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Assessment of the Atlantic salmon (Salmo salar) stock of the Margaree River, Nova Scotia, 1994

by

R.R. Claytor, R. Jones, P. LeBlanc, L. Forsyth, and G. Chaput
Department of Fisheries & Oceans
Science Branch, Gulf Region
P.O. Box 5030
Moncton, New Brunswick, E1C 9B6

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ABSTRACT

Spawning escapement for large salmon in 1994 was 2759, exceeding the spawning requirement of 1036 large salmon. Small salmon spawning escapement was 390 which did not exceed the spawning target of 582 for small salmon. The Margaree salmon stock is currently considered to be in a healthy condition because large salmon spawning requirements have been met in each of the last 10 years and small salmon spawning requirements have been met in 5 of the last 10 years. In general, 80% to 90% of the eggs deposited in the system come from large salmon.

Forecasts for 1995, using stock-recruitment relationships are between 2700 and 4600 large salmon. These forecasts are well above spawning targets. Allocations based on these forecasted surpluses should take into account average run-timing as they have in the past.

Total harvests in First Nation food fisheries were 14 small salmon and 50 large salmon in 1994. Recreational catches of small salmon were 434, about 40% less than in 1993. Hook and release of large salmon was 1466, about 30% above 1993 values.

Early run spawning requirements could be based on the rearing area above the sanctuary headwaters and measured against returns to the estuary by July 15.

RÉSUMÉ

L'échappée de frai de gros saumons a atteint 2 759 individus en 1994, soit 1 036 gros saumons de plus que l'objectif fixé. L'échappée de petits saumons, de 390, a été inférieur à l'objectif, de 582 poissons. Le stock de saumon de la Margaree semble actuellement en bon état car les besoins en gros géniteurs ont été comblés au cours de chacune des 10 dernières années et ceux en petits saumons l'ont été au cours de 5 de ces années. De façon générale, de 80 % à 90 % des oeufs du bassin provenaient de gros saumons.

Les relations stock-recrutement permettent de prévoir une échappée se situant entre 2 700 et 4 600 gros saumons pour 1995. Cette valeur est de beaucoup supérieure à l'objectif de frai. Les allocations reposant sur cet excédent prévu devraient, comme par le passé, tenir compte du moment moyen de la remontée.

La récolte totale de la pêche d'alimentation des Premières nations a été de 14 petits saumons et de 50 gros saumons en 1994. Les prises de petits saumons de la pêche récréative ont atteint 434 poissons, soit 40 % environ de moins qu'en 1993. En tout, 1 466 gros saumons ont été capturés et remis à l'eau, soit 30 % environ de plus qu'en 1993.

Les besoins de géniteurs de la remontée hâtive pourraient être déterminés en fonction de la zone de croissance située en amont des eaux d'amont protégées et être évalués d'après la remontée dans l'estuaire au 15 juillet.

SUMMARY SHEET

STOCK: Margaree River (SFA 18)
TARGET: 6.7 million eggs (1,036 large, 582 small salmon)

Year	1989	1990[1]	1991	1992	1993	1994	MIN[2]	MAX[2]	MEAN[2]
Angling harvest[3]									
Large	1570	1507	1757	1938	1102	1466	1102	2636	1575
Small	561	649	752	678	777	434	434	977	683
Native harvest									
Large	-	-	1	-	58	50			-
Small	-	-	2	-	8	14			-
Total returns									
Large	2289	5156	3484	6375	3358	2900	1462	6375	4132
small	768	1977	1909	1645	2087	708	708	2209	1677
Spawning escapement									
Large	2164	5022	3323	6222	3224	2759	1378	6222	3991
Small[4]	328	1471	1340	1088	1504	390	328	1504	1146
% of Egg target met (Large)									
	209	485	321	601	311	266	133	601	385

[1] Total returns and spawning escapement estimates for 1990 have been revised using average trapnet efficiencies.

[2] Min, Max are for 1985 to 1994. Mean for 1989 to 1993.

[3] All angling catches are NS license stub estimates. Angling catches for large salmon are hook and release estimates.

[4] Small spawning escapement has been updated, as previous removal estimates included both retained and released small salmon. Updated estimate removes retained and applies a 5% hook and release mortality rate to the released fish.

Description of fisheries: Harvests occurred in recreational and First Nation fisheries. Recreational season was from June 1 to Oct. 15 with an extension in the lower part of the river to Oct. 30. Food fishery agreements were signed with Wagmatcook, Membertou, Chapel Island, Eskasoni, and Waycobah First Nations. Wagmatcook and Membertou were the only First Nations to fish and all their harvest occurred in the fall.

Target: Based on 2.4 eggs/m^2.

Fishery Data: Depends on voluntary sampling in First Nation fisheries and angler logbooks. Abundance indices from angling are more similar to population estimates for small than for large salmon.

Research Data: Tagging at estuarial trap and recaptures at Lake O'Law counting fence and logbook anglers provide raw data for population estimates by mark-recapture methods. Electrofishing surveys provide information on juvenile populations. Most small salmon enter the river in the summer, most large salmon in the fall. Juvenile densities are consistent with spawning requirements being met in recent years.

Estimation of stock parameters: Population is estimated using mark-recapture techniques. The assumption of equal mixing and vulnerability is tested by comparing tagged to total catch ratios from Lake O'Law fence and angler logbooks, tag loss is estimated by experiments at the hatchery, and sampling intensity is tested by simulations. These requirements were found to be satisfied.

Assessment results: Large salmon spawning escapement exceeded requirements but small salmon did not. Large salmon have exceeded requirements each year since 1985, small salmon requirements have been met in 5 of the last 10 years.

Ecological considerations: Temperatures in all parts of the river were higher in 1994 than 1993. Stream discharge was among the lowest and summer returns were the latest on record.

Future prospects: Forecasts for 1995 are 2731 large salmon using a Ricker stock-recruitment model, 4236 large salmon using a Beverton-Holt model, and 4687 using a Tabular model.

Management considerations: Forecasts are well above spawning targets. Allocations based on these forecasted surpluses should take into account average run-timing as they have in the past.

INTRODUCTION

The objective of this Margaree River Atlantic salmon stock assessment is to estimate spawning escapement, compare it to the target spawning escapement of the river, and provide a forecast for large salmon returns in 1995.

The principle issue investigated in the assessment is the status of early returning salmon to the Margaree River and an evaluation of the spawning escapement target based on 2.4 eggs/m^2. Although numbers of salmon returning early, before August 31, and those returning late, after September 1 have been reported in past assessments, it has only been possible to compare spawning escapements against a target for complete returns (Gray and Chadwick 1984; Claytor and Chadwick 1985; Claytor and Léger 1986; Claytor et al. 1987; Claytor and Chaput 1988; Claytor and Jones 1990; Chaput and Jones 1991; and Chaput et al. 1992, 1993, 1994). These estimates of spawning escapement indicate that requirements have been exceeded for the entire population each year since 1985. Salmon returning early in the year are of greatest interest to user groups and a separate assessment of this group of fish has been requested. Establishing a target spawning escapement for seasonally returning fish requires that fish returning in each season spawn at separate locations or times. Stock recruitment relationships are examined to determine if target spawning escapements other than those based on 2.4 eggs/m^2 are appropriate.

New analysis in this assessment concentrates on establishing an initial target for early returning salmon. Tag return data are summarized by date of tagging and location and date of recapture in order to determine if there is spatial or temporal segregation of early and late returning salmon that would help establish definitions and targets for these groups.

DESCRIPTION OF FISHERIES

Salmon in the Margaree River were harvested in a recreational fishery and First Nation food fishery.

Regulations

Recreational fishery regulations were the same in 1994 as 1993. There was a daily limit of 2 small salmon that could be retained and a maximum of 8 small salmon that could be retained in a year. All large salmon must be released in the recreational fishery. The season remained the same and opened June 1 and closed Oct. 31. The recreational fishery is not limited by total quota or effort limits. In 1994, the season was extended to October 31 as in 1993 but the river was open up to Ross Bridge. In previous years, it was only open up to Cranton Bridge during extensions (Table 1, Fig. 1).

Food fishery agreements were signed with all five Cape Breton First Nations; Wagmatcook, Membertou, Chapel Island, Eskasoni, and Waycobah. Allocations for the Margaree were 130 small and 650 large salmon and gear was restricted to trapnets, angling, and seining (Table 2).

Harvests

Wagmatcook and Membertou were the only First Nations to harvest salmon from the Margaree in 1994 (Table 3). Total harvests by First Nations were 14 small salmon and 50 large salmon in 1994. In 1993, 8 small salmon and 58 large salmon were harvested by First Nations.

Recreational fishery catches are available from two sources: DFO Conservation and Protection Officers (DFO) and Nova Scotia License stub returns (STUBS). DFO under-estimates catch because officers have other duties which interfere with an unbiased collection of total catch. DFO statistics do, however, provide a relative index of annual trends and provide in-season information on angling activity by day and pool location of catch (Chaput and Claytor 1988). In recent years this information is available only for small salmon. In 1994, DFO estimates of small salmon caught were 175, compared to mean catches from 1989 to 1993 of 228 (Table 4).

STUB estimates can provide seasonal information for small salmon kept and released but large salmon hook and release estimates are available only as annual totals (O'Neil et al. 1991). In 1994, catches of small salmon were half those in 1993 and the 1989 to 1993 mean (Table 5). Catches of large salmon were above 1993 catches and similar to the 1989 to 1993 mean (Table 5). Effort and numbers of anglers, were both less than 1993 and 1989 to 1993 mean levels (Table 5).

TARGET

The conservation spawning escapement target for the entire Margaree River system is based on a target egg deposition of 2.4 eggs/m^2 and historical biological characteristics. The rearing area for the system is 27,976 units of habitat with each unit equal to 100 m^2 (Table 6). This egg deposition rate and number of rearing units converts to a target spawning escapement requirement for the Margaree River of 582 small salmon and 1036 large salmon (Table 7).

FISHERY DATA

Data on the biological characteristics of First Nation and recreational catches and abundance indices in the recreational fishery come from volunteer programs.

First Nation catch is voluntarily brought to the DFO lab trailer in Margaree Forks where DFO personnel process the fish for length, weight, sex, wild or hatchery origin, scale samples, and fecundity (Table 3).

Two voluntary programs associated with the recreational fishery provide abundance indices and scale samples that can be used for aging.

A volunteer salmon check-in program (SCIP) has been conducted on the Margaree since 1991 at five sites on the Margaree River. Scale samples are collected from these fish and number of fish registered may serve as an additional index of in-season angling success along with DFO angling stats. Small salmon reported to SCIP stations in 1994 were 70% lower than 1993 and 60% lower than 1991 to 1993 mean values (Table 8).

Voluntary angling logbooks provide an abundance index, tag returns for population estimation, and scale samples for aging. In 1994, the catch rate (CPUE) for anglers keeping logbooks was 0.040 small salmon per rod-day, considerably lower than 1991 to 1993 small salmon CPUEs (0.071 to 0.085) (Table 9). Large salmon CPUE by logbook anglers was 0.216 large salmon per rod-day, this is similar to the highest CPUEs from 1991 to 1993 (0.090 to 0.258) and much higher than the CPUE in 1993 of 0.090 (Table 9).

Logbooks also provide information on the percentage of wild and hatchery fish caught in the angling fishery from 1989 to 1994. During the summer, wild small salmon have made up 43% to 81% of the catch, while during the fall, wild small salmon have made up 75% to 89% of the catch (Table 10). During the summer,

wild large salmon have made up 63% to 100% of the catch and 90% to 94% of the fall catch (Table 10).

RESEARCH DATA

Research data from trapnets, Lake O'Law counting fence, and snorkel counts provide information on adult biological characteristics. Tagging and recapture of tags from logbook anglers and Lake O'Law counting fence provide the raw data for population estimates. Electrofishing surveys provide information on the juvenile salmon populations in the Margaree River.

There have been four trapnets operated in the Margaree River for assessment purposes since 1988 (Fig. 2). Levi's trap has been used as the principle index trap for tagging fish and providing in-season information on returns to the river (Table 11). The percentage of small salmon which return to the river by August 31 has ranged from 32% to 65% from 1992 to 1994 (Table 12). In 1993 and 1994, 35% to 41% of the small salmon returned in the fall but in 1992, 68% of the small salmon returned in the fall (Table 12). For large salmon, 21% to 48% had returned to the river by August 31 from 1992 to 1994 and 52% to 79% returned to the river during the fall (Table 12).

With the reduction in distant fisheries no tag returns have been returned from these areas since 1993 (Table 13). This lack of tag returns suggests that reductions in these fisheries have reduced at sea fishing mortality for the Margaree River Atlantic salmon stock. This effect is expected because of additional closures in the Newfoundland salmon fisheries.

Sampling at the trapnets has provided scale samples for determining ages of the Margaree salmon population. Smolts in the Margaree River are predominantly age 2. Age 2 smolts have ranged from 52% to 65% of the one-sea-winter (small) salmon sampled from 1990 to 1993 and from 56% to 70% of the two-sea-winter (large) salmon sampled from 1990 to 1993 (Table 14). Previous spawners have averaged about 74% age 2 smolts (Table 14). The percentage of age 4 smolts has gradually increased to 8% since 1990 in the one-sea-winter salmon samples (Table 14). Hatchery salmon tend to return as one-sea-winter fish with the percentages ranging between 36% and 77% while averaging 65% (Table 15). The opposite is true for wild salmon with an average of 60% returning as maiden two-sea-winter fish (Table 15). Previous spawners have been between 6-8% of those returning adults in any given year between 1990-93 (Table 15).

Length frequency data from the trapnet shows that hatchery small salmon were slightly larger than wild small salmon but hatchery large salmon were smaller than wild large salmon (Fig. 3).

Wild and hatchery smolts and adults are also counted at a fence in Lake O'Law. Counts of large salmon in 1994 were 86 compared to those of 1993 which were 58 (Table 16).

Sampling from all programs provides information on the proportion of wild and hatchery fish in the population. During the summer, 65% of all small salmon sampled were of wild origin and this percentage increased to 83% during the fall. Wild large salmon were 88% of the fish sampled during the summer but 95% during the fall (Table 17).

Snorkel counts have also been made on the river since 1990, except 1993. Counts were highest in 1990 (Table 18).

Juvenile surveys indicate that parr densities are at levels that correspond to spawning escapement having been met in recent years. Parr densities per 100

m^2 range from 33 to 96 at the five sites in 1994 (Table 19). Parr densities at all sites are much higher than they were in the mid-1970s (Chaput and Claytor 1989) when stock size was low (Fig. 4).

ESTIMATION OF STOCK PARAMETERS

Total returns were estimated using mark-recapture techniques as described by Chaput et al. (1994) using the Bayesian estimation procedure derived by Gazey and Staley (1986). All tagging occurred at Levi's trap (Fig. 2). Recaptures came from the Lake O'Law fence and logbook anglers (Table 20).

Large and small salmon returns were estimated using mark-recapture. Small salmon, however, are a low percentage of the population and few tag recoveries are obtained from these salmon. As a result, numbers of small salmon are also estimated using the ratio of small:large salmon at Levi's trap and the population estimate of large salmon. This ratio estimate is the preferred method for small salmon and the one used to determine if small salmon spawning escapement has been met.

In any mark-recapture experiment it is necessary to consider whether or not the assumption of equal mixing and vulnerability of tagged and untagged fish is met, that tag loss and non-reported tags are accounted for, and that the tagging sample and recoveries are in sufficient numbers for the expected size of the population.

The mixing assumption can be tested by examining the percentage of tagged and untagged fish at the two recovery sites. Logbook anglers fish the entire river system while Lake O'Law fence recovers tags from a small portion of the river. The percentage of tagged and untagged fish at these two recovery sites is similar indicating that the mixing assumption is satisfied (Table 20).

Tag loss to the pool of tags in the population may occur because of tag mortality or tags falling off the fish. Experiments at the Margaree hatchery indicate that tag mortality is zero but that tag loss rate is on average 0.01 tags/per day at large. The number of tags available is reduced using the median days to recapture and this tag loss rate.

Simulation experiments examined the percentage of the population that needs to be tagged and recaptured to provide adequate population estimates for past conditions on the Margaree River. These experiments indicate that for the Margaree River there is a high (>90% probability) of being within 25% of the true population value at current levels of tagging and recapture (Table 21). These experiments were done with 100 simulations at two population sizes, 2000 and 4000 fish. The probability of capture for tagging was set and a random selection from a uniform distribution from 0 to 1 was made. If the selection was lower than the probability set the fish was considered tagged or recaptured (Appendix 1).

Revision of 1990 return estimate

The return estimate of large salmon for 1990 was 11,144 (Chaput and Jones 1991). This estimate is almost twice as high the next highest estimate and was based on a small number of tags observed during a creel survey. Trapnets have been in operation on the Margaree for eight years and a greater understanding of the range of efficiencies expected from year to year has been achieved. Accepting the 1990 return estimate requires that the trapnet efficiencies in that year were three to four times less than all other years of operation (Table 22).

This seems unlikely because all other years including the three most recent years when the Levi's trap has been operated for the full year vary only by a factor of two among years (Table 22). Thus, it seems reasonable to re-evaluate this estimate using trapnet efficiencies from the Upper1 fall trapnet catches of 1988, 1989, and 1992 to obtain an estimate of fall returns in 1990.

The efficiencies of the Upper1 trapnet have been used for this re-evaluation because it was operated for one more year than the Lower trapnet (Table 22). Efficiencies for this trap have ranged from 0.04 to 0.06 (Table 22). Using the mid-point between these values provides an estimate of 3300 large salmon returning to the Margaree River in the fall of 1990. The mean percentage of large salmon returning to the river in the fall from 1992 to 1994, the years when a trapnet (Levi's) have been operated for the full year, was 64%. This percentage produces an estimate of 5156 large salmon returning to the Margaree River in 1990. The range on this estimate using the upper and lower limits for trapnet efficiencies and the maximum and minimum percentages of large salmon observed in fall is 3481 to 7933 large salmon (Table 22).

An alternative approach was to estimate large salmon returns using the Nova Scotia license stub return data. This method involved determining the STUB/RETURN ratio using all years except 1990 and using the average STUB/RETURN ratio to estimate 1990 returns (Table 23). This method estimated returns of 2988 large salmon returns to the Margaree River in 1990 (Table 23). This method, however, under-estimates returns (Claytor et al. 1995). The method using the trapnet efficiencies is most similar to current methods estimating returns to the Margaree River and was the estimate adopted for final revisions of the 1990 estimate.

Estimating small salmon returns by the method used in the current assessment, large:small ratio, estimates 1977 small salmon returning using the average trapnet ratio from 1992 to 1994. Using the extreme ratios to provide the widest possible estimate provides ranges of small salmon returns in 1990 of 940 to 5077 (Table 22).

ASSESSMENT RESULTS

Estimated returns to the Margaree River were 2900 large salmon with a 90% confidence interval of 2350 to 4500 and 708 small salmon with a 90% confidence interval of 573 to 1101 (Fig. 5, Table 24). Spawning escapement estimates for large salmon were 2759 with a 90% confidence interval of 2209 to 4359 and 390 small salmon with a 90% confidence interval of 255 to 783 (Table 24). Small salmon returns are the lowest since 1985 (Table 24).

