SW and MSW statistics by summer and fall periods and calculating exploitation rates.

Using adjusted DFO statistics to determine total MSW returns from the fall estimate produces a value of $1438/0.48 = 2996$ MSW salmon and 1SW total return of $1359/0.37 = 3673$. This method assumes equal exploitation rates for summer and fall runs. If exploitation rate on summer run is much higher than the fall, then the summer run could be over-estimated by this method.

Applying non-adjusted and adjusted DFO catches to these population estimates provides the following exploitation rates for the entire season.

	DFO		STUB	TAG RETURNS
	NON ADJUSTED	ADJUSTED	NON-ADJUSTED	
1SW	11.8	16.2	19.21	16
MSW	19.4	12.3	58.3	8

Adjusted DFO catches provide exploitation rates more similar to those calculated from tag returns than non-adjusted DFO and stub return statistics.

SPAWNING REQUIREMENTS

Spawning requirements for the Margaree River were found to be 1,036 MSW and 579 1SW salmon. These figures were derived as given below:

- (1) egg requirements = $2.4 \text{ eggs m}^{-2} \times 2,797,600 \text{ m}^2$
= 6,714,600 eggs
- (2) eggs/MSW salmon = $8,643 \text{ eggs/MSW} \times .75 \text{ (females)}$
= 6,482
- (3) required number of MSW = $6,714,600 \div 6,482$
= 1,036

- number of female MSW = $1,036 \times .75$
= 776

- number of male MSW = $260 = 1,036 - 776$

- number of male 1SW = $516 = 776 - 260$

- number of 1SW = $579 = 516 \div .89$

Using these values, MSW salmon account for 100% of the egg deposition requirements and 97% of the total egg deposition.

SPAWNING ESCAPEMENT, EGG DEPOSITION AND EXPLOITATION RATE

In 1987, DFO catch was adjusted by a creel factor of 2.0. This factor was applied to years since hook and release was implemented in 1984. This factor is now shown to be inadequate for application each year. Hence adjustments to catches applied to 1984-1986 are not valid. Determinations of egg deposition are presented using non-adjusted DFO statistics for all years and adjusted DFO statistics by creel for 1987 and 1988. Because

exploitation rate for the entire season based on tag returns in 1987 was 19% and is similar to Hayes (1949) 20%, only 20 and 40% will be used here (Table 16).

Egg deposition may also be calculated from total salmon returns estimated by mark-recapture experiment weighted by seasonal angling catches, as above, minus removals.

	1SW		MSW	
	NON-ADJUSTED CATCH	ADJUSTED CATCH	NON-ADJUSTED CATCH	ADJUSTED CATCH
Total returns	3673	3673	2996	2996
Removals Angling	435	595	29*	29*
Broodstock	10	10	62	62
Spawners	3228	3068	2905	2915
* Hook and release mortality 5%				

These figures based on mark-recapture experiment are likely the most accurate reflection of egg deposition in the Margaree River for 1988. The egg deposition from these figures is shown in Table 16 and suggest that egg deposition exceeds spawning requirements by nearly 3 times.

FORECAST

The fall MSW salmon angling catch (DFO) was predicted using fall 1SW angling catch (DFO) from the previous year since 1983 (Fig. 5). This relationship predicted a fall catch of 273 for 1988, actual DFO catch was 287. For 1989 a fall MSW catch of 518 is predicted. If this figure accounted for 60% the catch as in 1988, the total catch would be 863 MSW salmon. Adjusting by creel factors 0.62 and 2.0 (determined over the past two years), and an exploitation rate of 20% (as indicated by the upper range of tag returns) produces a total MSW return between 2658 and 8630. Either of these numbers would satisfy spawning requirements.

It should be noted that this relationship is based on non-adjusted DFO statistics. Because DFO estimates of MSW hooked and released salmon may not reflect historical catch/kill records, this relationship may not be applicable in 1989.

HATCHERY CONTRIBUTION

The proportion of hatchery and wild 1SW and MSW salmon in the Margaree River are indicated in Tables 17,18. The proportion of hatchery return 1SW and MSW salmon in the summer is approximately 30%. This percentage is much

lower than in 1987. The proportion of wild 1SW salmon in the fall is 97% compared to 69% in 1987. The proportion of wild MSW salmon in the fall is greater than 95% as it was in 1987 (Table 18). This change in proportion of early run 1SW hatchery released fish may have resulted from the decision not to use Rocky Brook, Miramichi progeny as an egg source (Table 19).

BIOLOGICAL CHARACTERISTICS

The average 1SW salmon fork length in 1988 was 55.4 cm compared to 54.4 cm in 1987. While 1988 scales have not yet been aged, data from 1987 indicate that 65% of wild 1SW salmon were 2+ smolts, and 71% of wild MSW salmon were 2+ smolts. Repeat spawners accounted for 1.7% of 1SW and 5% of MSW samples in 1987 (Tables 20, 21, 22).

DISTANT FISHERIES

Fish tagged since 1986 as part of Margaree assessment and enhancement projects have been recovered in distant fisheries in Quebec, Labrador, Newfoundland and Greenland (Table 23).

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Table 1. Commercial salmon landings for Salmon Fishing Area 18 (1967-1984) in kg.

Year	Northumberland Strait-NS Fisheries Statistical District			Gulf Cape Breton-NS Fisheries Statistical District			Gulf NS Zone 6 total (kg)	
	11	12	13	Subtotal	2	3		Subtotal
1967		10,503	29,885	40,388	10,728	2,124	12,852	53,240
1968	1,175	9,495	14,949	25,619	10,480	2,057	12,537	38,156
1969		9,968	11,050	21,018	7,831	1,598	9,429	30,447
1970		4,605	13,015	17,620	12,760	114	12,874	30,494
1971		1,689	5,597	7,286	4,485	255	4,740	12,026
1972		5,155	18,714	23,869	7,026	996	8,022	31,891
1973		2,562	15,788	18,350	8,043	1,297	9,340	27,690
1974		5,742	17,437	23,179	11,213	3,045	14,258	37,437
1975		2,080	9,824	11,904	10,670	1,057	11,727	23,631
1976		1,606	5,845	7,451	9,954	956	10,910	18,361
1977		4,137	9,171	13,308	11,490	1,423	12,913	26,221
1978		2,940	15,907	18,847	10,691	678	11,369	30,216
1979		169	4,549	4,718	3,117	82	3,199	7,917
1980		2,534	11,932	14,466	9,088	858	9,946	24,412
1981		1,822	8,283	10,105	4,978	479	5,457	15,562
1982		2,805	13,680	16,485	8,704	1,475	10,179	26,664
1983		1,863	9,770	11,633	11,621	1,026	12,647	24,280
1984		1,097	7,850	8,947	5,291	902	6,193	15,140

Table 2. Salmon angling catch on Margaree River (1947-1988) as compiled by Department of Fisheries and Oceans fisheries officers (DFO statistics).

Year	1SW	MSW			Total
		Retained	Released	Total	
1947	37	363			400
1948	106	704			810
1949	50	332			382
1950	119	320			439
1951	46	424			470
1952	87	204			291
1953	57	291			348
1954	78	298			376
1955	53	258			311
1956	29	90			119
1957	36	136			172
1958 ²	N/A	N/A			334
1959 ²	N/A	N/A			235
1960 ²	N/A	N/A			140
1961	40	49			89
1962	46	410			456
1963	87	212			299
1964	120	289			409
1965	86	254			340
1966	92	165			257
1967	92	210			302
1968	63	197			260
1969	206	136			342
1970	85	214			299
1971	21	92			113
1972	41	106			147
1973	165	116			281
1974	59	107			166
1975	36	64			100
1976	95	82			177
1977	68	140			208
1978	25	158			183
1979	605	62	19	81	686
1980	169	138	2	140	309
1981	899	105	34	139	1,038
1982	692	103	76	179	871
1983	72	106	43	149	221
1984	148	12	109	121	269
1985	223	0	312	312	535
1986	295	0	754	754	1,049
1987	353	0	408	408	761
1988	435	0	580	580	1,015

² Information regarding 1SW and MSW salmon for 1958-1960 are not available.

Table 3. Salmon angling catch on Margaree River, 1984-1988, based on Nova Scotia license stubs.

	No. of Anglers	1SW				MSW				Effort			Percentage	
		Retain	Release	Total	Retain	Release	Total	Unknown	Rod-days ¹	CUE	1SW	MSW		
1984 Obs	678	184	48	232	9	285	294	4	5,956	0.089				
Est		191	50	241	9	294	303	4	6,669	0.082	44%	56%		
1985 Obs	793	371	102	473	0	1,130	1,130	3	7,324	0.219				
Est		399	110	509	0	1,215	1,215	3	7,824	0.221	30%	70%		
1986 Obs	1,131	622	126	748	0	2,522	2,522	2	9,724	0.336				
Est		650	132	782	0	2,636	2,636	2	10,232	0.334	23%	77%		
1987 Est	1,441	826	151	977	0	1,857	1,857	0	12,887	0.220	34%	66%		
1988 Est	N/A	704	N/A	N/A	0	1,746	1,746	N/A	15,080	0.163	29%	71%		

¹ Rod-days are defined as one angler fishing for any portion of one day.

² Preliminary

Table 4. Number of 1SW and MSW salmon caught in summer and fall components of the Margaree River sports fishery (DFO statistics).¹

Year		Summer	Fall	Total	% Summer
1947-1978					
	Mean MSW	87	137	223	39
	1SW	37	35	71	51
	%MSW	70	80	76	
1979-1983					
	Mean MSW	32	105	137	23
	1SW	400	422	822	49
	%MSW	7	20	14	
1984	MSW	27	94	121	22
	1SW	81	67	148	55
	%MSW	25	58	45	
1985	MSW	144	168	312	46
	1SW	116	107	223	52
	%MSW	55	61	58	
1986	MSW	297	457	754	39
	1SW	196	99	295	66
	%MSW	58	81	72	
1987	MSW	123	285	408	30
	1SW	268	85	353	76
	%MSW	32	77	54	
1988	MSW	293	287	580	51
	1SW	287	148	435	66
	%MSW	51	66	57	

¹ Detail for all years may be found in Chaput and Claytor (1988).

Table 5. Observed salmon catch, effort, and catch per unit effort for Forks Pool creel survey. RH, removed hook by hand; LO, fish was lost. K/RH, catch is sum of kept 1SW and MSW released by removing hook by hand. K/ALL, catch is sum of kept 1SW and MSW released by all methods including lost. Numbers in parentheses are standard errors.

Forks Pool Creel													
Season	Available days	No. creel days	No. anglers interviewed	Effort		1SW Kept	Catch		CUE		CUE		
				Rod-days	Hours		RH	MSW	Fish/Rod-day	Fish/Hour	K/RH	K/ALL	K/RH
SUMMER													
June 1 - August 31													
Weekday	AM	64	20	169	169(1.07)	420(4.25)	4	3	1	0.041	0.047	0.017	0.019
	PM	64	21	201	198(1.30)	488(3.90)	13	4	6	0.086	0.116	0.035	0.047
Weekend	AM	28	10	95	95(2.39)	225(7.01)	3	2	0	0.053	0.053	0.022	0.022
	PM	28	10	79	78(1.74)	248(8.18)	3	0	0	0.038	0.038	0.012	0.012
Total		92	61	544	540(0.73)	1380(2.55)	23	9	7	0.059	0.072	0.023	0.028
FALL													
September 1 - October 15													
Weekday	AM	30	11	122	122(1.22)	329(4.25)	5	1	1	0.049	0.057	0.018	0.021
	PM	30	11	80	80(1.64)	217(4.99)	1	1	1	0.025	0.038	0.009	0.014
Weekend	AM	15	4	85	85(2.56)	221(3.46)	3	2	3	0.059	0.094	0.023	0.036
	PM	15	5	54	54(4.72)	129(10.03)	0	1	0	0.019	0.019	0.008	0.008
TOTAL		45	31	341	341(1.29)	896(3.38)	9	5	5	0.041	0.056	0.016	0.021
1987 FALL		45	30	284	284	676	3	20	13	0.081	0.127	0.034	0.053

Table 6. Estimated effort and salmon catch at Forks Pool, June 1 - October 15, 1988 using creel data (Table 5). Number in parentheses indicates 95% confidence interval.