Large salmon exceeded the target spawning escapement of 1036 even at the minimum estimate but small salmon were below the target spawning escapement of 582 (Table 24). Large salmon spawning escapements have ranged from 1378 to 6222 from 1985 to 1994, while small salmon spawning escapements have ranged from 328 to 1504 from 1985 to 1994 (Table 24). Large salmon spawning escapements have been met in each of the last 10 years and small salmon spawning escapements have been met in 5 of the last 10 years (Table 24).

Wild large salmon made up 93% of large salmon total returns in 1994 and have contributed 93% to 97% of the total eggs from 1992 to 1994 (Table 25). Hatchery large salmon made up 7% of large salmon total returns in 1994 and have contributed 3% to 7% of the total eggs from 1992 to 1994 (Table 25).

Trapnet efficiency during the operation of the trap have been either 8% or 16% (Table 26). Population estimates based only on the time Levi's trap was operating have been used to determine trap efficiencies. For this reason,

population estimates in Table 24 differ from those in Table 26 because fish entering the river after trapnet operation had finished were estimated by the mark-recapture procedure.

ECOLOGICAL CONSIDERATIONS

Temperature in all parts of the river were higher in 1994 than 1993 (Figs. 6, 7, 8). Discharge in June was below historical means in 1994 and 17 of the last 19 years were below the long-term mean (Figs. 9, 10). Returns of small and large salmon during the summer were the latest on record (Fig. 11). The relationship between small salmon and discharge is more predictable than large salmon. At low water, small salmon are more likely to be late than early and the opposite is true at high water (Fig. 11). High water in the summer is associated with earlier than average returns and angling catches of large salmon but low water in the summer is as likely to produce early as late returns (Fig. 11). In the fall, low water delays large salmon but high water has no effect on run-timing (Fig. 11).

FORECAST / PROSPECTS

Forecasts for the Margaree River are based on stock-recruitment relationships and range from 2700 to 4600 large salmon returning in 1995 (Table 27). The reason for these differences and the management implications are described below.

Stock recruitment relationships provide the basis for pre-season forecasts on the Margaree River. The stock recruitment relationship is formed by assuming a five year lag between spawning and subsequent return of large salmon recruits to the river. This lag is based on the predominance of 2 year old smolts in the Margaree River. Spawners and recruits have been estimated for the years used in this analysis by Chaput and Jones (1992), and this document (Table 28).

Stock recruitment relationships were examined using four models, Tabular, Ricker, Beverton-Holt, and the Mean. For the Tabular approach the spawning stock was divided into four intervals of 600 spawners and recruits into 11 intervals of 1200 recruits (Table 29). The number of times each level of recruitment occurred at each spawning level was entered into the table. The average number of spawners and recruits at each spawning stock level is calculated and the average yield (recruits minus spawners) and recruit per spawner (recruits divided by spawners) is estimated for each level (Table 29).

The Ricker curve was developed using the relationship:

$$R \quad S \times e^{a(1\ S/b)}$$

where **R** is the number of recruits, **S** is the number of spawners, e^a is the initial slope of the curve, and **b** is the value at which spawners equal recruits or the value at which the stock will just replace itself (Hilborn and Walters 1992). The **a** and **b** parameters were estimated using the EXCEL (1993) solver function (Table 27).

The Beverton-Holt model was developed using the relationship:

$$R \quad \frac{aS}{b \quad S}$$

where **R** and **S** are as in the Ricker model, **a** is the maximum number of recruits produced, and **b** is the recruitment (on average) equal to **a/2** (Hilborn and Walters 1992). The **a** and **b** parameters were estimated using the EXCEL (1993) solver function (Table 27).

The mean forecasts a return of 3249 (Table 27).

An additonal approach using wild small salmon (year i) to forecast wild large salmon (year i+1) was also tried. This relationship was not significant (Fig. 12) and cannot be used to provide a forecast.

The Tabular approach provides the best forecast in terms of lowest residual sum of squares, followed by the Beverton-Holt model, the mean, and the Ricker which performs the poorest of the four models (Table 27). Over the range of the data observed, however, each of these models provides a similar description of the stock-recruitment relationship, which is that numbers of recruits per spawner is high at low numbers of spawners and declines to replacement or one recruit per one spawner at about 4000 spawners or the maximum observed up to 1989 (Table 30; Fig. 12). This decline in recruits/spawner is important because the spawning stock that will produce returns in 1995 was the largest number of spawners estimated in the time-series and is beyond the replacement line (Table 27).

MANAGEMENT CONSIDERATIONS

Forecast

Each forecast model predicts that large salmon returns will exceed the spawning target for 1995. Allocations of this surplus should take into account average run-timing characteristics of the river as they have in the past.

Target:

The stock-recruitment relationships developed for forecasting are also important for evaluating current target levels of 1036 large salmon and 582 small salmon. Although the three models provide similar forecasts over the range of data, management targets based on these models would differ depending on whether the objective is to manage for maximum recruitment or maximum yield.

Managing for maximum recruitment under the assumption that the Ricker model is correct indicates a target of 2100 large salmon. Maximum recruitment under the Tabular model occurs at 2900 (Table 30) large salmon and for the Beverton-Holt model at about 4500 large salmon spawners (Table 27, parameter **a** x 1000). These targets, however, would be an inefficient management objective because the recruits per spawner are very low at these levels (Table 30). One way to manage for maximizing recruitment efficiency under the Beverton-Holt model might be to pick the point at which the change in recruit/spawner curve starts to change very little. For the Beverton-Holt curve this point occurs at about 1000 spawners (Fig. 13).

Target spawners would be less if the objective was to maximize yield. The Tabular model predicts maximum yield at 1500 spawners, the Ricker at 1400 spawners, and the Beverton-Holt curve at 1000 spawners (Table 30, Fig. 12). The differences in expected yields between these three models are 500 large salmon.

Simulations examining the consequences of managing under each of these assumptions as if they were correct, but in fact one of the other models is correct would clarify the importance of distinguishing between these models and

guide management in choosing a management objective and deciding if the target for Margaree Atlantic salmon needs to be changed.

Target Early Run:

The first step in setting an early run target for the Margaree River would be to examine other rivers to see if run-timing can be expected to be a stock characteristic of Southern Gulf of St. Lawrence Rivers. Examination of eight index sites throughout the Southern Gulf of St. Lawrence indicates that two peaks are often seen in rivers where fish enter from June to October (Fig. 14). A decline in returns about the end of August occurs in estuary, mid-river and headwater sites (Fig. 14) and indicates that run-timing is an important stock characteristic of these rivers. It would not be surprising to observe this trend on the Margaree River where fish also return from June to October and an initial definition of early run fish would be those returning before the end of August.

A second indication of whether or not run-timing may be a stock characteristic comes from informal experiments in which early-run fish (those returning before the end of August) have been collected as broodstock and returns have been monitored. If early run-timing is a stock characteristic then most of these fish should return in the summer. On the Nepisiguit River early-run small and large salmon return in the summer about 60% of the time (Table 31). On the Morell River small salmon return early about 80% of the time and large salmon about 60% of the time (Table 32).

A similar experiment has taken place on the Margaree River and returns have been monitored by logbook anglers and at the estuary trapnets. These data are similar to the Morell River in that about 80% of the small salmon return early and 60% of the large salmon (Table 33). An additional experiment on the Margaree River involved the introduction of early run Rocky Brook, Miramichi River stocks in the late 70s (Table 34). These fish returned as small salmon from 1979 to 1982 and large salmon from 1980 to 1983. These fish were the major contributors to small salmon returns being 4 weeks earlier than other years and large salmon being 2 weeks earlier than other years (Fig. 15). These results indicate that run-timing is a stock characteristic of many river populations and wherever possible should be considered in setting targets.

Although fish enter the Margaree River from June to October it does not have two strong peaks in timing as other rivers with these characteristics (compare Figs. 14 and 16). Historical angling data and 1992 and 1993 Levi's trap data indicate that about 30% of the large salmon come in by the end of August and about 40% of the small salmon (Fig. 16).

Because the Margaree River does not show two strong peaks with a decline at the end of August as other rivers, fish returning by the end of August may not define the early run on the Margaree River.

Defining and setting a target for early run fish will depend on determining if there are sections of the river where fish entering the river at different times are segregated for spawning. The hypothesis is that early returning fish predominantly utilize the upper sections of the river and late returning fish the lower sections. During the stock status workshop it was noted that this segregation may occur with changes in gradient. The Margaree has three sections of differing gradient. The highest gradient occurs above the sanctuary, a medium gradient from the sanctuary to Lake O'Law brook, and a low gradient below Lake O'Law (Fig. 17). This hypothesis is investigated using tagging and tag recapture data from the estuary trapnets (1987 to 1994) and recapture data from broodstock collections, Lake O'Law counting fence, and the recreational fishery. The date of fish entering the river is the date they were first tagged in the estuary.

The hypothesis is first tested by examining tag returns at the Lake O'Law fence, angling above and below Lake O'Law, and in broodstock collections that are primarily made between Lake O'Law and the sanctuary.

Two to four times as many of the fish tagged in June are recovered in upper sections of the river, either in broodstock collections or by angling than those tagged after July 1 (Table 35). This comparison is based on tag recoveries in broodstock collections made in sections G, H, I, and the sanctuary (Fig. 1), at the Lake O'Law counting fence in section F (Fig. 1), and by anglers in the section of the river below (Lower Section) and above (Upper Section) Lake O'Law and in the Southwest Margaree. Fish tagged from July 1 to July 15 also have a greater tendency to be recovered in the upper sections of the river by angling than fish tagged after July 15 (Table 35). Fish tagged from June to July 15 have never been observed at the Lake O'Law fence (Table 35). These data indicate that fish returning before July 15 may be using a different part of the river than fish arriving later in the year. The spatial division between these early fish and fish entering later in the year is above Lake O'Law Brook.

The distance above Lake O'Law before spawning segregation occurs is examined by comparing the date of estuary tagging with section of the river in which the fish were re-captured by angling (Table 36). The highest percentage of recoveries of a tagging group in the uppermost section (Section I, Fig. 1) occurs from the fish tagged in June. There were, however, September and October tagged fish caught in this section and about the same percentage of fish tagged in July are caught in this section as those tagged in September and October (Table 35).

The in-river tagging indicates that the sanctuary area (Table 1, Fig. 1) is the largest area that could be considered where separation of early and late fish occurs. Fish returning to the river before July 15 would seem to be the most likely to be segregating in this area.

If fish entering the estuary at certain times of the year consistently fall back or remain in the estuary it would indicate they are not to be included in early returns. This can be determined by comparing the date of tagging in the estuary with subsequent recapture in the estuary (Table 37). Fish tagged in June have a greater tendency to be recaptured in June, July, or August compared to September and October indicating they are probably moving into the system relatively close to time of tagging (Table 37). Fish tagged in June also have a strong tendency to be caught in the angling fishery during June and July (Table 38). These trends indicate that June fish are for the most part moving rapidly from the estuary to freshwater.

A higher percentage of fish tagged after July 1, are recaptured during the fall than in the month of tagging (Table 37), yet most of them are recaptured in the angling fishery during the summer (Table 38). Some fish entering the river after July, do delay entry into freshwater compared to June fish. Nevertheless, the angling recapture date indicates that the majority of fish move into freshwater soon after tagging (Table 38).

Thus, an initial early run target could be based on the rearing area in the sanctuary and compared to fish entering the river at the estuary by July 15.

Rearing areas have been summarized for the upper section of the Margaree River by tributary, the main river from Ross Bridge to Calumruadh Brook, and the upper stretches of the sanctuary area (Table 6). An initial estimate of rearing area above the sanctuary can be made by using the proportion of the length of the main river that is above the sanctuary to the survey limit and adding up the tributary rearing areas. The key landmarks are Ross Bridge at kilometre 28, the

sanctuary at kilometre 36, and Calumruadh Brook at kilometre 50 (Fig. 17). Adding the tributary areas and upper reaches of the sanctuary area to the proportion of the survey area above the sanctuary from Ross Bridge provides an estimate of 6,523 rearing units or about 23% of the rearing area of the entire Margaree River system (Table 6). This rearing area would correspond to an early requirement of fish in the estuary by July 15 of 242 large salmon and 136 small salmon.

These trapnet efficiencies can be used to estimate numbers of fish returning by time period and to determine if early targets (242 large and 136 small) as defined above have been met in recent years. Using this method, spawning requirements of small salmon and large salmon in the estuary by July 15 would have been met in 1992 and 1993 but not 1994 (Table 39) and there could have been some harvest of salmon from this portion of the run. In 1994, early small and large salmon were below proposed target requirements but large numbers came into the river at the end of August.

RESEARCH RECOMMENDATIONS

1. Can logbooks provide an independent abundance estimate?
2. Investigate the year-class effect on small salmon returns.
3. Compare sea-survival from Lake O'Law smolts to other rivers.
4. What is the effect of including years prior to the closure of the commercial fishery in the stock recruitment curve.
5. A counting fence in the sanctuary area would help in setting and managing early run targets.
6. The management objective needs to be set and targets re-evaluated.

ACKNOWLEDGEMENTS

The authors thank John Peppar and an anonymous reviewer for helpful comments.

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MARGAREE SALMON
STOCK STATUS WORKSHOP

December 12, 1994
Visitor Interpretation Centre

Participants:

Blair Bernard	Aboriginal Fisheries Service
Fabien Francis	Aboriginal Fisheries Service
Peter Marshall	Aboriginal Fisheries Service
Anthony Pierro	Aboriginal Fisheries Service
Ray Prosper	Aboriginal Fisheries Service
Lewis Hinks	Atlantic Salmon Federation
Lynda Calvert	Cape Breton SFAC
Harry Vickers	Cape Breton Anglers Assoc.
Allister Marshall	Chapel Island Fishery
Wes Barrington	DFO - C and P
Leonard Forsyth	DFO - Science
John Hart	Margaree Salmon Assoc.
Carl Ross	Margaree Salmon Assoc.
Darryl Muuant	Nova Scotia Dept. of Fisheries
Tim Lutzac	DFO - Science
Paul LeBlanc	DFO - Science
Ross Claytor	DFO - Science
Ross Jones	DFO - Science

Landings:

- Angling exploitation rates on large salmon are high (30 to 60%) when compared to mark-recapture techniques. This is likely the result of multiple recaptures.

Target:

- How to determine a target for summer fish was discussed. A preliminary look at location of summer and fall recaptures indicated a great deal of overlap in location of capture for fish tagged from June to August compared to those from September and October up to the sanctuary area. It was suggested that stream gradient may provide an initial indication of where spatial separation among summer and fall fish may occur.

- A fence in the sanctuary area would be useful for determining the relative use of this area by summer and fall salmon. Different coloured carlin tags would be useful for sorting this out during snorkel counts

- Estimating smolts produced in the sanctuary area by mark-recapture would assist in defining the summer run target

- A habitat survey done from Ingram Bridge to the Forks may be useful in adjusting estimates of rearing area

- Discussion concerning the overall target for the river centred around how natural mortality of adults and smolts was affected by density. Spawning escapements were high in the last four years and will help define the shape of the stock recruitment curve at high densities and how high densities affect adult and smolt survival. These points will be critical for determining the carrying capacity of the river under present conditions.

Data:

- Tag loss is estimated from an experiment in which fish collected for broodstock were tagged and held in the hatchery. There was concern that tag loss may be higher in the wild than in a controlled environment like hatchery tanks

- Fish with tagging scars are noted at the Lake O'Law fence and are counted as tagged fish. These could be used to estimate tag loss. There was concern that fish tagged early in the season could lose their tags and the scar would heal by the time these fish passed through the counting fence

- Electrofishing above the Lake O'Law fence would provide information on juvenile status related to spawning escapement

- Additional electrofishing sites could help to define spawning distribution and serve as a check on the population estimate trends

- Lake O'Law fence would also be a good place to count redds above the fence to verify this technique

Stock Status:

- An attempt was made to define the summer run. The committee felt that salmon entering in June and July should be considered summer run fish. It was suggested that a breakdown of when salmon were first tagged and later recaptured in the trapnet could indicate where a definition of summer fish could be made.

- Variability in summer discharge was felt to make August fish a mixture of summer and fall salmon

- There was interest in learning more about the stock status of the Southwest branch

- Kelt survival seems to be lower on the Margaree River than other systems, a sampling program looking at condition of kelts may help explain this, as well as a comparison of other river systems where kelt survival is high such as the Miramichi River.

Additional Issues:

- ZMAC meetings are necessary to provide a forum for discussing management issues.

Minutes of Peer Review
Diadromous Stocks
February 7-10, 1995

Review Committee:

Chadwick, Mike (Chair), Chief, Marine and Anadromous Fish Division, Gulf Region

1. Caron, François, Biologiste, Ministère de l'Environnement et de la faune, Direction de la faune et des habitats, 150, boul. René-Lévesque Est, Québec, Québec
2. Chiasson, Alyre, doyen, Faculté des sciences, Université de Moncton, Moncton, NB
3. Clay, Doug, Canadian Heritage, Fundy National Park, Alma, NB
4. Cunjak, Rick, Research Scientist, Habitat Ecology Section, Environmental Studies, DFO, Gulf Region
5. Davis, Anthony, Professor, Department of Sociology and Anthropology, St. Francis Xavier University, Antigonish, NS
6. Dempson, Brian, Northwest Atlantic Fisheries Centre, DFO, Newfoundland Region, St. John's, Nfld
7. Hutchings, Jeff, Northwest Atlantic Fisheries Centre, DFO, Newfoundland Region, St. John's Nfld
8. Myles, Wes, NB Sportfishery Board, Doaktown, NB
9. O'Neil, Shane, Biologist, Freshwater and Anadromous Division, DFO, S-F Region
10. Simon, Vincent, Chief, Big Cove First Nation, Big Cove, NB
11. Wheaton, Fred, New Brunswick Wildlife Federation, Moncton, NB
12. Whoriskey, Fred, Atlantic Salmon Federation, St. Andrews, NB

A. Margaree salmon

1. Description of fishery
(a) Assessment was very well written
(b) A brief history of the fishery could be included in the assessment.

2. Target
(a) Perhaps the estimated target should be used instead of 2.4.

3. Inputs
(a) Should the minimum estimate for the 1990 spawning be used in the forecast model? How else can uncertainty in point estimates be incorporated into the forecast model?
(b) Years should be identified on the stock-recruit plots.
(c) State the proportion of hatchery parr in electrofishing densities.
(d) The 1994 returns of grilse were the lowest in the past 10 years. This should be stated.
(e) Provide overview of uncertainty around the 1990 estimate of returns. Examine percent of hatchery returns in 1990. Look at CAFSAC subcommittee report.

4. Model

(a) When parr densities in previous years are linked to egg depositions, there is some support for the Beverton Holt stock-recruit curve. This could be investigated further.
(b) Is it appropriate to include data prior to closure of commercial fisheries in 1984 because recruit to spawner ratios may have been lower during years of the commercial fisheries.

5. Synopsis
(a) Mention that the recovery of tags in the upper river is unlikely to be biased by higher angling effort.
(b) Could the logbook anglers be better interpreted as an independent index of abundance?
(c) June discharge, 17 of the past 19 years have been below the mean. This may be due to clearcutting 20 years ago.
(d) State clearly that this stock appears healthy.
(e) Include the role of hatchery in the stock meeting spawning requirements was 90%.
(f) What is proportion wild grilse in 1994?
(g) Forecast for 1995 needs to be explained in terms of caution.