Season		ESTIMATED				
		Effort		1SW Kept	Catch	
		Rod-days	Hours		RH	LO
SUMMER						
June 1 - August 31						
Weekday	AM	541(539-1,543)	344(1,335-1,353)	13	10	3
	PM	603(600-1,606)	487(1,479-1,495)	40	12	18
Weekend	AM	266(261- 271)	630(614- 646)	8	6	0
	PM	221(217- 225)	694(675- 713)	8	0	0
Summer Total		1,631(1,630-1,632)	4,155(4,150-4,160)	69	28	21
FALL						
September 1 - October 15						
Weekday	AM	333(330- 336)	897(888- 906)	13	3	3
	PM	218(214- 222)	592(581- 603)	3	3	3
Weekend	AM	319(311- 327)	829(818- 840)	11	7	11
	PM	162(149- 175)	387(359- 415)	0	3	0
Fall Total		1,032(1,029-1,035)	2,705(2,698-2,712)	27	16	17
1987 FALL		887	2,086	8	63	44

Table 7. Contribution of Forks Pool to total summer and fall river catch from 1947-1988. Based on DFO statistics. Numbers in parentheses indicate range.

YEAR	1SW		MSW	
	Summer	Fall	Summer	Fall
1947-1983	26.0(6.3-69.8)	18.7(4.3-50.0)	21.7(0.0-66.7)	14.3(3.8-31.6)
1984	12.3	3.0	33.3	0.0
1985	18.1	2.8	27.1	3.6
1986	15.3	7.1	17.5	11.6
1987	17.2	8.2	30.1	11.2
1988	18.8	12.2	14.7	9.1
Mean 1984-1988	16.3	6.7	24.5	7.1

¹ Mean value is given, details for each year found in Chaput and Claytor (1988).

Table 8. Estimated salmon catch at Forks Pool and total river (using creel data), compared to DFO statistics at Forks Pool and total river catch. K, 1SW salmon kept; RH, released by removing hook by hand; K/RH, catch for 1SW kept MSW released by hand; K/ALL, applies to 1SW kept and MSW released by all methods including lost. See Table 6 for figures used to derive this table. Numbers in parentheses are 1987 values.

	Forks Pool			Total river			
	Creel		DFO	Creel		DFO	STUBS
	K/RH	K/ALL		K/RH	K/ALL		
June 1 - August 31							
1SW	69	N/A	54(46)	N/A	287(268)	465 (628)	
MSW	28	49	43(37)	333	293(123)	890 (557)	
September 1 - October 15							
1SW	27(8)	N/A	18(7)	N/A	148(85)	239 (198)	
MSW	16(63)	33(107)	26(32)	363(955)	287(285)	855(1300)	

Table 9. Observed salmon catch, effort, and catch per unit effort for anglers returning logbooks. RH, removed hook by hand; CL, cut line release; LO, fish was lost. K/RH, CL catch is sum of kept 1SW and MSW released by removing hook by hand and cutting line. K/ALL, catch is sum of kept 1SW and MSW released by all methods including lost.

Date	Anglers Responding	Effort		1SW			MSW			Fish/Rod-day		Fish/Hour		
		Rod-days	Hours	Kept	RH	LO	RH	CL	LO	K/RH,CL	K/ALL	K/RH,CL	K/ALL	
June 1 - Aug. 31	16	308	1566	27	5	14	55	5	21	2	0.300	0.419	0.059	0.082
Sept. 1 - Oct. 15	17	205	1023	16	7	4	47	0	14	0	0.341	0.439	0.068	0.088
Total	22	513	2589	43	12	18	102	5	35	2	0.316	0.427	0.063	0.085

Table 10. Summary of ratios and creel correction factors used in adjusting DFO and Nova Scotia license stub return 1SW and MSW catch statistics. N/O: Trapnet not operated in summer 1988.

	1SW		MSW		TRAPNET
	Creel:DFO correction factor	Logbook MSW:1SW	Creel river MSW:1SW	Creel:DFO correction factor	MSW:1SW
1988					
Summer	1.30	2.22	0.52	0.765	N/O
Fall	1.50	2.94	0.80	0.62	1.00
1987					
Fall	1.20	4.00	5.74	2.00	6.60

Table 11. Adjusted DFO and Nova Scotia license stub (STUB) return 1SW and MSW catch statistics. Values given in Table 10 have been applied to catch estimates. 1SW creel DFO: correction, logbook MSW:1SW, and Creel river MSW:1SW have been applied to 1SW catch estimates; MSW creel:DFO correction has been applied to DFO MSW catch estimates Stub values for 1988 are preliminary. Stub summer and fall catches calculated using proportions caught in summer and fall using DFO statistics.

	1SW			MSW		
Season	Catch estimate	Adjusted Creel:DFO correction factor	Adjusted Logbook MSW:1SW	Adjusted Creel river MSW:1SW	Adjusted Creel:DFO correction factor	Catch estimate
1988						
Summer						
DFO	287	373 ¹	828	194	190 ¹	293
STUB	465	N/A	1,032	242	N/A	890
Fall						
DFO	148	222 ¹	653	178	178 ¹	287
STUB	239	N/A	703	191	N/A	856
1987						
Fall						
DFO	98	118	472	677	570	285
STUB	198	N/A	792	1,137	N/A	1,300

¹ Adjusted sport catch determined to be most reliable.

Table 12. Schaefer and Peterson estimates from trappnet and angling data. A 15% tag removal factor was used to reduce tags available in trappnet estimate and a 26% factor was used in angling estimate.