6. Research recommendations
(a) Sea survival of hatchery smolts should be tabulated and compared to other watersheds.
(b) The logbook program on Margaree River should be expanded to other watersheds.
(c) Proportion repeat spawners should be summarized in future assessments.
(d) There appears to be a strong year-class effect on the return of small salmon. This could be explored further for the entier data set.

7. Other issues
(a) What is the reason for the success on Margaree River?
(b) Should there be any concern about the status of the early run? Have there been changes in the early part of the season? The proposed early-run target needs to be discussed with clients; it may take 3-4 years to refine.

Participants

1. Atkinson, Gary, Technician, Anadromous Fishes, Southern NB, Gulf Region
2. Amiro, Peter, Biologist, Salmon Assessment and Enhancement Research, S-F Region
3. Biron, Michel, Technician, Anadromous Fishes, Miramichi River, Gulf Region
4. Chadwick, Mike, Chief, Marine and Anadromous Fish Division, Gulf Region
5. Chaput, Gérald, Biologist, Anadromous Fishes, Miramichi River, Gulf Region
6. Claytor, Ross, Section Head, Pelagics, Gulf Region
7. Cutting, Dick, Section Head, Stock Assessment and Enhancement, S-F Region
8. Harvie, Carolyn, Computer Services Coordinator, S-F Region
8. Jessop, Brian, Biologist, Non-Salmon Assessment
9. Jones, Ross, Technician, Anadromous Fishes, Gulf NS, Gulf Region
10. LeBlanc, Paul, Technician, Anadromous Fishes, Gulf NS, Gulf Region
11. Locke, Andrea, Scientist, Anadromous Fishes, Chaleur Bay & Southern NB, Gulf R.
12. Lutzac, Tim, Biologist, Aboriginal Fisheries, Gulf Region
13. Marshall, Dr. Larry, Biologist, Salmon Assessment, S-F Region
14. Moore, Dave, Technician, Anadromous Fishes, Miramichi River, Gulf Region
15. Mowbray, Fran, Technician, Anadromous Fishes, Chaleur Bay, Gulf Region
16. Pickard, Russell, Technician, Anadromous Fishes, Chaleur Bay, Gulf Region
17. Ritter, John, Division Chief, Freshwater and Anadromous Division, S-F Region

Appendix 1. Simulation program to investigate sampling strategy and level or mark-recapture experiments.

```
' markrec6.bas

' produces population estimates based on mark-recaptures
' assuming given percentage of being captured
' and recaptured.
' no breakdown according to run-timing

CLS

  pop = 4000
  TrapProb = .2
  RecProb = .2
  nosim = 100
  bpop = 10     ' number of intervals in histogram

  DIM PopDat(pop, 3)
  DIM n(nosim), pertag(nosim), perrec(nosim)
  DIM bin(bpop + 2), nbin(bpop + 1)
  DIM x(bpop + 2), y(bpop + 1)
  DIM mbin(bpop + 1)

'  OPEN "c:\markrec\popchk.prn" FOR OUTPUT AS #1
  OPEN "c:\markrec\exp2000.prn" FOR APPEND AS #2
  OPEN "c:\markrec\exp2000h.prn" FOR APPEND AS #3
  OPEN "c:\markrec\plot2000.prn" FOR APPEND AS #4

FOR tp = 1 TO 7
   IF tp = 1 THEN TrapProb = .01
   IF tp = 2 THEN TrapProb = .02
   IF tp = 3 THEN TrapProb = .04
   IF tp = 4 THEN TrapProb = .08
   IF tp = 5 THEN TrapProb = .16
   IF tp = 6 THEN TrapProb = .32
   IF tp = 7 THEN TrapProb = .64


 FOR rp = 1 TO 7
   IF rp = 1 THEN RecProb = .01
   IF rp = 2 THEN RecProb = .02
   IF rp = 3 THEN RecProb = .04
   IF rp = 4 THEN RecProb = .08
   IF rp = 5 THEN RecProb = .16
   IF rp = 6 THEN RecProb = .32
   IF rp = 7 THEN RecProb = .64


FOR sim = 1 TO nosim

' initialize population

FOR p = 1 TO pop
  FOR r = 1 TO 3
    IF r = 1 THEN
      PopDat(p, r) = p
    END IF
    IF r >= 2 THEN
       PopDat(p, r) = 0
    END IF
'PRINT PopDat(p, r),
  NEXT r
'PRINT
NEXT p

'INPUT y$

' check trap and see if recaptured

FOR i = 1 TO pop
```

```
  IF RND <= TrapProb THEN
      PopDat(i, 2) = 1
  END IF
  IF RND <= RecProb THEN
      PopDat(i, 3) = 1
  END IF
NEXT i

' print trap record

FOR p = 1 TO pop
  FOR r = 1 TO 3
'     PRINT PopDat(p, r),
  NEXT r
'PRINT
'WRITE #1, PopDat(p, 1), PopDat(p, 2), PopDat(p, 3)
NEXT p

' sum tags


tags = 0: recap = 0: tagrec = 0
FOR p = 1 TO pop
  tags = tags + PopDat(p, 2)
  recap = recap + PopDat(p, 3)
  IF PopDat(p, 2) = 1 AND PopDat(p, 3) = 1 THEN
     tagrec = tagrec + 1
  END IF
NEXT p


' pop estimate

n(sim) = (((tags + 1) * (recap + 1)) / (tagrec + 1)) - 1

' check perc tags and recap

pertag(sim) = tags / pop
perrec(sim) = recap / pop

' residual from pop

res = n(sim) - pop
perres = (n(sim) - pop) / pop

'PRINT sim; pop; tags; tagrec; recap; n(sim); pertag(sim); perrec(sim); res; perres

WRITE #2, sim, pop, TrapProb, RecProb, tags, tagrec, recap, n(sim), pertag(sim), perrec(sim), res,
perres

LOCATE 23, 1
PRINT "simulation", sim

NEXT sim
CLS


' calculate mean n, mean per tagged, mean per recap

sumN = 0: sumT = 0: sumR = 0
FOR sim = 1 TO nosim
    sumN = sumN + n(sim)
    sumT = sumT + pertag(sim)
    sumR = sumR + perrec(sim)
NEXT sim

meanN = sumN / nosim
meanT = sumT / nosim
meanR = sumR / nosim

'PRINT "meanN", meanN; "meanT", meanT; "meanR", meanR
WRITE #4, pop, meanN, resN, TrapProb, RecProb
```

```
'INPUT y$

' set up lower level of each bin for histogram

' calc bin size based on number of intervals

binc = pop * 2 / bpop
bin(1) = 0
bin(2) = binc / 2
bin(bpop + 2) = 1000000

FOR k = 3 TO bpop + 1
     bin(k) = bin(k - 1) + binc
NEXT k

'print bins

PRINT "bins"
FOR k = 1 TO bpop + 2
' PRINT k, bin(k)
NEXT k

'INPUT y$

'initialize bins to zero

FOR k = 1 TO bpop + 1
  nbin(k) = 0
NEXT k

' fill bins

FOR sim = 1 TO nosim
  FOR k = 1 TO bpop + 1
    IF n(sim) >= bin(k) AND n(sim) < bin(k + 1) THEN
       nbin(k) = nbin(k) + 1
     EXIT FOR
    END IF
  NEXT k
'PRINT sim, n(sim)
'INPUT y$
NEXT sim

' check counts in each bin and write to file

PRINT "bin", "  nbin", "  sumbin", "  maxbin"
sumbin = 0: maxbin = -1
FOR k = 1 TO bpop + 1
   sumbin = sumbin + nbin(k)
   IF nbin(k) > maxbin THEN maxbin = nbin(k)
   PRINT bin(k), nbin(k), sumbin, maxbin
   WRITE #3, pop, meanN, TrapProb, RecProb, bin(k), nbin(k), sumbin
NEXT k

'INPUT y$


CLS

SCREEN 9


xs = 40: xm = 640: ys = 290: ym = 50

x(1) = xs
FOR k = 2 TO bpop + 2
  x(k) = x(k - 1) + xm / (bpop + 2)
NEXT k

FOR k = 1 TO bpop + 1
```

```
  y(k) = ys - (ys - ym) * nbin(k) / maxbin
'PRINT y(k)
NEXT k

FOR k = 1 TO bpop + 1
'   PRINT k, x(k), y(k)
    LINE (x(k), ys)-(x(k + 1), y(k)), 2, BF
NEXT k

' calc midpoints
mbin(1) = 0
FOR k = 2 TO bpop + 1
  mbin(k) = mbin(k - 1) + binc
NEXT k

LOCATE 2, 10
PRINT "True Population = ", pop
LOCATE 3, 10
PRINT "Mean Population = ", meanN

LOCATE 2, 45
PRINT "Trap Prob = "; TrapProb
LOCATE 3, 45
PRINT "Recap Prob = "; RecProb

LOCATE 5, 1
PRINT "Max Count = "
LOCATE 6, 1
PRINT maxbin

LOCATE 22, 6
PRINT mbin(1)
LOCATE 22, 41
PRINT pop
LOCATE 22, 75
PRINT pop * 2

LOCATE 24, 35
PRINT "Midpoint"

'INPUT y$

NEXT rp
NEXT tp

'CLOSE #1
CLOSE #2
CLOSE #3
CLOSE #4
```

Table 1. River sections of the Margaree River, Inverness County, Nova Scotia. Updated to include new pools since (Chaput 1988).

River Section	*km from Breakwater*	*Length of Section (km)*	*Angling Pools Within Section*	*Distinguishing features*
A	6.50	1.50	Chapel, Barracks, Ram Island, Long Marsh, Tidal	Upper limit of average tidal influence.
B	8.00	5.25	Tippy Toes, Lower Thompkins, Seal, Gillis Island, Big McDaniel, Rift, Snag, Long, Short, Dollar, Hut	Lower pools above head of tide and below confluence of southwest and northeast Margaree branches.
C	13.25	0.50	Thornbush, Forks	Confluence of southwest and northeast Margaree.
Z	13.75	21.00	Noon, Red Bank, Martin Camerons, Peter McFarlanes, Carrols, Camerons, Collins, Peter Gillis', McDonnell, Gillis, Black Angus	Above the confluence of southwest Margaree branch up to Scotsville bridge.
D	13.75	4.75	Barrack, Libbus, Doyles Bridge, Point, Upper Thompkins, Tanner, Wash, Etheridge, Garden, Brook	Upstream of Margaree Forks to the mouth of Big Brook.
E	18.50	1.25	Brush, Corner, Shepard's Rock, Little McDaniel, Swimming Hole	Between Big Brook and Lake O'Law Brook .
F	19.75	4.25	Plaster Rock, Lairds, Sheardam, Swallow Bank, Rock Pile, Cranton Bridge, Faheys, Crowdis	Between Lake O'Law Brook and Nile Brook.
G	24.00	3.00	Redbank, Sweetharts, Harts, Ingram Bridge, Rock, Whitley, Hatchery, Ledges, Cliff	Between Nile Brook and Ingram Brook.
H	27.00	6.00	Morrison, Slide, Marsh Brook, Jim Easter, Boars Back, Maple, Tingleys Rock, Coady Brook, Ross Bridge, Chance, Tent, Black Rock	Upper valley pools accessible from main paved road, above Ingraham Bridge.
I	33.00	6.00	Old Bridge, Wards Rock, Skye Lodge, Cemetery	Pools accessible from Big Intervale road, below Big Intervale Bridge.
Sanc.	39.00	15.50	McKenzie, Big Intervale, First Brook, McLeods, Marsh, Second Brook, Rocky, McKay, Blue, Reed, Third Brook	Headwaters of northeast Margaree, above Big Intervale Bridge.

Table 2. Summary of the First Nation salmon allocations, gear type, and seasons for the Margaree River, 1994.

First Nation	Allocation Small	Allocation Large	Gear Type	Season
Eskasoni	6	30	Trapnet, Angling, and Seining *	June 1 - Aug 31
	20	100	Trapnet, Angling, and Seining *	Sept 1 - Oct 31
Chapel Island	6	30	Trapnet, Angling, and Seining *	June 1 - Aug 31
	20	100	Trapnet, Angling, and Seining *	Sept 1 - Oct 31
Membertou	6	30	Trapnet, Angling, and Seining *	June 1 - Aug 31
	20	100	Trapnet, Angling, and Seining *	Sept 1 - Nov 30
Wagmatcook	6	30	Trapnet, Angling, and Seining *	June 1 - Aug 31
	20	100	Trapnet, Angling, and Seining *	Sept 1 - Oct 31
Waycobah	6	30	Trapnet, Angling, and Seining *	June 1 - Aug 31
	20	100	Trapnet, Angling, and Seining *	Sept 1 - Oct 31
Summer	30	150	Trapnet, Angling, and Seining *	June 1 - Aug 31
Fall	100	500	Trapnet, Angling, and Seining *	Sept 1 - Oct 31
Total Season:	130	650	Trapnet, Angling, and Seining *	June 1 - Oct 31

* Seining would take place only if sufficient numbers could not be obtained using the other two methods.

Table 3. First Nation harvests by the Wagmatcook and Membertou First Nations on the Margaree River for 1993 and 1994. Weight is in kilograms.

Year	First Nation	Small Sex	Small No.	Small Wt.	Large Sex	Large No.	Large Wt.
1993	Wagmatcook	Female	0	0	Female	39	208.7
		Male	8	12.7	Male	17	78.4
		Unknown	0	0.0	Unknown	2	10.0
		Total	8	12.7	Total	58	297.1
1994	Wagmatcook	Female	0	0	Female	28	141.5
		Male	12	19.8	Male	16	71.2
		Total	12	19.8	Total	44	212.7
	Membertou	Female	0	0	Female	5	24.7
		Male	2	4.3	Male	1	4.7
		Total	2	4.3	Total	6	29.4
	Total Harvests	Female	0	0	Female	33	166.2
		Male	14	24.1	Male	17	75.9
		Total	14	24.1	Total	50	242.1

Note - The 1994 harvests occurred from Sept. 17 until Oct. 25.

Table 4. Salmon angling catch on Margaree River (1947-1994) as compiled by Department of Fisheries and Oceans fisheries officers (DFO statistics).

		Large				
Year	Small	Retained	Released	Total	Unsized	Total
1947	36	363			1	400
1948	106	704			.	810
1949	41	332			9	382
1950	111	320			8	439
1951	21	424			25	470
1952	83	204			4	291
1953	49	291			8	348
1954	68	298			10	376
1955	53	258			.	311
1956	28	90			1	119
1957	36	136			.	172
1958 *	N/A	N/A			.	334
1959 *	N/A	N/A			.	235
1960 *	N/A	N/A			.	140
1961	29	49			11	89
1962	46	410			.	456
1963	87	212			.	299
1964	120	289			.	409
1965	86	254			.	340
1966	92	165			.	257
1967	98	265			8	371
1968	64	198			6	268
1969	214	139			6	359
1970	85	215			3	303
1971	21	94			.	115
1972	42	105			.	147
1973	166	117			.	283
1974	60	107			.	167
1975	36	64			.	100
1976	96	82			.	178
1977	69	140			1	210
1978	25	158			.	183
1979	597	62	19	81	8	686
1980	167	138	2	140	11	318
1981	899	105	34	139	11	1049
1982	691	103	76	179	1	871
1983	68	107	42	149	4	221
1984	148	12	109	121	.	269
1985	223	0	312	312	1	536
1986	295	0	754	754	.	1049
1987	353	0	408	408	.	761
1988	435	0	580	580	.	1015
1989	179	0	244	244	.	423
1990 @	208	0	314	314	.	522
1991 @	246	0	-	-	.	246
1992 @	236	0	-	-	.	236
1993 @	272	0	-	-	.	272
1994 @	175	0	-	-	.	175
Mean (89-93)	228					
+/- Mean	-23.31%					

* - Information regarding small and large salmon for 1958-1960 are not available.

@ - Note: Season was extended from October 15 to October 31.

Table 5. Annual summaries of catch and effort for Gulf Shore Cape Breton rivers from 1984-94 using license stub returns. Mean = (1989 to 1993). The 1994 data is preliminary.

		No.	Small		Large		Unk.	Total		Rods			
Year	River	Angler	Obs.	Est.	Obs.	Est.	Obs.	Obs.	Est.	Obs.	Est.	CPUE	% Large
	Cheticamp												
1984		35	2	2	36	37	0	38	39	132	148	0.288	94.7
1985		24	15	15	52	53	0	67	68	170	182	0.394	77.6
1986		34	4	4	50	50	0	54	54	108	114	0.500	92.6
1987		37	7	7	59	60	0	66	67	124	131	0.532	89.4
1988		28	1	1	37	43	0	38	45	105	127	0.362	97.4
1989		33	6	7	116	140	0	122	148	237	296	0.515	95.1
1990		23	0	0	44	56	0	44	56	107	140	0.411	100.0
1991		29	6	8	81	104	0	87	112	212	281	0.410	93.1
1992		30	15	19	55	69	0	70	88	132	171	0.530	78.6
1993		47	15	21	27	37	0	42	58	149	170	0.282	64.3
1994		21	6	8	8	10	0	14	18	65	88	0.215	57.1
	+/- 1993	-55%	-60%	-62%	-70%	-73%	.	-67%	-69%	-56%	-48%	-24%	-11%
	+/- Mean	-35%	-29%	-27%	-88%	-88%	.	-81%	-81%	-61%	-58%	-50%	-34%
	Mabou												
1984		1	0	0	0	0	0	0	0	1	1	0.000	.
1985		0	0	0	0	0	0	0	0	0	0	.	.
1986		3	3	3	18	19	0	21	22	12	13	1.750	85.7
1987		1	0	0	0	0	0	0	0	1	1	0.000	.
1988		1	0	0	0	0	0	0	0	4	5	0.000	.
1989		0	0	0	0	0	0	0	0	0	0	.	.
1990		2	0	0	0	0	0	0	0	12	16	0.000	.
1991		3	2	3	2	3	0	4	5	7	9	0.571	50.0
1992		5	6	8	14	18	0	20	25	20	26	1.000	70.0
1993		4	2	2	3	4	0	5	6	11	13	0.455	60.0
1994		4	2	3	1	1	0	3	4	20	27	0.150	33.3
	+/- 1993	0%	0%	50%	-67%	-75%	.	-40%	-33%	82%	108%	-67%	-45%
	+/- Mean	43%	0%	15%	-74%	-80%	.	-48%	-44%	100%	111%	-63%	-8%
	Margaree												
1984		678	233	242	293	305	4	530	551	5952	6665	0.089	55.7
1985		793	473	509	1130	1215	3	1606	1724	7324	7824	0.219	70.5
1986		1131	748	782	2522	2636	2	3272	3420	9724	10232	0.336	77.1
1987		1441	925	977	1757	1857	0	2682	2834	12165	12887	0.220	65.5
1988		1455	749	879	1647	1932	0	2396	2810	11582	14042	0.207	68.7
1989		1486	464	561	1298	1570	0	1762	2132	10594	13234	0.166	73.7
1990		1382	514	649	1193	1507	0	1707	2156	10789	14072	0.158	69.9
1991		1236	586	752	1370	1757	0	1956	2509	10142	13432	0.193	70.0
1992		1426	539	678	1541	1938	0	2080	2616	11483	14909	0.181	74.1
1993		1885	696	777	987	1102	0	1683	1879	13920	15863	0.121	58.6
1994		1273	331	434	1118	1466	0	1449	1900	9802	13270	0.148	77.2
	+/- 1993	-32%	-52%	-44%	13%	33%	.	-14%	1%	-30%	-16%	22%	32%
	+/- Mean	-14%	-41%	-36%	-13%	-7%	.	-21%	-16%	-14%	-7%	-10%	11%
	Gulf Shore Cape Breton Island:												
1984		714	235	244	329	342	4	568	590	6085	6814	0.093	58.3
1985		817	488	524	1182	1268	3	1673	1792	7494	8006	0.223	70.8
1986		1168	755	789	2590	2705	2	3347	3496	9844	10359	0.340	77.4
1987		1479	932	984	1816	1917	0	2748	2901	12290	13019	0.224	66.1
1988		1484	750	880	1684	1975	0	2434	2855	11691	14174	0.208	69.2
1989		1519	470	568	1414	1710	0	1884	2280	10831	13530	0.174	75.1
1990		1407	514	649	1237	1563	0	1751	2212	10908	14228	0.161	70.6
1991		1268	594	763	1453	1864	0	2047	2626	10361	13722	0.198	71.0
1992		1461	560	705	1610	2025	0	2170	2729	11635	15106	0.187	74.2
1993		1936	713	800	1017	1143	0	1730	1943	14080	16046	0.123	58.8
1994		1298	339	445	1127	1477	0	1466	1922	9887	13385	0.148	76.9
	+/- 1993	-33%	-52%	-44%	11%	29%	.	-15%	-1%	-30%	-17%	20%	31%
	+/- Mean	-15%	-41%	-36%	-16%	-11%	.	-24%	-18%	-14%	-8%	-12%	10%

Table 6. Bottom area of the Margaree River and tributaries utilizable by salmon (Marshall 1982).

River Section	*Units of Bottom Area (100 m²)*	
Main Margaree:		
Gallant River to Margaree Forks	3,433	1
Gallant River	1,492	2
Sub-Total:	**4,925**	
Southwest Margaree:		
Main Southwest	4,463	1
Mount Pleasant Brook	549	3
Matheson Glen Brook	245	2
Scotsville Brook	133	2
Sub-Total:	**5,390**	
Northeast Margaree:		
Below Sanctuary:		
Margaree Forks to Ross Bridge	6,462	1,2
Ross Bridge to Big Intervale Bridge	1,955	2
Big Brook	612	3
Lake O'Law Brook	972	3
Nile Brook	225	3
Ingram Brook	912	3
Sub-Total:	**11,138**	
Above Sanctuary:		
Big Intervale Bridge to Calumruadh Brook	3,422	2
Calumruadh Brook to Second Forks Brook	907	2
Main Branch	754	2
North Branch	321	2
Stewart Brook	63	2
Forest Glen Brook	511	2
Second Forks Brook	95	3
Rocky Brook	91	4
Coinneach Brook	145	2
Calumruadh Brook	179	2
Campbell Brook	35	2
Sub-Total:	**6,523**	
Grand Total:	**27,976**	
Below Sanctuary	**21,453**	**0.77**
Above Sanctuary	**6,523**	**0.23**

1 MacEachern, 1955.
2 Surveyed 1976, 1977, 1978
3 Spot surveys and profile maps.
4 Profile maps.

Table 7. Estimation of spawner requirements for conservation target for the Margaree River.

Conservation Requirements:					
Rearing Units		=	27,976	(100 m²)	(Marshall 1982)
Optimal Egg Deposition		=	240	per unit	(Elson 1975)
Total Egg Requirements		=	6,714,240		
Biological Characteristics:					
Fecundity	eggs / kg	=	1,764		(Elson 1975)
Small	% Female	=	11%		(Marshall 1982)
	Mean Wt (kg)	=	1.7		(Marshall 1982)
Large	% Female	=	75%		(Marshall 1982)
	Mean Wt (kg)	=	4.9		(Marshall 1982)
Eggs per spawner	Small	=	eggs/kg * mean wt (kg) * %female		
		=	1,764 * 1.7 * 11%		
		=	330		
	Large	=	eggs/kg * mean wt (kg) * %female		
		=	1,764 * 4.9 * 75%		
		=	6,483		
Required number of large salmon		=	egg requirements / eggs per large salmon		
		=	6,714,240 / 6,483		
		=	1,036		
	Females	=	777		
	Males	=	259		
Deficit Males		=	518		
Required number of small salmon		=	deficit males / %male		
		=	518 / 89%		
		=	582		
Minimum Requirements:	***Large***	=	***1,036***		
	Small	=	***582***		

Table 8. Weekly small salmon counts from Salmon Check In Program (SCIP) on the Margaree River for 1991- 1994.

	Year					
Week	***1991***	***1992***	***1993***	***1994***	***+/- 1993***	***+/- Mean***
Jun 11 - Jun 17	0	2	0	2	.	200%
Jun 18 - Jun 24	0	6	2	3	50%	13%
Jun 25 - July 1	3	6	8	0	-100%	-100%
July 2 - July 8	2	7	8	5	-38%	-12%
July 9 - July 15	5	16	7	1	-86%	-89%
July 16 - July 22	3	13	13	2	-85%	-79%
July 23 - July 29	5	3	7	3	-57%	-40%
July 30 - Aug 5	4	2	3	1	-67%	-67%
Aug 6 - Aug 12	11	1	17	2	-88%	-79%
Aug 13 - Aug 19	9	0	11	4	-64%	-40%
Aug 20 - Aug 26	12	4	18	2	-89%	-82%
Aug 27 - Sept 2	10	3	7	6	-14%	-10%
Sept 3 - Sept 9	4	4	3	2	-33%	-45%
Sept 10 - Sept 16	4	3	1	3	200%	13%
Sept 17 - Sept 23	14	2	3	3	0%	-53%
Sept 24 - Sept 30	5	1	3	0	-100%	-100%
Oct 1 - Oct 7	4	11	5	0	-100%	-100%
Oct 8 - Oct 14	5	4	3	0	-100%	-100%
Oct 15 - Oct 21	1	7	5	3	-40%	-31%
Oct 22 - Oct 28	2	6	3	0	-100%	-100%
Oct 29 - Oct 31	0	0	1	0	-100%	-100%
Total	103	101	128	42	-67%	-62%

Table 9. Summary of effort, catch and CPUE from logbook anglers on Margaree River, 1991 to 1994.

				Small		Large		Total	
Year	*Season*	*Month*	*Rods*	*Catch*	*CPUE*	*Catch*	*CPUE*	*Catch*	*CPUE*
1994									
	Summer	June	80	3	0.038	13	0.163	16	0.200
		July	71	1	0.014	3	0.042	4	0.056
		August	98	9	0.092	4	0.041	13	0.133
	Sub-Total		249	13	0.052	20	0.080	33	0.133
	Fall	September	141	4	0.028	32	0.227	36	0.255
		Oct. 1-15	132	6	0.045	53	0.402	59	0.447
		Oct. 16-31	79	1	0.013	25	0.316	26	0.329
		Oct. 1-31	211	7	0.033	78	0.370	85	0.403
	Sub-Total		352	11	0.031	110	0.313	121	0.344
	Total Season		601	24	**0.040**	130	**0.216**	154	**0.256**
1993									
	Summer	June	134	2	0.015	2	0.015	4	0.030
		July	204	16	0.078	12	0.059	28	0.137
		August	157	29	0.185	16	0.102	45	0.287
	Sub-Total		495	47	0.095	30	0.061	77	0.156
	Fall	September	193	6	0.031	18	0.093	24	0.124
		Oct. 1-15	154	6	0.039	26	0.169	32	0.208
		Oct. 16-31	40	4	0.100	5	0.125	9	0.225
		Oct. 1-31	194	10	0.052	31	0.160	41	0.211
	Sub-Total		387	16	0.041	49	0.127	65	0.168
	Total Season		882	63	**0.071**	79	**0.090**	142	**0.161**
1992									
	Summer	June	117	6	0.051	3	0.026	9	0.077
		July	185	28	0.151	40	0.216	68	0.368
		August	162	10	0.062	20	0.123	30	0.185
	Sub-Total		464	44	0.095	63	0.136	107	0.231
	Fall	September	176	12	0.068	26	0.148	38	0.216
		Oct. 1-15	211	18	0.085	66	0.313	84	0.398
		Oct. 16-31	74	5	0.068	49	0.662	54	0.730
		Oct. 1-31	285	23	0.081	115	0.404	138	0.484
	Sub-Total		461	35	0.076	141	0.306	176	0.382
	Total Season		925	79	**0.085**	204	**0.221**	283	**0.306**
1991									
	Summer	June	60	0	0.000	3	0.050	3	0.050
		July	101	9	0.089	10	0.099	19	0.188
		August	186	16	0.086	32	0.172	48	0.258
	Sub-Total		347	25	0.072	45	0.130	70	0.202
	Fall	September	222	24	0.108	76	0.342	100	0.450
		Oct. 1-15	176	7	0.040	63	0.358	70	0.398
		Oct. 16-31	43	4	0.093	19	0.442	23	0.535
		Oct. 1-31	219	11	0.050	82	0.374	93	0.425
	Sub-Total		441	35	0.079	158	0.358	193	0.438
	Total Season		788	60	**0.076**	203	**0.258**	263	**0.334**

Table 10. Proportion wild and proportion hatchery of small and large salmon in the angling catches based on logbook reports.

Year	Summer		Fall		Total	
	Catch	% Wild	Catch	% Wild	Catch	% Wild
Small Salmon						
1989	37	43%	8	75%	45	49%
1990	37	81%	32	88%	69	84%
1991	26	54%	27	89%	53	72%
1992	42	55%	35	83%	77	68%
1993	43	56%	15	87%	58	64%
1994	13	69%	11	82%	24	75%
Large Salmon						
1989	48	63%	41	90%	89	75%
1990	41	85%	42	90%	83	88%
1991	40	73%	107	93%	147	87%
1992	50	78%	120	92%	170	88%
1993	26	85%	46	91%	72	89%
1994	20	100%	96	94%	116	95%

Table 11. Historical monthly estuarian trapnet catches and fishing periods on the Margaree River 1988-1994. Refer to Figure 2 for trapnet locations.

		Small Salmon						Large Salmon						Fishing Periods	
Trap	*Year*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Tot*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Tot*	*Summer*	*Fall*
Lower1	1988	.	.	.	68	31	99	.	.	.	41	74	115		Sep 2 - Oct 23
	1989	.	.	4	29	10	43	.	.	7	96	84	187		Aug 28 - Oct 16 (1)
	1990	2	.	.	29	42	73	15	2	.	50	69	136	Jun 5 - Jul 20	Sep 4 - Oct 16
Upper1	1988	.	.	18	64	16	98	.	.	3	30	49	82		Aug 29 - Oct 22 (2)
	1989	.	.	.	31	10	41	.	.	.	98	71	169		Aug 29 - Oct 16 (3)
	1990	.	5	.	40	45	90	.	1	.	89	76	166	Jun 28 - Jul 26	Sep 5 - Oct 17
	1991	1	8	30	.	.	39	5	6	32	.	.	43	Jun 11 - Aug 28 (4)	
	1992	.	3	.	19	46	68	.	9	.	68	201	278	Jul 7 - Jul 26	Aug 31 - Oct 20
Levis1	1991	.	33	102	.	.	135	.	33	129	.	.	162	Jul 6 - Aug 30	
	1992	10	23	18	37	73	161	17	48	60	149	329	603	Jun 15 - Aug 31	Sep 1 - Oct 14
	1993	25	52	28	18	38	161	13	77	30	29	103	252	Jun 14 - Aug 31 (5)	Sep 1 - Oct 18
	1994	4	4	58	31	15	112	9	5	167	197	86	464	Jun 13 - Aug 31	Sep 1 - Oct 22 (6)
Lower2	1993	10	34	26	7	11	88	9	43	31	8	31	122	Jun 22 - Aug 31	Sep 1 - Oct 18 (7)

Washouts or Non Fishing Periods:

-1- Sep 27 trapnet completely underwater.
-2- Sep 30 not set to try and correct seal problem.
-3- Sep 27 trap underwater, Oct 11 not able to reset because strong current.
-4- Jul 17 - Aug 2 trap was not set because of jellyfish and green algae.
-5- Aug 5 - Aug 17 washout.
-6- Oct 2- Oct 6 washout.
-7- Aug 5 - Aug 9 washout.

Table 12. Counts at Levis trapnet and percentages of small & large salmon returning during the summer, fall and entire season for each year the trap operated.

SMALL SALMON

	Summer					Fall			
Year	Jun	Jul15	Jul31	Aug	Total	Sep	Oct	Total	Total
Total catch									
92	10	15	8	18	51	37	73	110	161
93	25	14	38	28	105	18	38	56	161
94	4	1	3	58	66	31	15	46	112
Percent of total run									
92	6	9	5	11	32	23	45	68	100
93	16	9	24	17	65	11	24	35	100
94	4	1	3	52	59	28	13	41	100
Percent of season run									
92	20	29	16	35	100	34	66	100	
93	24	13	36	27	100	32	68	100	
94	6	2	5	88	100	67	33	100	

LARGE SALMON

	Summer					Fall			
Year	Jun	Jul15	Jul31	Aug	Total	Sep	Oct	Total	Total
Total catch									
92	17	34	14	60	125	149	329	478	603
93	13	8	69	30	120	29	103	132	252
94	9	2	3	169	183	197	85	282	465
Percent of total run									
92	3	6	2	10	21	25	55	79	100
93	5	3	27	12	48	12	41	52	100
94	2	0	1	36	39	42	18	61	100
Percent of season run									
92	14	27	11	48	100	31	69	100	
93	11	7	58	25	100	22	78	100	
94	5	1	2	92	100	70	30	100	

Table 13. Summary of tag recaptures from smolt and adult releases in the Margaree River 1986 to 1994.

Release Year	Stock	Stage	No. Tags Applied	Tag Type	Series		Greenland					Newfoundland							Quebec	Total
							1A	1B	1C	1D	1E	1F	1	2	3	4	8	13	14	Q9	Returns
1986	Rocky Brook	2+ smolt	7311	CWT	55 0/0			2		2	3	1	1			2					11
1986	Rocky Brook	2+ smolt	3376	CWT	62 2/23																0
1986	Rocky Brook	2+ smolt	1992	CWT	62 2/25			1		1											2
1987	Lake O'Law	1+ smolt	995	CWT	55 16/7																0
1987	Lake O'Law	1+ smolt	1107	CWT	55 16/8																0
1987	Margaree River	2+ smolt	10000	CWT	55 16/16	a										1					1
1987	Margaree River	1+ smolt	8599	CWT	55 16/16	a															0
1987	Lake O'Law	1+ smolt	3080	CWT	55 16/17	a										2					2
1987	Margaree River	2+ smolt	933	Carlin	P22200-P22299																0
					P22500-P23199		1	1	1												3
					P23300-P23499																0
1987	Margaree River	small/large	138	Carlin	zz23000-zz23137										2					2	4
1988	Margaree River	2+ smolt	4116	CWT	55 16/12																
		small/large	340	Carlin	zz23138-zz23299										2	2				1	5
					zz23401-zz23581																
1989	Margaree River	small/large	425	Carlin	zz23583-zz23999	b					1			1	3		1				6
					zz23300-zz23309																
1990	Margaree River	small/large	576	Carlin	zz23310-zz23399	c									1			1	1	2	5
					zz24000-zz24489																
1991	Margaree River	small/large	494	Carlin	zz24490-zz24799	d								2						1	3
					zz24900-zz24999																
					zz35000-zz35087																
1992	Margaree River	small/large	1175	Carlin	zz35088-zz35991	e														2	2
					zz36000-zz36280																
1993	Margaree River	small/large	661	Carlin	zz36281-zz36943	f															0
1994	Margaree River	small/large	564	Carlin	zz60000-zz60563																0

a - May also be Neisiguit River origin as same series used for those released.
b - Excluding tags 23950 and 23951.
c - Excluding tags 24287, 24443, and 24482.
d - Excluding tags 24510, 24713, 24719, and 24763.
e - Excluding tags 35124,35213, 35563, 35569, 35576, 35787, 36018, 36019, 36079, and 36213.
f - Excluding tags 36727 and 36871.

Table 14. Summary of smolt ages of adult salmon sampled at trapnets on the Margaree River, 1990-93.

		Number by Sampling Month						Smolt Age			
Sea Age	*Year*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Tot*	*2*	*3*	*4*	*5*
1	1990	0	3	.	57	67	127	64.6	35.4	0.0	0.0
	1991	0	14	94	.	.	108	52.8	45.4	1.9	0.0
	1992	2	12	12	38	96	160	62.5	31.3	6.3	0.0
	1993	6	36	38	18	42	140	52.1	39.3	7.9	0.7
	Total	8	65	144	113	205	535	58.3	37.2	4.3	0.2
2	1990	5	1	.	80	85	171	69.6	28.1	2.3	0.0
	1991	3	22	106	.	.	131	62.6	36.6	0.8	0.0
	1992	10	31	41	156	320	558	55.7	43.4	0.9	0.0
	1993	13	83	46	22	83	247	57.9	40.9	1.2	0.0
	Total	31	137	193	258	488	1107	59.2	39.7	1.2	0.0
3	1990	0	0	.	6	21	27	77.8	22.2	0.0	0.0
	1991	0	1	2	.	.	3	100.0	0.0	0.0	0.0
	1992	0	2	4	7	28	41	90.2	9.8	0.0	0.0
	1993	0	1	1	2	7	11	27.3	72.7	0.0	0.0
	Total	0	4	7	15	56	82	78.0	22.0	0.0	0.0
Previous	1990	1	0	.	14	14	29	86.2	13.8	0.0	0.0
Spawners	1991	2	1	12	.	.	15	66.7	33.3	0.0	0.0
	1992	1	4	2	11	39	57	75.4	22.8	1.8	0.0
	1993	1	8	3	2	18	32	65.6	34.4	0.0	0.0
	Total	5	13	17	27	71	133	74.4	24.8	0.8	0.0
All	1990	6	4	.	157	187	354	69.8	29.1	1.1	0.0
	1991	5	38	214	.	.	257	59.1	39.7	1.2	0.0
	1992	13	49	59	212	483	816	60.2	37.9	2.0	0.0
	1993	20	128	88	44	150	430	55.8	40.7	3.3	0.2
	Total	44	219	361	413	820	1857	60.9	37.1	2.0	0.1

Table 15. Summary of sea ages of wild and hatchery adult salmon sampled at trapnets on the Margaree River, 1990-93.

		Number by Sampling Month						Sea Age			
Origin	*Year*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Tot*	*1*	*2*	*3*	*PrevSp*
Hatchery	1990	7	3	.	13	5	28	35.7	53.6	7.1	3.6
	1991	1	32	18	.	.	51	62.7	33.3	2.0	2.0
	1992	13	17	7	11	25	73	60.3	34.2	0.0	5.5
	1993	35	50	14	5	4	108	76.9	19.4	0.0	3.7
	Total	56	102	39	29	34	260	65.0	30.0	1.2	3.8
Wild	1990	6	4	.	192	226	428	35.7	47.7	8.4	8.2
	1991	5	47	266	.	.	318	42.8	50.3	0.9	6.0
	1992	14	63	67	248	602	994	18.3	70.7	4.6	6.3
	1993	22	152	101	57	179	511	32.5	57.1	2.9	7.4
	Total	47	266	434	497	1007	2251	28.3	60.4	4.4	6.9
All	1990	13	7	.	205	231	456	35.7	48.0	8.3	7.9
	1991	6	79	284	.	.	369	45.5	48.0	1.1	5.4
	1992	27	80	74	259	627	1067	21.2	68.2	4.3	6.3
	1993	57	202	115	62	183	619	40.2	50.6	2.4	6.8
	Total	103	368	473	526	1041	2511	32.1	57.2	4.1	6.6

PrevSp = Previous Spawners.