Recovery Period	TRAP				Cj/Rj	Recovery Period	ANGLING		Cj	Total fish recovered	Cj/Rj											
	Tag Period		Tagged fish recovered	Total fish recovered			Tag Period															
	902-923	924-1014					902-923	924-1014														
903- 924	3	0	3	60	20.0	903- 924	2	0	2	38	19.0											
925-1015	2	2	4	73	18.25	925-1015	2	2	4	39	9.75											
Tagged fish recovered	Ri	2	7	--	----	Tagged fish recovered	Ri	2	6	--	----											
Total fish tagged	Mi	94	-	--	----	Total fish tagged	Mi	124	-	--	----											
Mi/Ri		11.2	47.0	--	----	Mi/Ri		62.0	-	--	----											
<table border="0" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:30%;"></td> <td style="text-align: center;">Schaefer Estimate</td> <td style="text-align: center;">Schaefer Estimate</td> </tr> <tr> <td style="text-align: center;">902-923</td> <td style="text-align: center;">924-1014</td> <td style="text-align: center;">902-923</td> <td style="text-align: center;">924-1014</td> </tr> <tr> <td style="text-align: center;">TOTAL</td> <td style="text-align: center;">TOTAL</td> <td style="text-align: center;">TOTAL</td> <td style="text-align: center;">TOTAL</td> </tr> </table>													Schaefer Estimate	Schaefer Estimate	902-923	924-1014	902-923	924-1014	TOTAL	TOTAL	TOTAL	TOTAL
	Schaefer Estimate	Schaefer Estimate																				
902-923	924-1014	902-923	924-1014																			
TOTAL	TOTAL	TOTAL	TOTAL																			
903- 924	672	0	672	903- 924	893	0	893															
925-1015	409	1716	2125	925-1015	458	1209	1667															
TOTAL	1081	1716	2797	TOTAL	1351	1209	2560															
Peterson Estimate				Peterson Estimate																		
M=150	151 X 134/B = 2529			M=218	219 X 78/7 = 2440																	
C=133				C= 77																		
R= 7	95% C.I. (1405-7226)			R= 6	95% C.I. (1303-7765)																	

Table 13. Numbers of 1SW and MSW salmon determined from MSW and 1SW percentages in trapnet; for each tagging period. Numbers in parentheses are percentages of 1SW and MSW salmon for each tagging period.

Numbers of 1SW and MSW from Trapnet proportions

	LOWER TRAP		ANGLING		TOTAL
	Tagging Period		Upper and Lower Traps Tagging Period		
	902-923	924-1014	902-923	924-1014	
1SW	42(63.6)	43(39.1)	85	15W	143
MSW	24(36.4)	67(60.9)	91	MSW	144
TOTAL	66	110	TOTAL	124	163
	Estimate		Estimate		
	902-923	924-1014	TOTAL	902-923	924-1014
1SW	688	671	1359	925	430
MSW	393	1045	1438	426	779
TOTAL	1081	1716	2797	1351	1209
			TOTAL	1351	1209
				TOTAL	2560

Table 14. Tags returned from non-logbook and logbook anglers on Margaree River, 1988.

Tagging Period	Non-logbook anglers 67% reported		Adjusted tag returns from others		Logbook anglers 100% reported		Total estimated tags returned	
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW
830- 913	3	1	9	2	13	3	16	4
914- 929	1	0	2	3	3	4	4	4
930-1014	1	1	0	0	0	0	1	1

Table 15. Numbers of 1SW and MSW salmon tagged in three tagging periods. Exploitation rate determined using adjusted tags/total estimated tags returned (Table 14).

Tagging Period	Fish tagged		Adjusted tags (26%) ¹		Exploitation rate (%)		
	1SW	MSW	1SW	MSW	1SW	MSW	ALL
830- 913	74	26	55	19	29	21	27
914- 929	52	38	38	28	11	14	12
930-1014	47	91	35	67	3	1	2
TOTAL	173	155	128	114	16	8	12

¹ (26%) refers to estimate of tags lost prior to recapture in angling fishery.

Table 16. Estimated Atlantic salmon egg deposition in the Margaree River
 A) from 1947-1988 using non-adjusted DFO statistics and from 1987-9188 for adjusted DFO statistics. Section B provides egg deposition based on spawners calculated from mark-recapture experiment. Exploitation rates (20.6 and 37.9%) used in past assessments have been used to estimate potential MSW and 1SW salmon spawners. Fecundity rates used to calculate egg deposition were 6,482 eggs/MSW and 330 eggs/1SW. Egg deposition requirements are 6,714,600 eggs. * indicates years in which spawning requirements have been met. N/C, no collection made; N/A, data not available.