Table 16. Movements of Atlantic salmon at Lake O'Law Brook , Margaree River for 1991 - 1994.

	Small Salmon			Large Salmon			Smolt		
Year	Wild	Hatc	Total	Wild	Hatc	Total	Wild	Hatc	Total
1991	28	6	34	72	4	76	2541	1845	4386
1992	14	1	15	48	10	58	2416	1900	4316
1993	25	5	30	54	4	58	1513	3522	5035
1994	21	9	30	79	7	86	631	8	639

- In 1991 fence was operated from May 2 until Nov. 18.
- In 1992 fence was operated from May 21 until Dec. 1.
- In 1993 fence was operated from May 9 until June 19 and from Sept. 29 until Nov. 15.
- In 1994 fence was operated from May 5 until June 30 and from Sept. 15 until Dec. 1.

Table 17. Numbers of wild and hatchery salmon from summer and fall sampling on Margaree River in 1994.

	Small Salmon			Large Salmon			Percent
SEASON:	Wild	Hatchery	% Wild	Wild	Hatchery	% Wild	Large
Summer (June 1 - Aug. 31)							
Trapnets							
Index	49	17	74%	157	24	87%	73%
Angling							
Logbooks	9	4	69%	20	0	100%	61%
SCIP	13	17	43%	.	.	.	.
Sub-Total:	71	38	65%	177	24	88%	65%
FALL (Sept. 1 - Oct. 31)							
Trapnets							
Index	42	4	91%	273	10	96%	86%
Native	12	2	86%	48	2	96%	78%
Lake O' Law Fence	21	9	70%	79	7	92%	74%
Angling							
Logbooks	9	2	82%	90	6	94%	90%
SCIP	8	2	80%	.	.	.	.
Sub-Total:	92	19	83%	490	25	95%	82%
Total Season:	***163***	***57***	***74%***	***667***	***49***	***93%***	***76%***

Table 18. Summary of snorkel counts done on the Margaree River 1990-1992 and 1994.

				Large			Small			
Section	***Year***	***Month***	***Day***	***Unk***	***Hatc***	***Wild***	***Unk***	***Hatc***	***Wild***	***Total***
Upper	90	8	9	0	6	83	0	1	14	104
Middle	90	8	9	57	24	34	21	3	14	153
Lower	90	8	9	115	28	53	10	7	18	231
All	90	8	9	172	58	170	31	11	46	488
Upper	91	8	1	0	1	5	1	1	1	9
Middle	91	8	1	0	0	0	3	6	1	10
Lower	91	8	1	2	10	4	2	3	3	24
All	91	8	1	2	11	9	6	10	5	43
Upper	92	7	29	0	4	59	0	6	10	79
Middle	92	7	29	0	12	31	0	13	14	70
Lower	92	7	29	0	41	85	0	42	18	186
All	92	7	29	0	57	175	0	61	42	335
Upper	94	8	1	.	.	.	.	.	.	3
Middle	94	8	1	.	.	.	.	.	.	26
Lower	94	8	1	.	.	.	.	.	.	67
All	94	8	1	.	.	.	.	.	.	96

Upper Section - Headwaters to breakwater in sanctuary.
Middle Section - Breakwater to Hatchery Pool.
Lower Section - Hatchery Pool to Forks Pool.
- Only a few individual pools were done in 1993 so this data was not tabled.

Table 19. Results of electrofishing surveys at barrier net sites in the Margaree River, July, 1994.

Tributary	Year	Site #	Area (m^2)	No. of Sweeps	Life Stage	Sweep Catch	Total Estimate	Variance	Density ($100m^2$)	Mean Length	PHS
Big Brook	*1994*	15	148	4	Fry	155	189	219.6	128	4.9	14.3%
Forest Glen Brook		40	116	3	Fry	111	116	14.6	100	4.0	6.6%
Forest Glen Brook		45	193	4	Fry	161	210	468.5	109	4.2	8.1%
MacFarlanes Brook		96	160	4	Fry	172	183	31.5	115	5.0	13.5%
Trout Brook		98	174	4	Fry	50	61	98.6	35	4.4	3.0%
Big Brook	*1994*	15	148	4	Parr	45	49	18.5	33	9.4	20.3%
Forest Glen Brook		40	116	3	Parr	88	107	142.5	92	7.9	35.6%
Forest Glen Brook		45	193	4	Parr	167	185	68.1	96	7.5	32.5%
MacFarlanes Brook		96	160	4	Parr	115	123	22.0	77	9.1	42.9%
Trout Brook		98	174	4	Parr	87	95	27.6	55	7.2	16.6%

Table 20. Raw data for mark-recapture population estimates of large salmon, 1992-94.

		Logbook			Fence		
Year	*Tags Applied*	*Recaps*	*No. Fish*	*Percent*	*Recaps*	*No. Fish*	*Percent*
1994	456	15	120	13%	14	86	16%
1993	242	5	71	7%	4	58	7%
1992	577	16	189	8%	5	58	9%

Table 21. Percentage of time Peterson estimate is within 25% of the true population at varying trap and recapture efficencies.

Population = 2000			
25 %	Recapture Efficiency		
Trap Efficiency	0.04	0.08	0.16
0.08	50	66	90
0.16	67	88	97

Population = 4000			
25 %	Recapture Efficiency		
Trap Efficiency	0.04	0.08	0.16
0.08	59	88	96
0.16	83	96	98

Table 22. Data used to revise 1990 large and small salmon estimates based on trapnet efficiencies.

	Trapnet Catches			Fall Population	Trapnet Efficiencies		
Year	Lower1	Upper1	Levis	Estimates	Lower1	Upper1	Levis
88	115	79		1314	0.088	0.060	
89	180	169		3973	0.045	0.043	
90	119	165		9752	0.012	0.017	
91				3013			
92		167 *	478	2747		0.061	0.174
93			132	1651			0.080
94			283	1762			0.161

* Catch up to Oct. 12 because the fall estimate is up until that date as well (Table 38).

	Proportion Large Salmon	Ratio Small:Large		FALL ESTIMATE		TOTAL ESTIMATE		SMALL ESTIMATE	
Year	Fall	Total Year	Trap Efficiency	Method	Estimate	Method	Estimate	Method	Estimate
92	0.79	0.27	0.04	Min Eff	4125	Min Prop	7933	Max Ratio	5077
93	0.52	0.64	**0.05**	**Ave Eff**	**3300**	**Ave Prop**	**5156**	**Ave Ratio**	**1977**
94	0.61	0.24	0.06	Max Eff	2750	Max Prop	3481	Min Ratio	940
Mean	**0.64**	**0.38**							

Table 23. Alternative method for revising 1990 large and small salmon estimate using Nova Scotia License Stub (STUB) returns. Total return estimate for 1990 is not included in Mean calculation of total returns. STUB/RETURN ratio for 1988 is not included in the Mean calculation of STUB/RETURN.

Year	Total Returns	License Stub	Stub/ Return	Jackknife Predicted Return	Pred - Obs/ Obs
87	4015	1857	0.463	3678	-8.39
88	1688	1932	1.145	3997	136.79
89	2289	1570	0.686	3248	41.90
90	11144	1507		2988	Using median of ratios
91	3484	1757	0.504	3630	4.19
92	6375	1938	0.304	3838	-39.80
93	3358	1102	0.328	2183	-34.99
94	2900	1466	0.506	3033	4.59
Mean	3444	1641	0.465	3529	2.48

Table 24. Estimates of returns, escapements, and percent of conservation target met for Atlantic salmon from the Margaree River, 1984 to 1994. Mean = (1989 to 1993).

	Large Returns			Large Escapement			Conservation Target Met by Large			Collected for Hatchery
		Percentiles			Percentiles			Percentiles		
Year	Median	5%	95%	Median	5%	95%	Median	5%	95%	(eggs)*
1984	412	327	563	381	296	532	37%	29%	51%	0.100
1985	1462	1109	2217	1378	1025	2133	133%	99%	206%	0.150
1986	3616	2738	5680	3461	2583	5525	334%	249%	533%	0.150
1987	4015	2976	6540	3899	2860	6424	376%	276%	620%	0.150
1988	1688	1286	2494	1545	1143	2351	149%	110%	227%	0.300
1989	2289	1708	3693	2164	1583	3568	209%	153%	344%	0.300
1990	**5156**	3481	7933	**5022**	3347	7799	485%	323%	753%	0.380
1991	3484	1853	5785	3323	1692	5624	321%	163%	543%	0.473
1992	6375	4875	9375	6222	4722	9222	601%	456%	890%	0.300
1993	3358	2408	6158	3224	2274	6024	311%	219%	581%	0.009
1994	**2900**	2350	4500	**2759**	2209	4359	266%	213%	421%	.
+/- 1993	-14%			-14%			-14%			-100%
+/- Mean	-30%			-31%			-31%			-100%
	Small Returns			**Small Escapement**			**Conservation Target Met by Small**			
1984	504	400	688	311	158	446	53%	27%	77%	
1985	838	634	1167	433	125	658	74%	21%	113%	
1986	1096	838	1420	439	56	638	75%	10%	110%	
1987	1478	1143	1865	644	166	888	111%	29%	153%	
1988	2209	1674	2911	1451	795	2032	249%	137%	349%	
1989	768	591	977	328	30	416	56%	5%	71%	
1990	**1977**	940	5077	**1471**	291	4428	253%	50%	761%	
1991	1909	794	3891	1340	42	3139	230%	7%	539%	
1992	1645	1258	2419	1088	701	1862	187%	120%	320%	
1993	2087	1489	3851	1504	906	3268	258%	156%	562%	
1994	**708**	573	1101	**390**	255	783	67%	44%	135%	
+/- 1993	-66%			-74%			-74%			
+/- Mean	-58%			-66%			-66%			

* Eggs are in millions.

Table 25. Breakdown of the wild and hatchery large salmon contributions to the egg depositions to the Margaree River for 1994.

Description:	*Year*	*Wild*	*Hatchery*	*Total*
Percent Female	***1994***	80%	76%	80%
Avg Wt. of Large Salmon		4.72	4.45	4.70
Fecundity (eggs/kg)		1,764	1,764	1,764
Eggs per Spawner		6,661	5,966	6,633
Total Returns		2,690	210	2,900
Estimated Returns		2,642	208	2,850
Native Harvests		48	2	50
Total Removals		133	8	141
Angling Mortality		68	5	73
Poaching		17	1	18
Native Harvests		48	2	50
Total Escapement		2,557	202	2,759
Percent of Total Returns		93%	7%	100%
Total Eggs		17,031,844	1,205,430	18,237,274
Percent of Total Eggs		93%	7%	100%
	1993			
Percent of Total Eggs		95%	5%	100%
	1992			
Percent of Total Eggs		97%	3%	100%

Angling Mortality = large catch estimate * % origin (logs) * 0.05 .

Table 26. Population estimates based on large salmon catches at Levis trapnet during 1992, 1993 and 1994.

	Large Salmon		
Year	Trapnet Catch	Population Estimate	Trapnet Efficiency
92	603	3472	17.4 %
93	252	3150	8.0 %
94	464	2900	16.0 %

Table 27. Parameter estimates, forcasts and residuals for stock recruitment models.

	Model			
Parameter	Ricker	Beverton-Holt	Mean	Tabular
a	1.75	4.56	.	.
b	3.74	0.38	.	.
Res SS	1.61	0.90	1.22	0.83
Forcast	2731	4236	3249	4687

Table 28. Raw data for the stock recruitment relationships.

Spawning Year	Spawners	Recruits
1947	1685	4582
1948	3358	7204
1949	1839	5716
1950	1744	4000
1951	2093	2440
1952	969	2833
1956	486	2616
1957	822	4534
1961	344	3620
1962	1306	3850
1963	887	3538
1964	1053	2515
1965	993	3694
1966	727	1393
1967	1009	2083
1968	828	2378
1969	488	3394
1970	901	2702
1971	351	2630
1972	373	3261
1973	393	3131
1974	436	1066
1975	293	2813
1976	366	1819
1977	538	2909
1978	699	3292
1979	363	1868
1980	681	1462
1981	618	3616
1982	760	4015
1983	657	1688
1984	381	2289
1985	1378	5156
1986	3461	3484
1987	3899	6375
1988	1545	3358
1989	2164	2900
1990	5022	

Table 29. Tabular stock recruitment model for Margaree River Atlantic Salmon.

	Spawning Stock			
Recruitment	0 - 600	600 - 1200	1200 - 1800	>1800
> 7800				
7200 - 7800				1
6600 - 7200				
6000 - 6600				1
5400 - 6000			1	1
4200 - 4800		1	1	
3600 - 4200	1	3	2	
3000 - 3600	3	2	1	1
2400 - 3000	4	3		2
1200 - 2400	3	5		
0 - 1200	1			
Number of Points	12	14	5	6
Average Spawners	401	829	1532	2802
Average Recruits	2618	2839	4189	4687
Recruits minus Spawners	2217	2010	2657	1884
Recruits / Spawners	6.53	3.42	2.74	1.67

Table 30. Expected recruits, yield, and recruits/spawner for Ricker, Beverton-Holt and Tabular models. Numbers are X1000, bold numbers indicate maximum values.

	Recruits			Yield			Recruits/Spawner		
Spawners	Ricker	Beverton	Tabular	Ricker	Beverton	Tabular	Ricker	Beverton	Tabular
0.1	0.57	0.94		0.47	0.84		5.68	9.45	
0.2	1.08	1.57		0.88	1.37		5.41	7.83	
0.3	1.55	2.00	2.62	1.25	1.70	2.21	5.16	6.68	6.53
0.4	1.97	2.33		1.57	1.93		4.92	5.83	
0.5	2.35	2.58		1.85	2.08		4.69	5.17	
0.6	2.68	2.78		2.08	2.18		4.47	4.64	
0.7	2.99	2.95		2.29	2.25		4.27	4.21	
0.8	3.25	3.08		2.45	2.28		4.07	3.86	
0.9	3.49	3.20	2.84	2.59	2.30	2.01	3.88	3.55	3.42
1.0	3.70	3.30		2.70	**2.30**		3.70	3.30	
1.1	3.88	3.38		2.78	2.28		3.53	3.08	
1.2	4.03	3.46		2.83	2.26		3.36	2.88	
1.3	4.17	3.52		2.87	2.22		3.20	2.71	
1.4	4.28	3.58		**2.88**	2.18		3.06	2.56	
1.5	4.37	3.63	4.19	2.87	2.13	**2.66**	2.91	2.42	2.74
1.6	4.44	3.68		2.84	2.08		2.78	2.30	
1.7	4.50	3.72		2.80	2.02		2.65	2.19	
1.8	4.55	3.76		2.75	1.96		2.53	2.09	
1.9	4.57	3.80		2.67	1.90		2.41	2.00	
2.0	4.59	3.83		2.59	1.83		2.30	1.91	
2.1	**4.60**	3.86		2.50	1.76		2.19	1.84	
2.2	4.59	3.88		2.39	1.68		2.09	1.77	
2.3	4.58	3.91		2.28	1.61		1.99	1.70	
2.4	4.55	3.93		2.15	1.53		1.90	1.64	
2.5	4.52	3.95		2.02	1.45		1.81	1.58	
2.6	4.48	3.97		1.88	1.37		1.72	1.53	
2.7	4.44	3.99		1.74	1.29		1.64	1.48	
2.8	4.39	4.01		1.59	1.21		1.57	1.43	
2.9	4.34	4.03	**4.69**	1.44	1.13	1.88	1.49	1.39	1.67
3.0	4.28	4.04		1.28	1.04		1.43	1.35	
3.5	3.93	4.11		0.43	0.61		1.12	1.17	
4.0	3.54	4.16		-0.46	0.16		0.89	1.04	

Table 31. Percent of hatchery fish returning early to the Nepisiguit River counting fence. Fish returning before August 31 are defined as early.

	Small Salmon							
	Early			Late			Annual	Percent Hatchery
Year	Hatc	Wild	Total	Hatc	Wild	Total	Total	Early
82	100	354	454	111	430	541	995	47.39
83	49	102	151	21	134	155	306	70.00
84	111	557	668	14	274	288	956	88.80
85	150	199	349	10	150	160	509	93.75
86	211	351	562	285	561	846	1408	42.54
87	487	270	757	247	748	995	1752	66.35
88	161	251	412	393	1609	2002	2414	29.06
89	59	164	223	31	222	253	476	65.56
90	62	78	140	1	9	10	150	98.41
91	2	24	26	13	80	93	119	13.33
92	176	601	777	6	329	335	1112	96.70
93	14	71	85	0	33	33	118	100.00
94	22	119	141	4	121	125	266	84.62
Total	1604	3141	4745	1136	4700	5836	10581	58.54

	Large Salmon							
	Early			Late			Annual	Percent Hatchery
Year	Hatc	Wild	Total	Hatc	Wild	Total	Total	Early
82	93	76	169	48	160	208	377	65.96
83	20	181	201	9	83	92	293	68.97
84	58	130	188	43	180	223	411	57.43
85	156	327	483	38	300	338	821	80.41
86	271	181	452	92	400	492	944	74.66
87	231	183	414	247	721	968	1382	48.33
88	194	159	353	267	1229	1496	1849	42.08
89	185	214	399	138	543	681	1080	57.28
90	58	115	173	1	10	11	184	98.31
91	11	32	43	11	56	67	110	50.00
92	11	299	310	2	130	132	442	84.62
93	17	106	123	3	70	73	196	85.00
94	1	48	49	3	181	184	233	25.00
Total	1306	2051	3357	902	4063	4965	8322	59.15

Table 32. Percent of hatchery fish returning early to the Morell River, Leards Pond Fishway. Fish returning before August 31 are defined as early returns.

	Small Salmon							
	Early			Late			Annual	Percent Hatchery
Year	Hatc	Wild	Total	Hatc	Wild	Total	Total	Early
85	7	0	7	2	3	5	12	77.78
86	126	1	127	491	0	491	618	20.42
87	1029	0	1029	246	2	248	1277	80.71
88	1225	0	1225	161	9	170	1395	88.38
89	106	3	109	217	9	226	335	32.82
90	212	11	223	153	33	186	409	58.08
91	178	16	194	116	17	133	327	60.54
92	805	48	853	38	16	54	907	95.49
93	526	11	537	58	33	91	628	90.07
94	23	3	26	5	5	10	36	82.14
87-94	4104	92	4196	994	124	1118	5314	80.50

	Large Salmon							
	Early			Late			Annual	Percent Hatchery
Year	Hatc	Wild	Total	Hatc	Wild	Total	Total	Early
85	0	0	0	0	2	2	2	.
86	0	0	0	4	2	6	6	0.00
87	5	0	5	61	2	63	68	7.58
88	74	0	74	11	2	13	87	87.06
89	82	0	82	43	0	43	125	65.60
90	21	0	21	38	4	42	63	35.59
91	8	1	9	20	10	30	39	28.57
92	21	4	25	17	4	21	46	55.26
93	9	0	9	2	0	2	11	81.82
94	18	0	18	9	2	11	29	66.67
88-94	233	5	238	140	22	162	400	62.47

Table 33. Percent of hatchery returns monitored at trapnets and by logbook anglers on the Margaree River.

	Small Salmon							
	Early			Late			Annual	Percent Hatchery
Year	Hatc	Wild	Total	Hatc	Wild	Total	Total	Early
Margaree Logbook Angling								
89	21	16	37	2	6	8	45	91.30
90	7	30	37	4	28	32	69	64.67
91	12	14	26	3	24	27	53	80.11
92	19	23	42	6	29	35	77	76.06
93	19	24	43	2	13	15	58	90.66
94	4	9	13	2	9	11	24	66.67
Total	82	116	198	19	109	128	326	81.39
92-94	42	56	98	10	51	61	159	80.86
Margaree Trapnet								
92	20	30	50	18	92	110	160	52.63
93	54	54	108	1	56	57	165	98.18
94	17	49	66	4	42	46	112	80.95
Total	91	133	224	23	190	213	437	79.82

	Large Salmon							
	Early			Late			Annual	Percent Hatchery
Year	Hatc	Wild	Total	Hatc	Wild	Total	Total	Early
Margaree Logbook Angling								
89	18	30	48	4	37	41	89	81.82
90	8	33	41	5	37	42	83	60.72
91	18	22	40	12	95	107	147	60.99
92	22	28	50	20	100	120	170	52.45
93	11	15	26	6	38	44	70	66.67
94	0	20	20	6	90	96	116	0.00
Total	78	147	225	53	397	450	675	59.61
92-94	34	62	96	32	228	260	356	51.38
Margaree Trapnet								
92	16	104	120	21	455	476	596	43.24
93	11	110	121	4	137	141	262	73.33
94	24	157	181	10	273	283	464	70.59
Total	51	371	422	35	865	900	1322	59.30

Table 34. Numbers of salmon smolt and parr released to Margaree River since 1976 by parent stock origin (MAR = Margaree River , RB = Rocky Brook or Miramichi River). Rearing locations are: MAR, Margaree; COB, Cobequid; MER, Mersey.

		Smolt				Parr			
	Rearing	2+		1+		1+		0+	
Year	Location	MAR	RB	MAR	RB	MAR	RB	MAR	RB
1976	MAR	8,971							
1977	MAR					5,022			
1978	COB		15,250						
1979	COB		15,927 ?						
1980	COB		14,960						
1981	COB		15,950						
1982	MER			8,481		1,098			
1983	COB	13,486						9,853	
	MAR	3,783							
1984	MAR				10,195 @				
	MER			14,483					
	COB	11,210							
1985	MAR			2,669	1,303	5,882	834		
	COB	13,660				7,820	5,860		
1986	MAR			2,105		8,754		25,000	
	COB	8,820	9,684					6,750	
1987	MAR	6,369		8,599		5,400		40,000	
	COB	18,337						12,429	
1988	MAR	4,136		22,313		2,201		40,000	
	COB	12,785						6,300	
1989	MAR	2,600 *		13,000		10,000		150,000	
	COB	18,500						6,000	
1990	MAR	4,119 *		14,200		21,425		60,500	
	COB	15,976							
1991	MAR	12,100 *		20,000		22,000		110,000	
	COB	10,200				4,000			
1992	MAR	21,800 *		20,000		33,600		92,500	
	COB	16,900				3,500		9,800	
1993	MAR	17,083 *		20,000		27,554		52,728	
	COB	15,000				5,712			
1994	MAR			13,000		12,000			
	COB	11,000							

* Reared at the Lake O'Law cages.

@ MSW hatchery return broodstock collected from Margaree River and crossed with wild Margaree River salmon. The hatchery return broodstock would have been 2SW fish originating from Rocky Brook 2+ smolts released in 1981.

? Millbank broodstock.

Table 35. Total number of salmon tagged by month and the percent of recaptures from broodstock collections, the counting fence on Lake O'Law Brook and the recreational fishery from 1987-94.

			Percentage of recaptures at the various recapture methods				
					Angling Recaptures		
Month	Year	Total No. Tagged	Broodstock	LOL Fence	Lower Sect.	Upper Sect.	SW Marg.
	Summarized for 1987 to 1994:						
June		118	6.8%	0.0%	14.4%	13.6%	0.8%
July 1-15		125	3.2%	0.0%	9.6%	7.2%	1.6%
July 16-31		244	2.9%	1.2%	11.5%	3.7%	0.0%
August		742	.	1.9%	10.1%	3.9%	0.4%
September		1213	.	0.7%	6.3%	4.3%	0.3%
October		1517	.	1.1%	5.1%	3.0%	0.4%
	Annual variation:						
June	87	7	42.9%	.	0.0%	14.3%	0.0%
	88	0	.	.	.	.	.
	89	0	.	.	.	.	.
	90	11	0.0%	0.0%	9.1%	9.1%	0.0%
	91	6	0.0%	0.0%	0.0%	16.7%	0.0%
	92	27	7.4%	0.0%	7.4%	25.9%	0.0%
	93	54	5.6%	0.0%	25.9%	9.3%	1.9%
	94	13	.	0.0%	0.0%	7.7%	0.0%
July 1-15	87	0	.	.	.	.	.
	88	0	.	.	.	.	.
	89	0	.	.	.	.	.
	90	6	0.0%	0.0%	0.0%	0.0%	0.0%
	91	22	4.5%	0.0%	0.0%	18.2%	0.0%
	92	57	3.5%	0.0%	5.3%	3.5%	3.5%
	93	38	2.6%	0.0%	21.1%	7.9%	0.0%
	94	2	.	0.0%	50.0%	0.0%	0.0%
July 16-31	87	0	.	.	.	.	.
	88	0	.	.	.	.	.
	89	0	.	.	.	.	.
	90	1	0.0%	0.0%	0.0%	0.0%	0.0%
	91	57	5.3%	1.8%	12.3%	3.5%	0.0%
	92	22	4.5%	0.0%	27.3%	0.0%	0.0%
	93	158	1.9%	0.6%	9.5%	4.4%	0.0%
	94	6	.	16.7%	0.0%	0.0%	0.0%
August	87	22	.	.	4.5%	9.1%	0.0%
	88	21	.	.	23.8%	4.8%	0.0%
	89	11	.	0.0%	0.0%	0.0%	0.0%
	90	0	.	.	.	.	.
	91	282	.	1.1%	8.5%	5.3%	0.4%
	92	74	.	0.0%	9.5%	2.7%	0.0%
	93	110	.	1.8%	17.3%	2.7%	1.8%
	94	222	.	4.1%	8.6%	2.7%	0.0%
September	87	37	.	.	5.4%	2.7%	0.0%
	88	171	.	.	5.3%	4.7%	0.0%
	89	247	.	0.4%	1.2%	4.5%	0.0%
	90	209	.	1.0%	7.2%	2.4%	1.0%
	91	0	.	.	.	.	.
	92	266	.	0.0%	10.5%	4.9%	0.8%
	93	60	.	1.7%	8.3%	1.7%	0.0%
	94	223	.	2.2%	6.7%	5.8%	0.0%
October	87	72	.	.	6.9%	4.2%	0.0%
	88	148	.	.	1.4%	0.7%	0.0%
	89	167	.	0.0%	1.8%	3.0%	0.0%
	90	230	.	0.9%	7.8%	1.7%	0.4%
	91	0	.	.	.	.	.
	92	621	.	1.6%	4.8%	4.2%	0.6%
	93	181	.	2.2%	8.3%	2.2%	0.0%
	94	98	.	0.0%	4.1%	3.1%	1.0%

Notes:
- Lower Section includes all pools below Lake O'Law brook.
- Upper Section includes all pools above Lake O'Law brook.
- SW Margaree is the South West Branch of the Margaree River.
- Broodstock collections occurred at Hart's, Hatchery, Tingley Rock, Ross Bridge and MacKenzie Pools.

Table 36. Distribution of tag recaptures from the recreational fishery for each tagging month and the section of the river the recapture occurred for 1987-94.

	Summer					Fall		
Section	**Jun**	**Jul15**	**Jul31**	**Aug**	**all**	**Sep**	**Oct**	**all**
	Numbers:							
A	0	2	2	3	7	4	0	4
B	5	4	12	38	59	28	14	42
C	1	2	5	12	20	9	13	22
D	7	2	7	13	29	24	33	57
E	4	2	2	9	17	12	17	29
F	2	4	4	3	13	10	18	28
G	7	3	3	16	29	22	21	43
H	3	1	1	4	9	14	3	17
I	4	1	1	6	12	6	4	10
Z	1	2	0	3	6	4	6	10
Total	34	23	37	107	201	133	129	262
	Percent:							
A	0	9	5	3	4	3	0	2
B	15	17	32	36	29	21	11	16
C	3	9	14	11	10	7	10	8
D	21	9	19	12	14	18	26	22
E	12	9	5	8	9	9	13	11
F	6	17	11	3	7	8	14	11
G	21	13	8	15	14	17	16	16
H	9	4	3	4	5	11	2	7
I	12	4	3	6	6	5	3	4
Z	3	9	0	3	3	3	5	4

Table 37. Total number of salmon tagged by month and the percent of monthly recaptures at an esturian trapnet within the same year from 1992 to 1994.

Month	Year	Total No. Tagged	Recapture Month - Esturian Trapnets Jun	Jul	Aug	Sep	Oct	Tot
Summarized for 1992 to 1994:								
June		94	4.3%	2.1%	3.2%	2.1%	0.0%	11.7%
July 1-15		97	.	2.1%	0.0%	4.1%	7.2%	13.4%
July 16-31		186	.	0.5%	1.6%	0.5%	4.8%	7.5%
August		406	.	.	2.7%	2.7%	3.7%	9.1%
September		549	.	.	.	8.0%	4.9%	12.9%
October		900	.	.	.	.	6.4%	6.4%
Annual Variation:								
	Numbers:							
June	92	27	0	0	0	0	0	0
	93	54	4	2	0	1	0	7
	94	13	0	0	3	1	0	4
		94	4	2	3	2	0	11
July 1-15	92	57	.	1	0	3	6	10
	93	38	.	1	0	1	1	3
	94	2	.	0	0	0	0	0
		97	.	2	0	4	7	13
July 16-31	92	22	.	0	0	0	1	1
	93	158	.	1	3	1	8	13
	94	6	.	0	0	0	0	0
		186	.	1	3	1	9	14
August	92	74	.	.	1	3	5	9
	93	110	.	.	4	1	7	12
	94	222	.	.	6	7	3	16
		406	.	.	11	11	15	37
September	92	266	.	.	.	28	16	44
	93	60	.	.	.	4	5	9
	94	223	.	.	.	12	6	18
		549	.	.	.	44	27	71
October	92	621	.	.	.	.	46	46
	93	181	.	.	.	.	7	7
	94	98	.	.	.	.	5	5
		900	.	.	.	.	58	58
	Percentages:							
June	92	27	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	93	54	7.4%	3.7%	0.0%	1.9%	0.0%	13.0%
	94	13	0.0%	0.0%	23.1%	7.7%	0.0%	30.8%
July 1-15	92	57	.	1.8%	0.0%	5.3%	10.5%	17.5%
	93	38	.	2.6%	0.0%	2.6%	2.6%	7.9%
	94	2	.	0.0%	0.0%	0.0%	0.0%	0.0%
July 16-31	92	22	.	0.0%	0.0%	0.0%	4.5%	4.5%
	93	158	.	0.6%	1.9%	0.6%	5.1%	8.2%
	94	6	.	0.0%	0.0%	0.0%	0.0%	0.0%
August	92	74	.	.	1.4%	4.1%	6.8%	12.2%
	93	110	.	.	3.6%	0.9%	6.4%	10.9%
	94	222	.	.	2.7%	3.2%	1.4%	7.2%
September	92	266	.	.	.	10.5%	6.0%	16.5%
	93	60	.	.	.	6.7%	8.3%	15.0%
	94	223	.	.	.	5.4%	2.7%	8.1%
October	92	621	.	.	.	.	7.4%	7.4%
	93	181	.	.	.	.	3.9%	3.9%
	94	98	.	.	.	.	5.1%	5.1%

Table 38. Total number of salmon tagged by month and the percent of monthly recaptures in the recreational within the same year from 1992 to 1994.

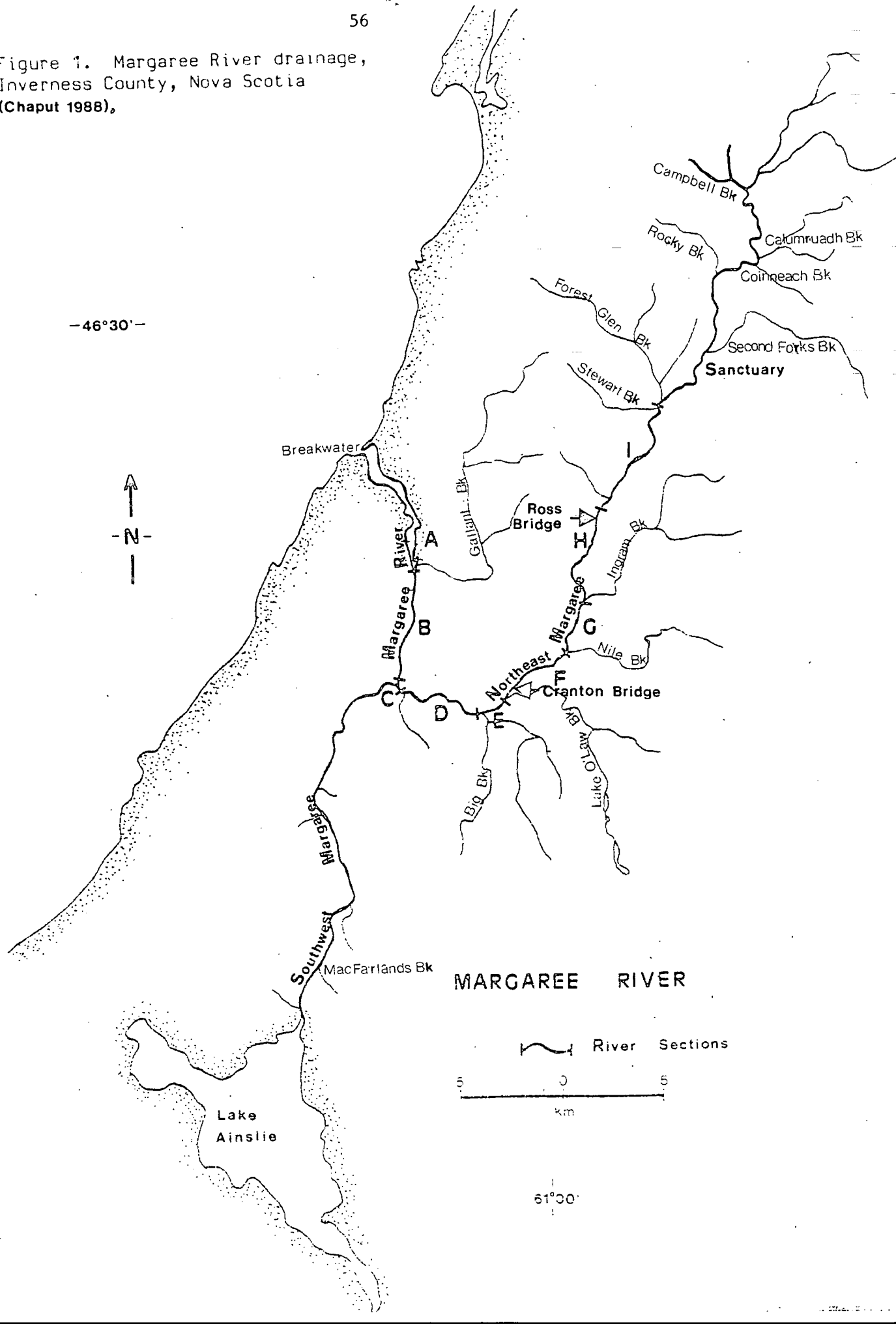
Month	Year	Total No. Tagged	Recapture Month - Recreational Fishery Jun	Jul	Aug	Sep	Oct	Tot
Summarized for 1992 to 1994:								
June		94	4.3%	19.1%	3.2%	1.1%	4.3%	31.9%
July 1-15		97	.	7.2%	7.2%	0.0%	4.1%	18.6%
July 16-31		186	.	1.6%	5.9%	4.3%	2.7%	14.5%
August		406	.	.	3.7%	6.4%	3.4%	13.5%
September		549	.	.	.	4.4%	8.9%	13.3%
October		900	.	.	.	.	9.4%	9.4%
Annual Variation:								
Numbers:								
6	92	27	0	6	2	0	1	9
	93	54	4	12	1	0	3	20
	94	13	0	0	0	1	0	1
		94	4	18	3	1	4	30
7.1	92	57	.	3	0	0	3	6
	93	38	.	3	7	0	1	11
	94	2	.	1	0	0	0	1
		97	.	7	7	0	4	18
7.2	92	22	.	2	0	3	1	6
	93	158	.	1	11	5	4	21
	94	6	.	0	0	0	0	0
		186	.	3	11	8	5	27
8	92	74	.	.	0	6	1	7
	93	110	.	.	11	4	9	24
	94	222	.	.	4	16	4	24
		406	.	.	15	26	14	55
9	92	266	.	.	.	14	27	41
	93	60	.	.	.	3	3	6
	94	223	.	.	.	7	19	26
		549	.	.	.	24	49	73
10	92	621	.	.	.	.	59	59
	93	181	.	.	.	.	18	18
	94	98	.	.	.	.	8	8
		900	.	.	.	.	85	85
Percentages:								
6	92	27	0.0%	22.2%	7.4%	0.0%	3.7%	33.3%
	93	54	7.4%	22.2%	1.9%	0.0%	5.6%	37.0%
	94	13	0.0%	0.0%	0.0%	7.7%	0.0%	7.7%
7.1	92	57	.	5.3%	0.0%	0.0%	5.3%	10.5%
	93	38	.	7.9%	18.4%	0.0%	2.6%	28.9%
	94	2	.	50.0%	0.0%	0.0%	0.0%	50.0%
7.2	92	22	.	9.1%	0.0%	13.6%	4.5%	27.3%
	93	158	.	0.6%	7.0%	3.2%	2.5%	13.3%
	94	6	.	0.0%	0.0%	0.0%	0.0%	0.0%
8	92	74	.	.	0.0%	8.1%	1.4%	9.5%
	93	110	.	.	10.0%	3.6%	8.2%	21.8%
	94	222	.	.	1.8%	7.2%	1.8%	10.8%
9	92	266	.	.	.	5.3%	10.2%	15.4%
	93	60	.	.	.	5.0%	5.0%	10.0%
	94	223	.	.	.	3.1%	8.5%	11.7%
10	92	621	.	.	.	.	9.5%	9.5%
	93	181	.	.	.	.	9.9%	9.9%
	94	98	.	.	.	.	8.2%	8.2%

Table 39. Returns by time period based on trapnet efficiencies in Table 26.