A) Eggs X 10⁶

Year	Collected for hatchery	MSW (20.6)	1SW (20.6)	Total	MSW (37.9)	1SW (37.9)	Total
1947	5.00	9.07	0.05	4.12	3.86	0.02	-
1948	4.50	17.58	0.13	13.21*	7.48	0.06	3.04
1949	2.80	8.30	0.64	6.14	3.58	0.03	0.76
1950	N/C	7.99	0.15	8.14*	3.40	0.06	3.46
1951	N/C	10.59	0.58	11.17*	4.50	0.02	4.52
1952	N/C	5.09	0.11	5.20	2.16	0.05	2.21
1953	N/C	7.27	0.73	8.00*	3.09	0.03	3.12
1954	N/C	7.45	0.99	8.44*	3.16	0.04	3.20
1955	0.50	6.44	0.67	6.61	2.74	0.03	2.27
1956	3.50	2.25	0.76	-	0.95	0.02	-
1957	0.90	3.40	0.46	2.96	1.45	0.02	0.50
1958	1.00	N/A	N/A	N/A	N/A	N/A	N/A
1959	0.50	N/A	N/A	N/A	N/A	N/A	N/A
1960	1.50	N/A	N/A	N/A	N/A	N/A	N/A
1961	2.00	1.23	0.51	-	0.52	0.02	-
1962	0.30	10.24	0.51	10.45*	4.36	0.02	4.08
1963	1.10	5.30	0.11	4.31	2.25	0.05	1.20
1964	0.40	7.22	0.15	6.97*	3.07	0.07	2.74
1965	0.60	6.35	0.11	5.86	2.70	0.05	2.15
1966	0.40	4.12	0.12	3.84	1.75	0.05	1.40
1967	0.20	5.24	0.12	5.16	2.23	0.05	2.08
1968	0.40	4.92	0.08	4.60	2.09	0.03	1.72
1969	0.35	3.40	0.26	3.31	1.45	0.11	1.21
1970	0.20	5.35	0.11	5.26	2.28	0.05	2.13
1971	0.05	2.30	0.03	2.28	0.98	0.01	0.94
1972	0.10	2.65	0.05	2.60	1.13	0.02	1.05
1973	0.10	2.90	0.21	3.01	1.23	0.09	1.22
1974	N/C	2.67	0.07	2.74	1.13	0.03	1.16
1975	0.05	1.60	0.05	1.60	0.68	0.02	0.65
1976	N/C	2.05	0.12	2.17	0.87	0.05	0.92
1977	N/C	3.50	0.09	3.59	1.48	0.04	1.52
1978	0.10	3.95	0.03	3.88	1.68	0.01	1.59
1979	N/C	2.15	0.77	2.92	0.99	0.33	1.32
1980	0.10	3.51	0.21	3.62	1.50	0.09	1.49
1981	0.05	3.69	1.14	4.78	1.70	0.50	2.15
1982	0.20	4.97	0.88	5.65	2.39	0.37	2.56
1983	0.10	4.00	0.09	3.99	1.86	0.04	1.80

Table 16 (continued)

Eggs X 10 ⁶							
Year	Collected for hatchery	MSW (20.6)	1SW (20.6)	Total	MSW (37.9)	1SW (37.9)	Total
1984	0.10	3.73	0.19	3.82	1.99	0.08	1.97
1985	0.15	9.82	0.28	9.95*	5.34	0.12	5.31
1986	0.15	23.73	0.38	23.96*	12.89	0.15	12.89*
1987	0.15	12.84	0.45	13.14*	6.98	0.19	7.02*
1988	0.30	18.25	0.55	18.50*	9.92	0.10	9.72*
Adjusted							
1987	0.15	25.68	0.53	26.06*	13.96	0.23	14.04*
1988	0.30	11.61	0.76	12.07*	6.31	0.32	6.33

B)

**Mark-Recapture
Spawners**

	MSW	1SW	TOTAL
1988 ¹	18.83	1.07	19.90
1988 ²	18.90	1.01	19.91

¹ Angling removals based on non-adjusted DFO catch.

² Angling removals based on adjusted DFO catch.

Table 17. Numbers of wild and hatchery salmon from summer and fall sampling on Margaree River in 1988. Numbers in parentheses indicate percentages of wild and hatchery fish for each category.

Season	1SW		MSW	
	Wild	Hatchery	Wild	Hatchery
SUMMER				
June 1 - Aug. 31				
Angling	44	19	33	17
Broodstock	5	5	44	18
Trapnets	18	0	2	1
Summer Total	67	24	79	36
FALL				
Sept. 1 - Oct. 21				
Angling	18	4	36	4
Trapnets	178	2	170	1
Fall Total	196	6	206	5

Table 18. Percentage of wild and hatchery fish returning to Margaree River in 1987 and 1988. Percentages are based on angling, broodstock, and trapnet samples.

Season	1SW		MSW	
	Wild	Hatchery	Wild	Hatchery
1987				
SUMMER	37	63	60	40
FALL	69	31	96	4
TOTAL ¹	45	55	85	15
1988				
SUMMER	74	26	69	31
FALL	97	3	98	2
TOTAL ¹	82	18	83	17

¹ Total percentages calculated from angling catches in Table 4.

Table 19. Numbers of salmon smolt and parr released to Margaree River since 1976. MAR, Margaree; RB, Rocky Brook; COB, Cobeguid; MER, Mersey.

Year	Rearing location	Smolt						Parr						
		2+		1+		0+		1+		0+				
		MAR	RB	MAR	RB	MAR	RB	MAR	RB	MAR	RB			
1976	MAR	8,971												
1977	MAR					5,022								
1978	COB		15,250											
1979	COB		15,927 ¹											
1980	COB		14,960											
1981	COB		15,950											
1982	MER			8,481		1,098								
1983	COB	13,486												
1983	MAR	3,783												9,853
1984	MAR													
1984	MER			14,483				10,195 ²						
1985	COB	11,210												
1985	MAR			2,669	1,303					5,882	834			
1986	COB	13,660								7,820	5,860			
1986	MAR			2,105						8,754				
1987	COB	8,820	9,684											25,000
1987	MAR	6,369								5,400				6,750
1988	COB	18,337												40,000
1988	MAR	4,136								2,201				12,429
1988	COB	12,785												40,000
														6,000

1 Millbank broodstock

2 Rocky Brook x Margaree broodstock

Table 20. Mean lengths and age for virgin 15W salmon sampled on Margaree River 1986-1988. Parentheses indicate number of wild fish sampled. 1988 samples have not yet been aged.

Season	Year							
	1988		1987			1986		
	Smolt Age ALL	Smolt age			Smolt age			
		2	3	ALL	2	3	ALL	
June 1 - Aug. 31	N	108	45(14)	21(15)	98	---	1	---
	MEAN	54.4	54.3	54.4	54.2	---	56.0	---
	STD	2.75	2.96	3.61	3.26	---	---	---
Sept. 1 - Oct. 30	N	195	14(12)	6(5)	20	3	---	---
	MEAN	56.0	55.0	55.5	55.2	59.0	---	---
	STD	3.01	2.54	4.09	2.98	2.65	---	---
Total	N	303	59(26)	27(20)	118	---	---	4
	MEAN	55.4	54.4	54.6	54.4	---	---	58.3
	STD	3.01	2.86	3.67	3.22	---	---	2.63

Table 21. Mean lengths and age for virgin MSW salmon sampled on Margaree River 1986-1988. Numbers in parentheses are wild fish sample sizes. 1988 samples have not yet been aged.