	Seasonal returns				Cumulative Returns		
Time	Year				Year		
Period	92	93	94		92	93	94
	Small Salmon						
June	57	313	25	June	57	313	25
Jul -15	86	175	6	Jul -15	144	488	31
Jul - 31	46	475	19	Jul - 31	190	963	50
Aug	103	350	363	Aug	293	1313	413
Sep	213	225	194	Sep	506	1538	606
Oct	420	475	94	Oct	925	2013	700
Total	925	2013	700				
	Large Salmon						
June	98	163	56	June	98	163	56
Jul -15	195	100	13	Jul -15	293	263	69
Jul - 31	80	863	19	Jul - 31	374	1125	88
Aug	345	375	1056	Aug	718	1500	1144
Sep	856	363	1231	Sep	1575	1863	2375
Oct	1891	1288	531	Oct	3466	3150	2906
Total	3466	3150	2906				

Returns during trapnet operation.

Figure 1. Margaree River drainage, Inverness County, Nova Scotia **(Chaput 1988).**



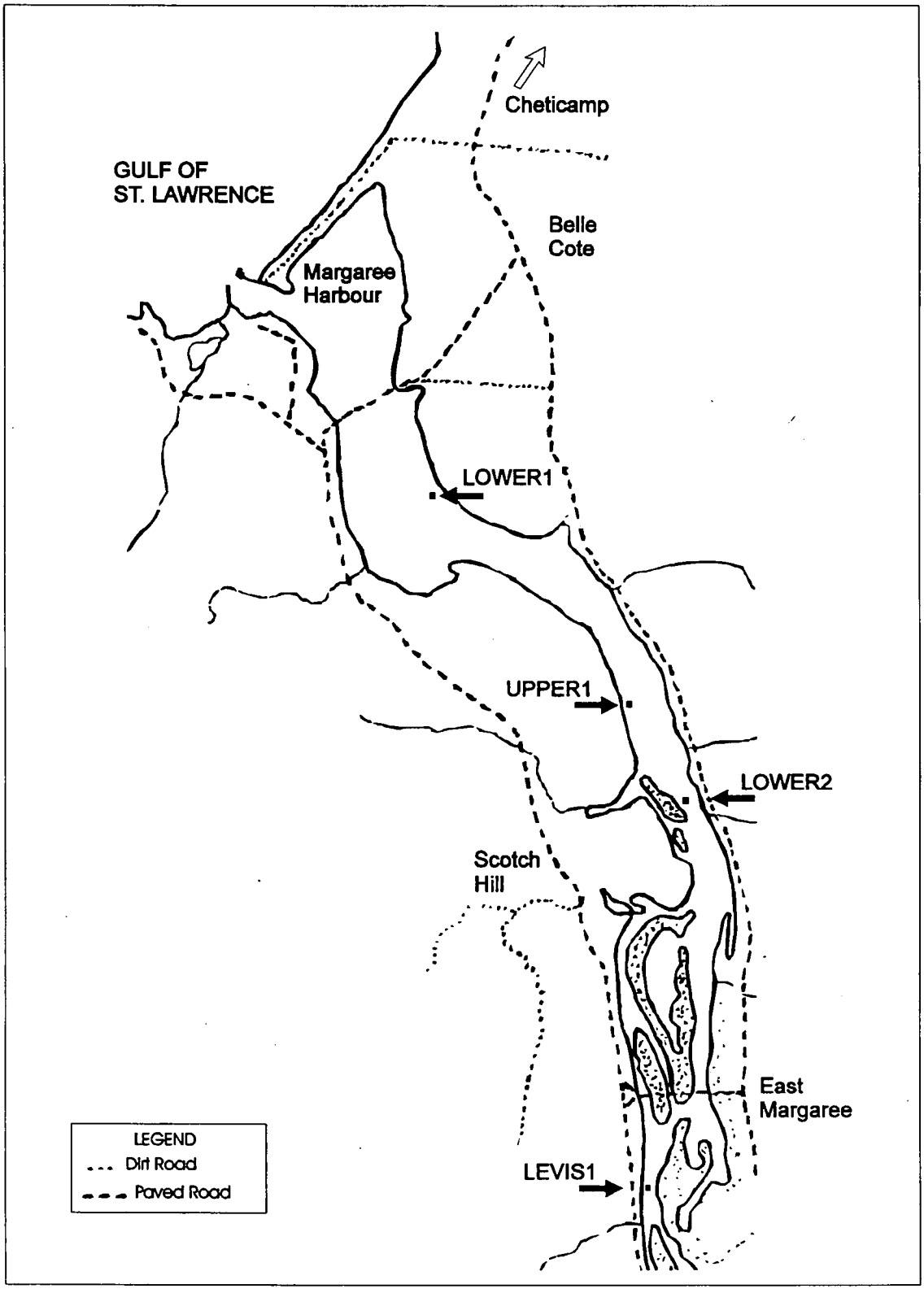
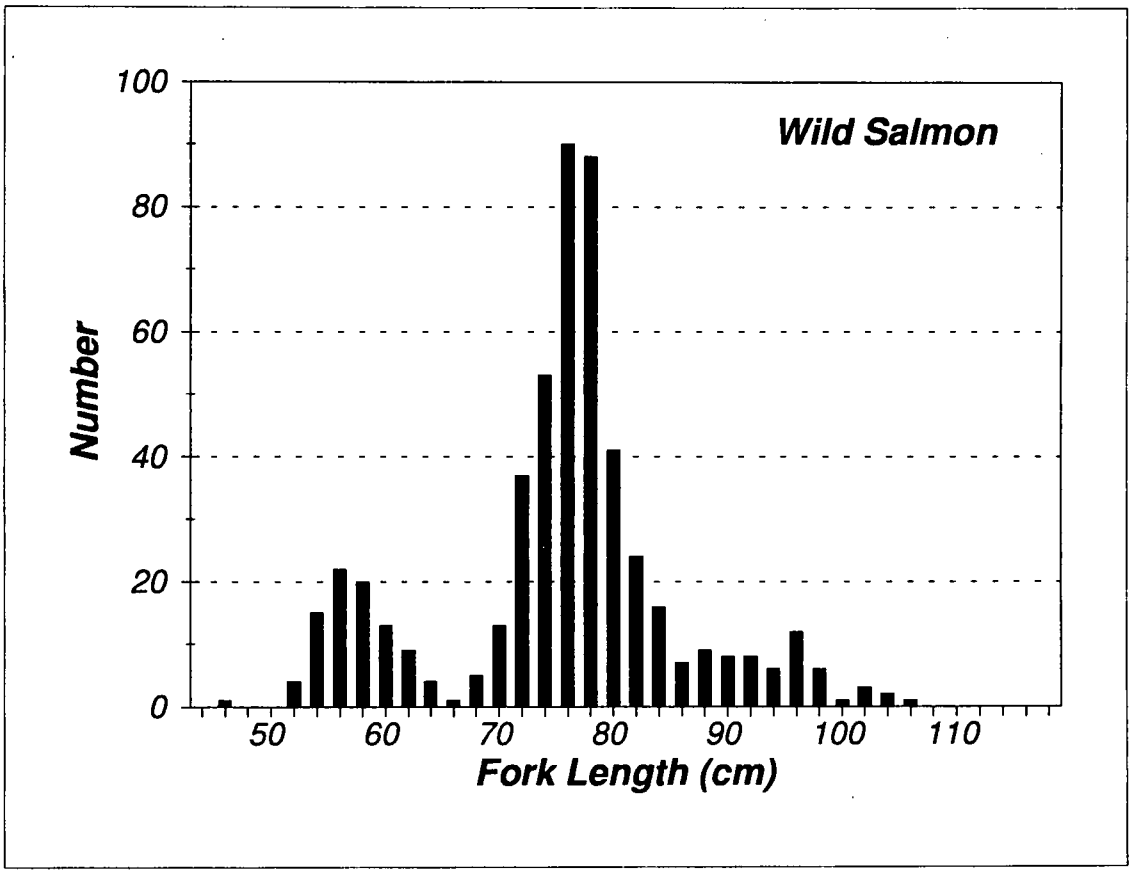


Figure 2. Margaree River trapnet locations from 1988 until 1994.



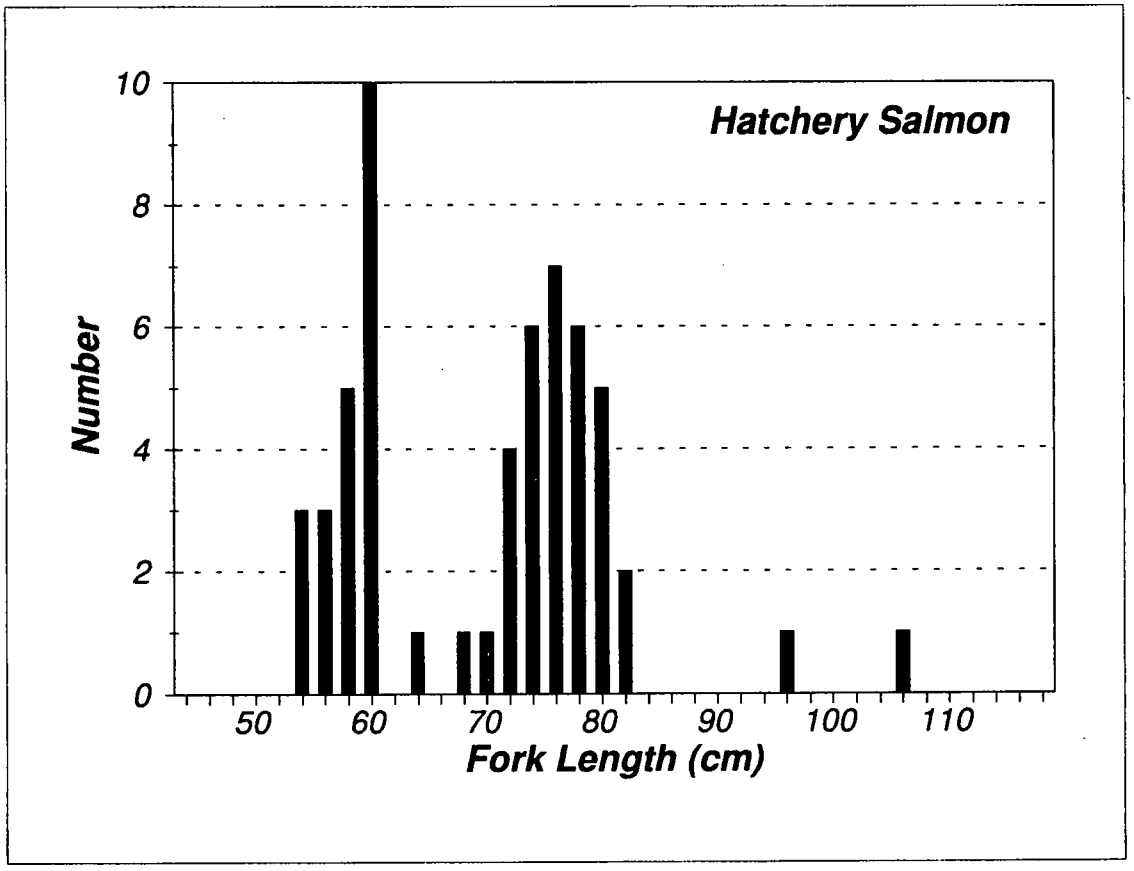


Figure 3. Length frequency distribution of wild and hatchery salmon from Levis trapnet on the Margaree River, 1994.

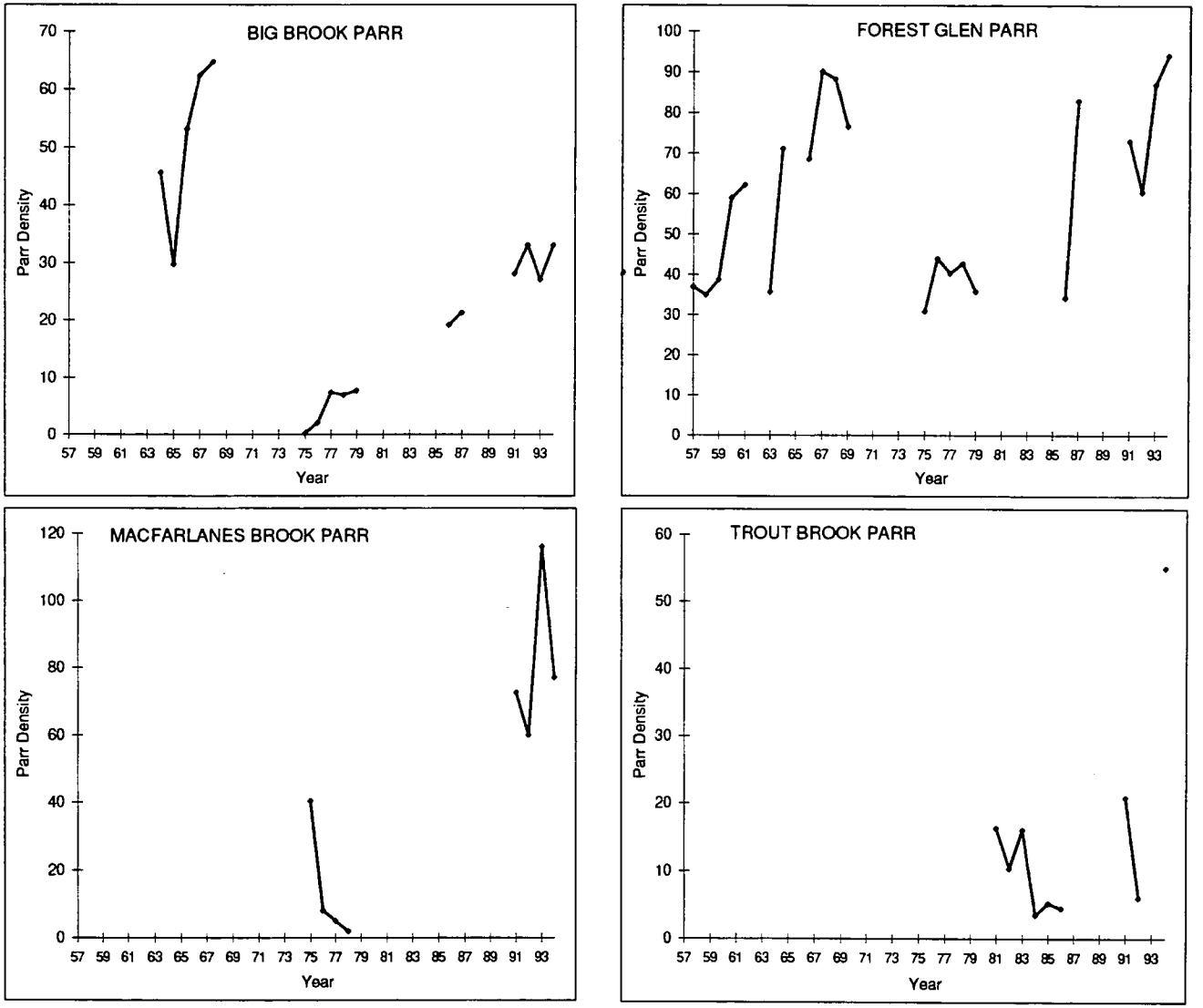
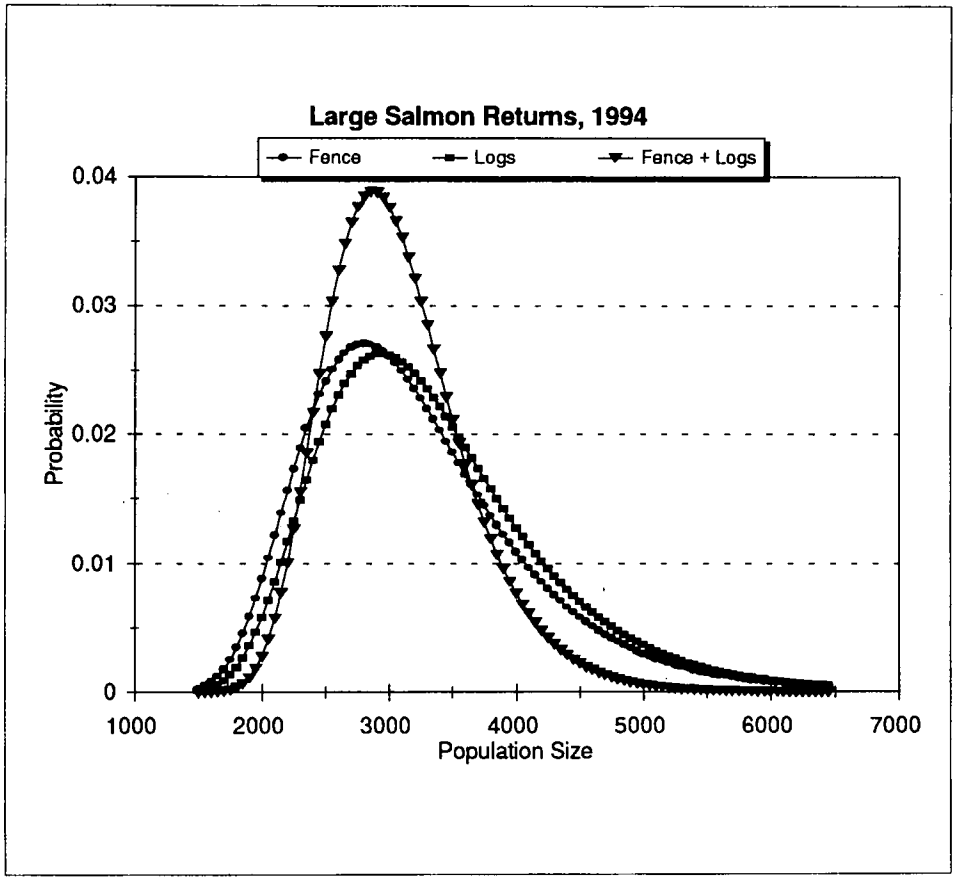


Fig. 4. Parr densities at four index sites on the Margaree River from 1957 to 1994.