		Year											
		1988				1987				1986			
		Sea Age				Sea Age				Sea Age			
		Smolt Age				Smolt Age				Smolt Age			
Season		2	3	4	ALL	2	3	4	ALL	2	3	4	ALL
June 1 - Aug. 31	N	21	32(25)	8(6)	45	45	(3)	---	3	19(4)	12(11)	34	(2)
	MEAN	80.3	75.0	74.1	74.6	84.3	84.3	---	84.3	76.7	76.1	76.5	79.0
	STD	8.88	3.79	3.31	3.51	8.96	8.96	---	8.96	3.27	3.03	3.05	12.73
Sept. 1 - Oct. 30	N	171	49(47)	24(23)	87	87	(3)	(2)	9	---	---	---	---
	MEAN	79.2	76.2	76.9	76.5	93.3	90.0	90.0	90.7	---	---	---	---
	STD	8.38	3.84	4.71	4.11	4.51	14.14	14.14	5.92	---	---	---	---
Total	N	192	81(72)	32(29)	132	(6)	(2)	12	19	12	34	2	2
	MEAN	79.3	75.7	76.2	75.9	88.8	90.0	89.1	76.7	76.1	76.5	79.0	79.0
	STD	8.42	3.84	4.52	4.00	8.04	14.14	6.95	3.27	3.03	3.05	12.73	12.73

Table 22. Mean lengths and age for repeat spawning 1SW and MSW salmon sampled on Margaree River 1986-1987. Numbers in parentheses are wild fish sample sizes. First number in sea age designates age at first spawning. Subsequent numbers indicate sea age at repeat spawning.

Season	1987		1986	
	Sea Age	Sea Age	Sea Age	Sea Age
	12	13 23 23 24	245	
		Smolt Age		Smolt Age
	3 UNK 2 3 UNK 2 2			2
June 1 - Aug. 31	N	(1)	(1)	(1)
	MEAN	90.0	90.0	77.0
	STD	---	---	---
Sept. 1 - Oct. 30	N	(1) (1) (2) (1) (1)	(2) (1)	(1)
	MEAN	60.0 78.0 79.0 81.0 91.0 92.0 105.0	91.0 105.0	---
	STD	---	1.41	---
TOTAL	N	(1) 1 (1) (1) (2) (1)	(2) (1)	(1)
	MEAN	60.0 78.0 79.0 81.0 91.0 91.0 105.0	91.0 105.0	77.0
	STD	---	---	---

Table 23. Tagged fish from Margaree system recovered in distant fisheries from 1986-1988.

Stock	Stage	Number tagged	Release date	Recovery date	Recovery location	Ave. FL (cm)	Wt. (Kg)	Sex M:F	Number recovered
Rocky Brook (h)	2+ smolt	13,279	May 1986	June 25, 26, 1987	Twillingate, NFLd.	53.0	1.85	1:0	2
				Aug. 31 - Sept. 1 1987	Sisimiut 1B, Greenland	----	----	----	3
				Sept. 2, 4, 1987	Nuuk 1D, Greenland	----	----	----	3
				Aug. 29, Sept. 2 1987	Paamiut 1E, Greenland	66.0	2.99	----	3
				Aug. 29, 1987	Narsaqif 1F, Greenland	66.0	3.18	----	1
				Aug. 25, 1987	Makkovik, Labrador	67.0	2.72	----	1
Margaree	2+ smolt	900	May 1988	Aug. 29, 1987	Sisimiut 1B, Greenland	62.0	1.9	----	1
Margaree	2SW bright	116	Oct. 1987	June 25, 1988	Bull Cove, PQ	----	----	----	1
				Aug. 8, 1988	St. Augustine, PQ	--	----	----	1
				June 28, 1988	St. Juliens, NFLd.	----	----	----	1
				Aug. 8, 1988	Cook's Harbour, NFLd.	----	----	----	1

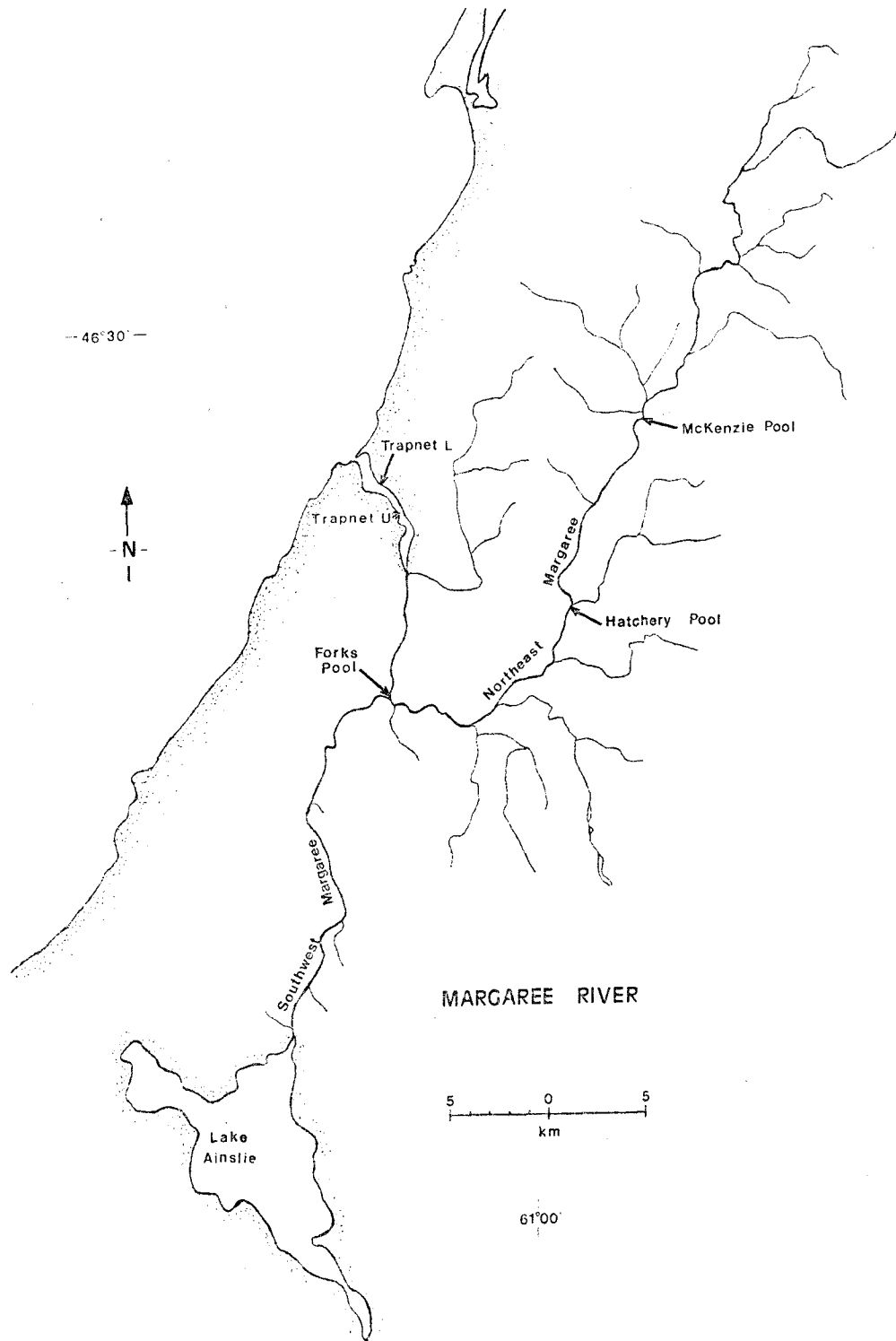


Fig. 1. Location of trapnets, Forks Pool creel, and broodstock collection sites (Hatchery and McKenzie Pools), Margaree River, 1988. Trapnet L; Lower net. Trapnet U; Upper net.

JANUARY							JANVIER							FEBRUARY							FEVRIER							MARCH							MARS						
							1 2							1 2 3 4 5 6							1 2 3 4 5																				
							001 002							032 033 034 035 036 037							061 062 063 064 065																				
3	4	5	6	7	8	9	3	4	5	6	7	8	9	7	8	9	10	11	12	13	6	7	8	9	10	11	12	6	7	8	9	10	11	12							
003	004	005	006	007	008	009	038	039	040	041	042	043	044	066	067	068	069	070	071	072	066	067	068	069	070	071	072														
10	11	12	13	14	15	16	14	15	16	17	18	19	20	13	14	15	16	17	18	19	13	14	15	16	17	18	19														
010	011	012	013	014	015	016	045	046	047	048	049	050	051	073	074	075	076	077	078	079	073	074	075	076	077	078	079														
17	18	19	20	21	22	23	21	22	23	24	25	26	27	20	21	22	23	24	25	26	20	21	22	23	24	25	26														
017	018	019	020	021	022	023	052	053	054	055	056	057	058	080	081	082	083	084	085	086	080	081	082	083	084	085	086														
24	25	26	27	28	29	30	28	29	27	28	29	30	31	27	28	29	30	31																							
024	025	026	027	028	029	030	059	060	087	088	089	090	091																												
APRIL							AVRIL							MAY							MAI							JUNE							JUIN						
							1 2							1 2 3 4 5 6 7							1 2 3 4																				
							092 093							122 123 124 125 126 127 128							153 154																				
3	4	5	6	7	8	9	3	4	5	6	7	8	9	8	9	10	11	12	13	14	5	6	7	5	6	7	8	9	10												
094	095	096	097	098	099	100	129	130	131	132	133	134	135	157	158	159	160	161	162	163	157	158	159	160	161	162	163														
10	11	12	13	14	15	16	15	16	17	18	19	20	21	13	14	15	16	17	18	13	14	15	16	17	18																
101	102	103	104	105	106	107	136	137	138	139	140	141	142	164	165	166	167	168	169	170	164	165	166	167	168	169	170														
17	18	19	20	21	22	23	22	23	24	25	26	27	28	21	22	23	24	25	26	27	21	22	23	24	25	26	27														
108	109	110	111	112	113	114	143	144	145	146	147	148	149	171	172	173	174	175	176	171	172	173	174	175	176																
24	25	26	27	28	29	30	29	30	31	26	27	28	29	30	26	27	28	29	30	26	27	28	29	30																	
115	116	117	118	119	120	121	150	151	152	179	180																														
JULY							JUILLET							AUGUST							AOÛT							SEPTEMBER							SEPTEMBRE						
							1 2							1 2 3 4 5							1 2 3 4 5							1 2 3 4 5													
							184							214							245							274													
6	7	8	9	10	11	12	6	7	8	9	10	11	12	6	7	8	9	10	11	12	6	7	8	9	10	11	12														
185	186	187	188	189	190	221	222	223	224	225	246	247	248	249	250	251	252	253	275	276	277	278	279	280	281																
13	14	15	16	17	18	19	15	16	17	18	19	20	21	13	14	15	16	17	18	19	13	14	15	16	17	18	19														
191	192	193	194	195	196	197	227	228	229	230	231	232	233	254	255	256	257	258	259	260	282	283	284	285	286	287	288														
18	19	20	21	22	23	24	22	23	24	25	26	27	28	20	21	22	23	24	25	26	20	21	22	23	24	25	26														
199	200	201	202	203	204	205	234	235	236	237	238	239	240	262	263	264	265	266	267	289	290	291	292	293	294	295															
24	25	26	27	28	29	30	28	29	30	31	25	26	27	28	29	25	26	27	28	29	25	26	27	28	29	30	31														
206	207	208	209	210	211	212	241	242	243	244	269	270	271	272	273	274																									
OCTOBER							OCTOBRE							NOVEMBER							NOVEMBRE							DECEMBER							DECEMBRE						
							1 2							1 2 3 4 5							1 2 3																				
							275							306 307 308 309 310							336 337 338																				
3	4	5	6	7	8	9	3	4	5	6	7	8	9	4	5	6	7	8	9	10	4	5	6	7	8	9	10														
276	277	278	279	280	281	282	311	312	313	314	315	316	317	339	340	341	342	343	344	345	339	340	341	342	343	344	345														
10	11	12	13	14	15	16	13	14	15	16	17	18	19	11	12	13	14	15	16	17	11	12	13	14	15	16	17														
283	284	285	286	287	288	289	318	319	320	321	322	323	324	346	347	348	349	350	351	352	346	347	348	349	350	351	352														
16	17	18	19	20	21	22	20	21	22	23	24	25	26	18	19	20	21	22	23	24	18	19	20	21	22	23	24														
290	291	292	293	294	295	296	325	326	327	328	329	330	331	353	354	355	356	357	358	359	353	354	355	356	357	358	359														
24	25	26	27	28	29	30	28	29	30	25	26	27	28	29	30	25	26	27	28	29	30	31	25	26	27	28	29	30	31												
297	298	299	300	301	302	303	332	333	334	335	360	361	362	363	364	365	366																								

Fig. 2. Days and time periods for Forks Pool creel. Upper triangle denotes AM and lower triangle PM creel.

1988 FORKS POOL CREEL

ANGLER INTERVIEW FORM

Day _____ Month _____

CATCH INFORMATION

Angler #	Begin Fishing	End Fishing	Catch G/S	Kept	Not Kept			Adipose Fin P/A	Fork Lgth	Wght	Sex	Scale Sample	Tag #	Comment
					RH	CL	LO							

For CATCH, code as follows: Grilse = G
Salmon = S
No Catch = NC
Don't Know = ? check off 'LO' column under 'NOT KEPT'

Fig. 3. Angler interview form used in Forks Pool creel, 1988.

VOLUNTEER ANGLING LOGBOOK

NAME _____

These columns must be filled each time you go fishing.

Date	Fishing Time		Location Fished	Grilse Retained				Salmon And Grilse Released				Comments (Tag No. Etc.)		
	Start AM/PM	Finish AM/PM		Fork Length	Sex	Adipose Fin Pres./Abs.	Location Caught	Grilse/Salmon	Adipose Fin Pres./Abs.	Release Method Check One			Location Released	
										RII	CL			LU

RECORD ALL DAYS FISHING EVEN IF YOU HAD NO CATCH

Fig. 4. Volunteer angling forms used on Margaree River, 1988.

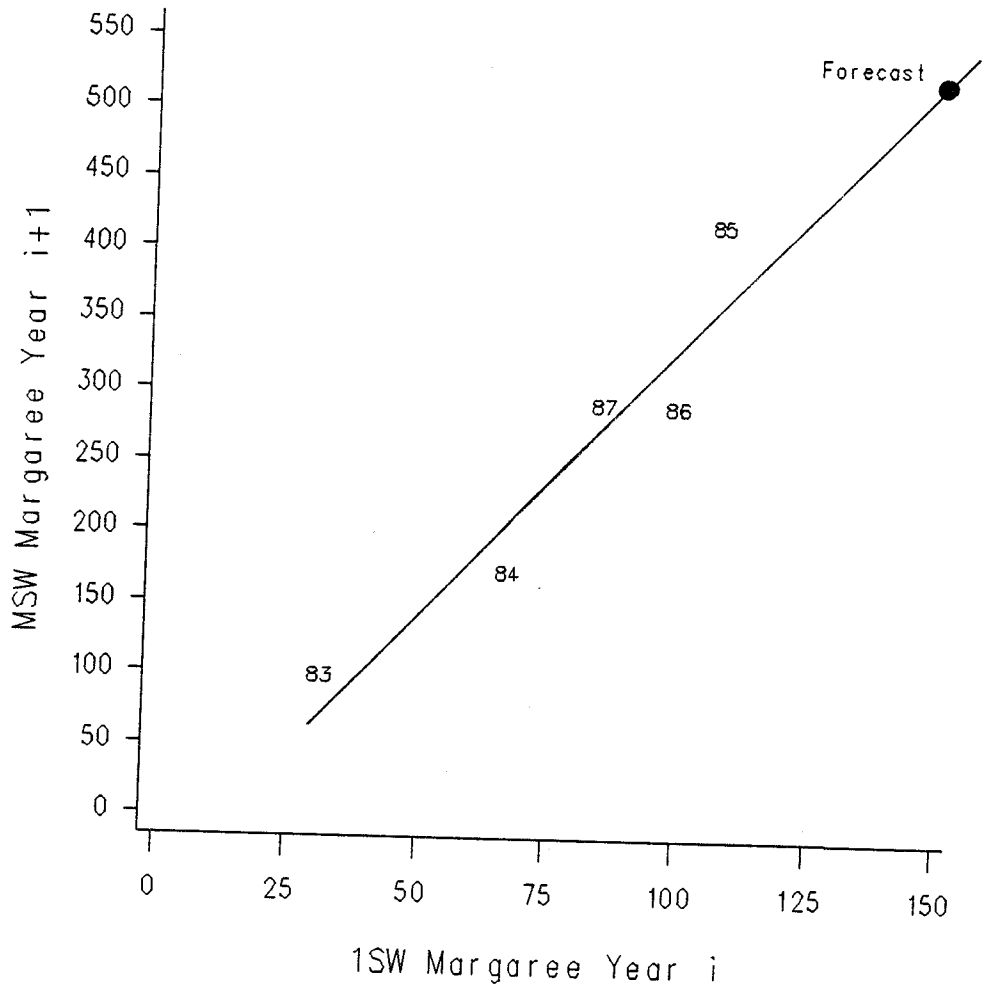


Fig. 5. Forecast of Fall 1989 MSW DFO sport catch. MSW salmon $(i+1) = 3.82 \times 1SW \text{ salmon } (i) - 47.58$, $R^2=0.88$, $p=0.0178$.