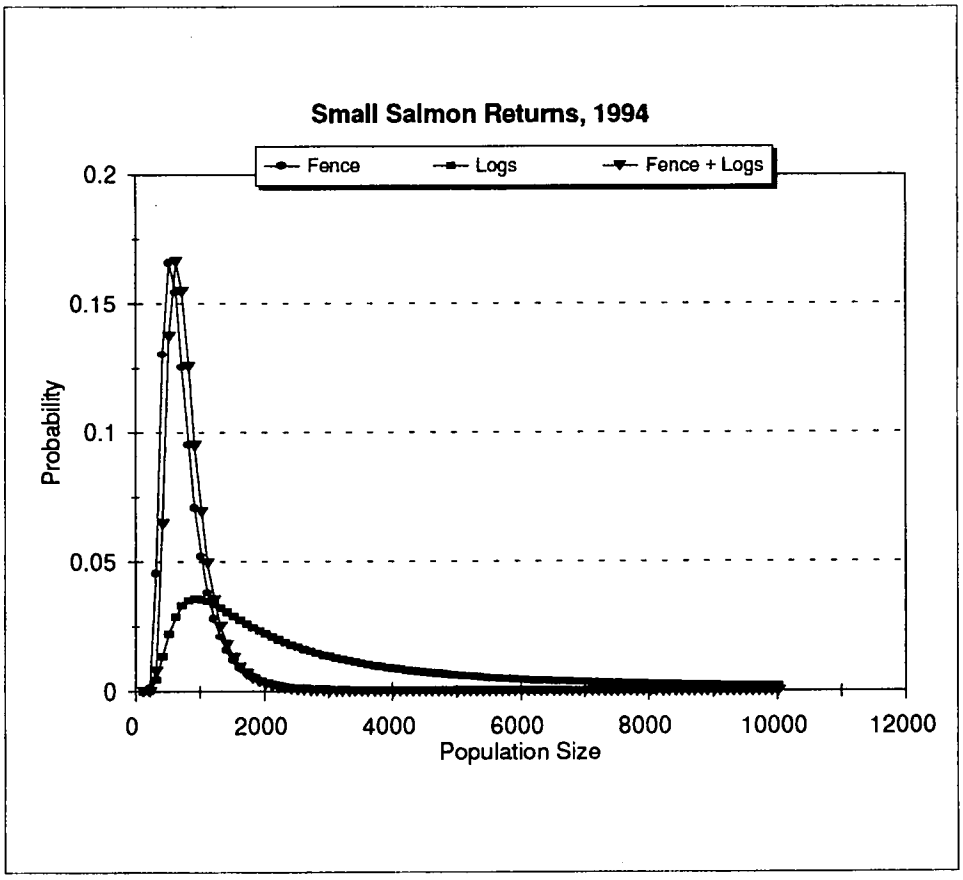
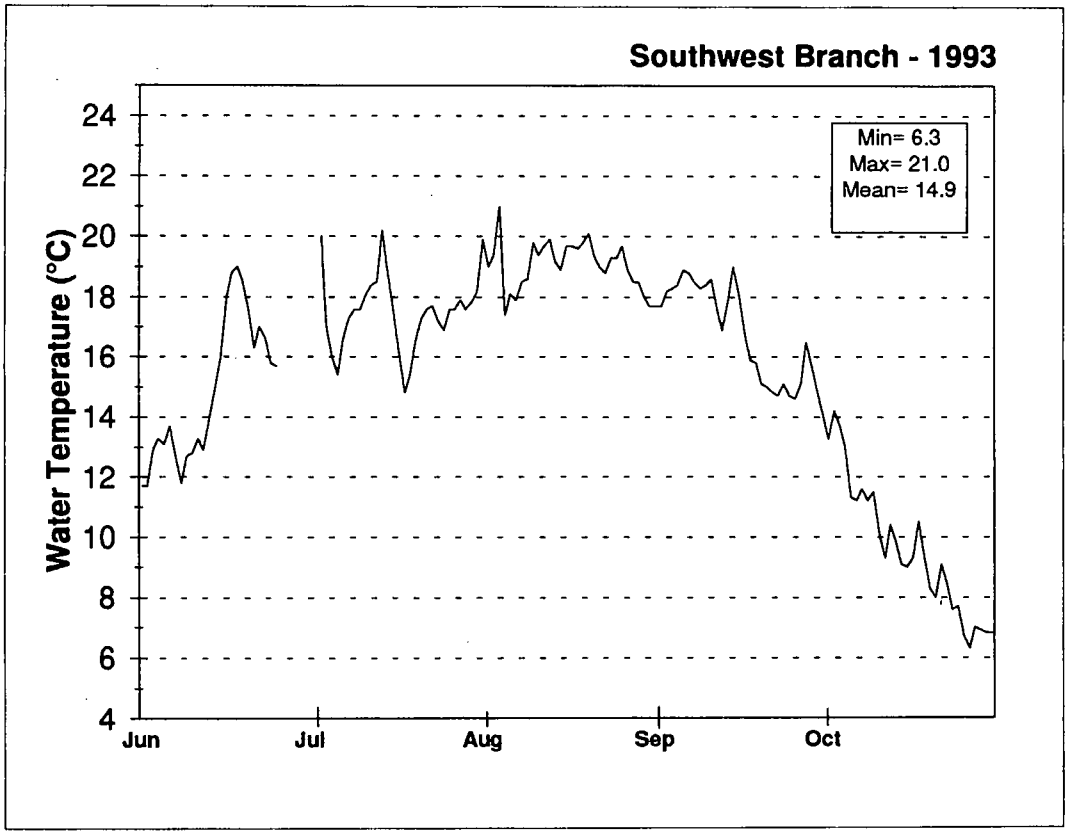


Figure 5. Estimated returns of large and small salmon to the Margaree River in 1994 based on mark/recapture techniques.



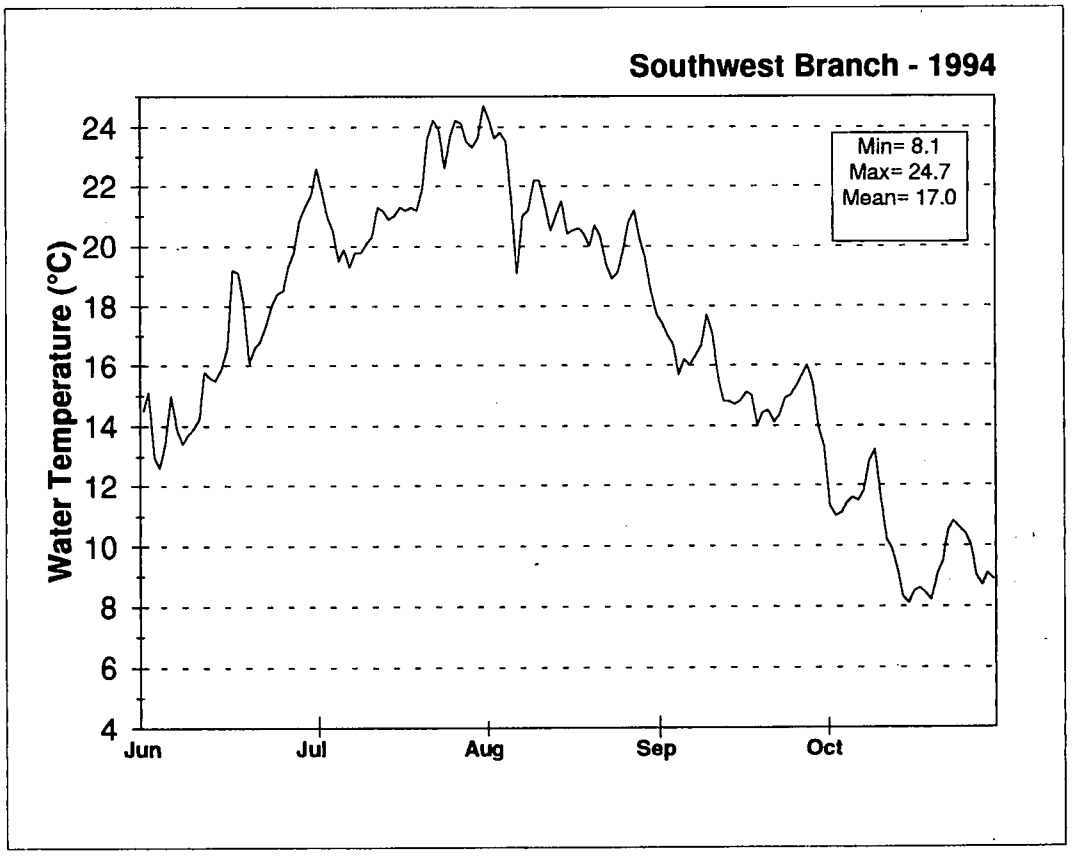
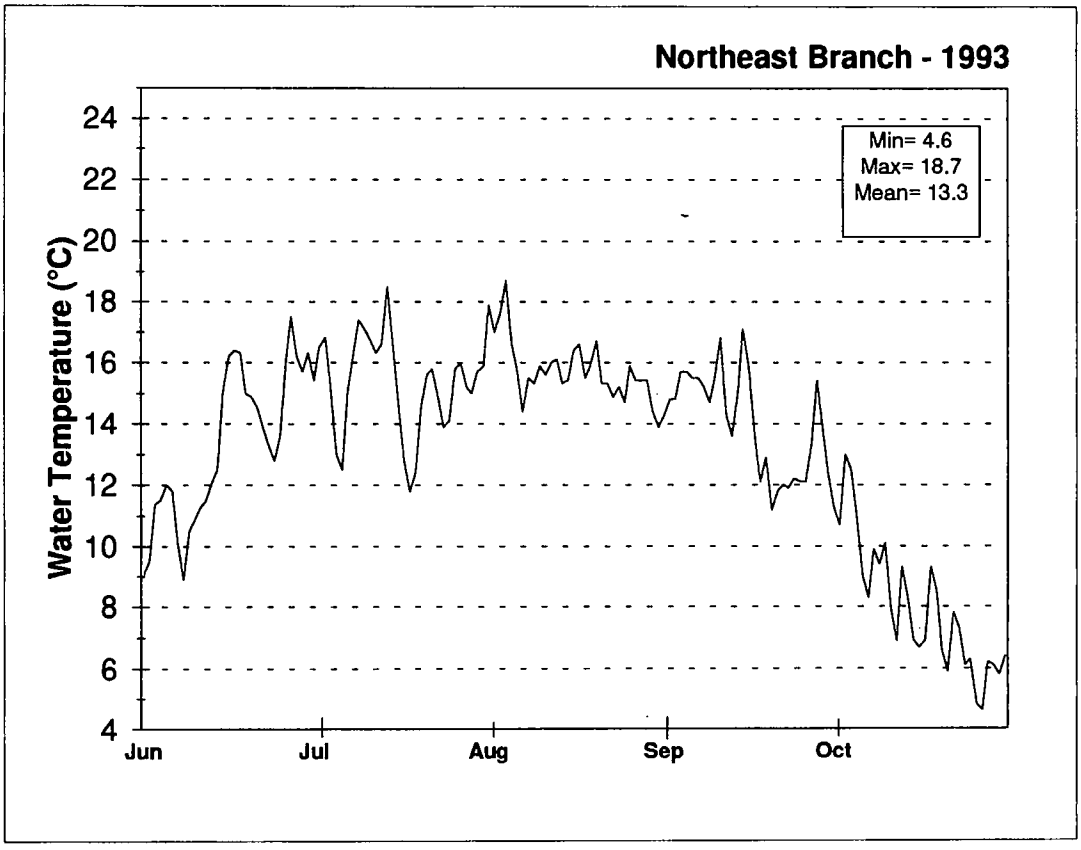


Figure 6. Mean daily water temperatures for the Southwest Margaree River recorded at the gauging station (Bailey Bridge) during 1993 and 1994.



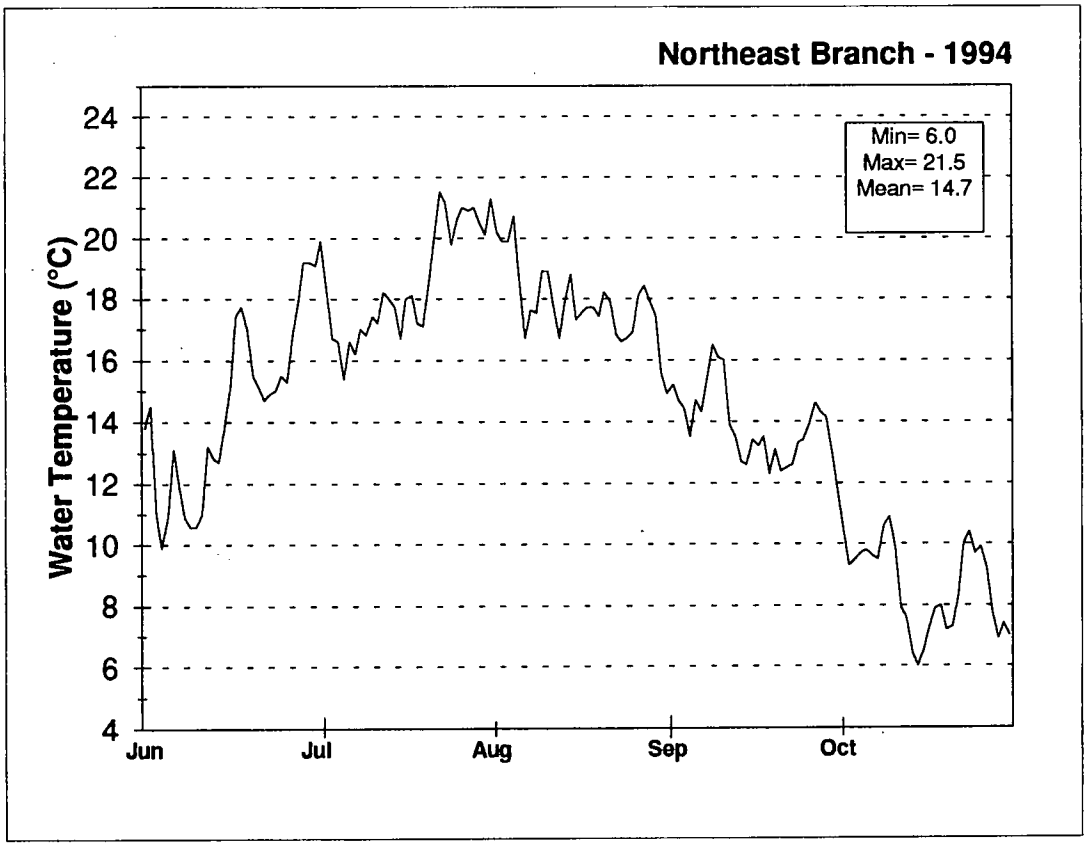
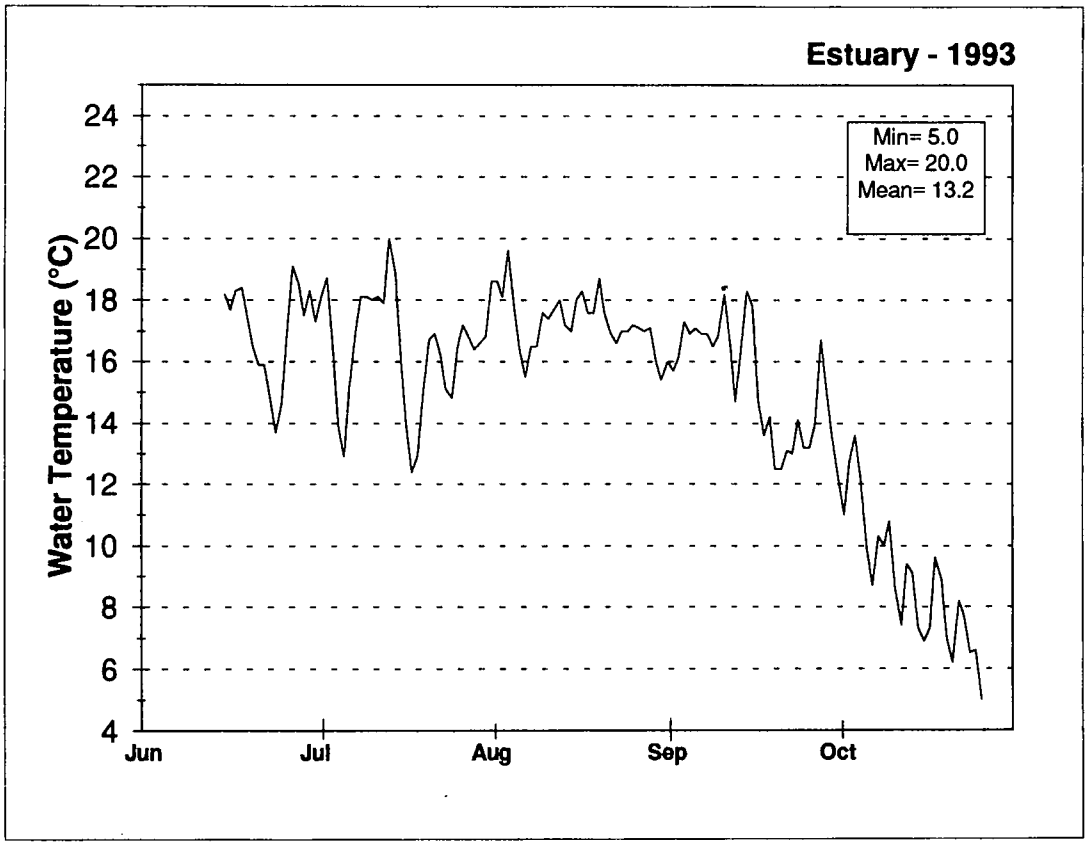


Figure 7. Mean daily water temperatures for the Northeast Margaree River recorded just above Doyles Bridge during 1993 and 1994.



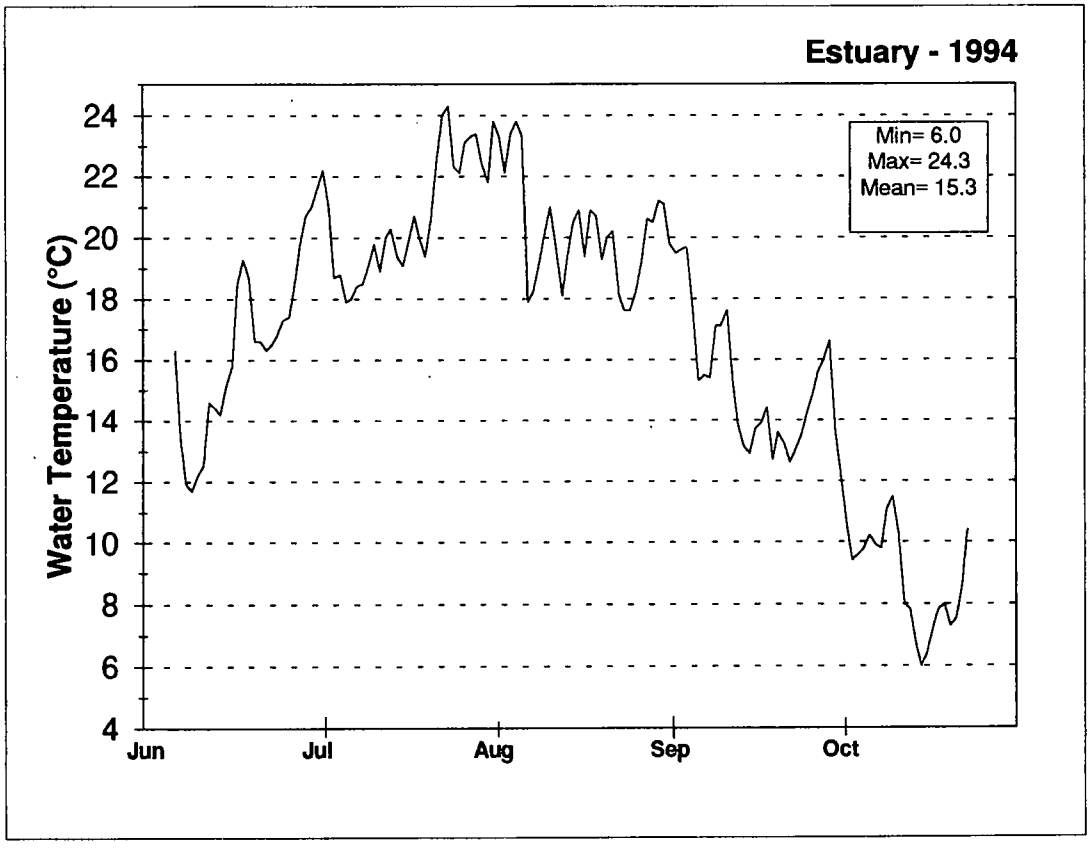


Figure 8. Mean daily water temperatures for the Margaree estuary recorded at Levis trapnet during 1993 and 1994.

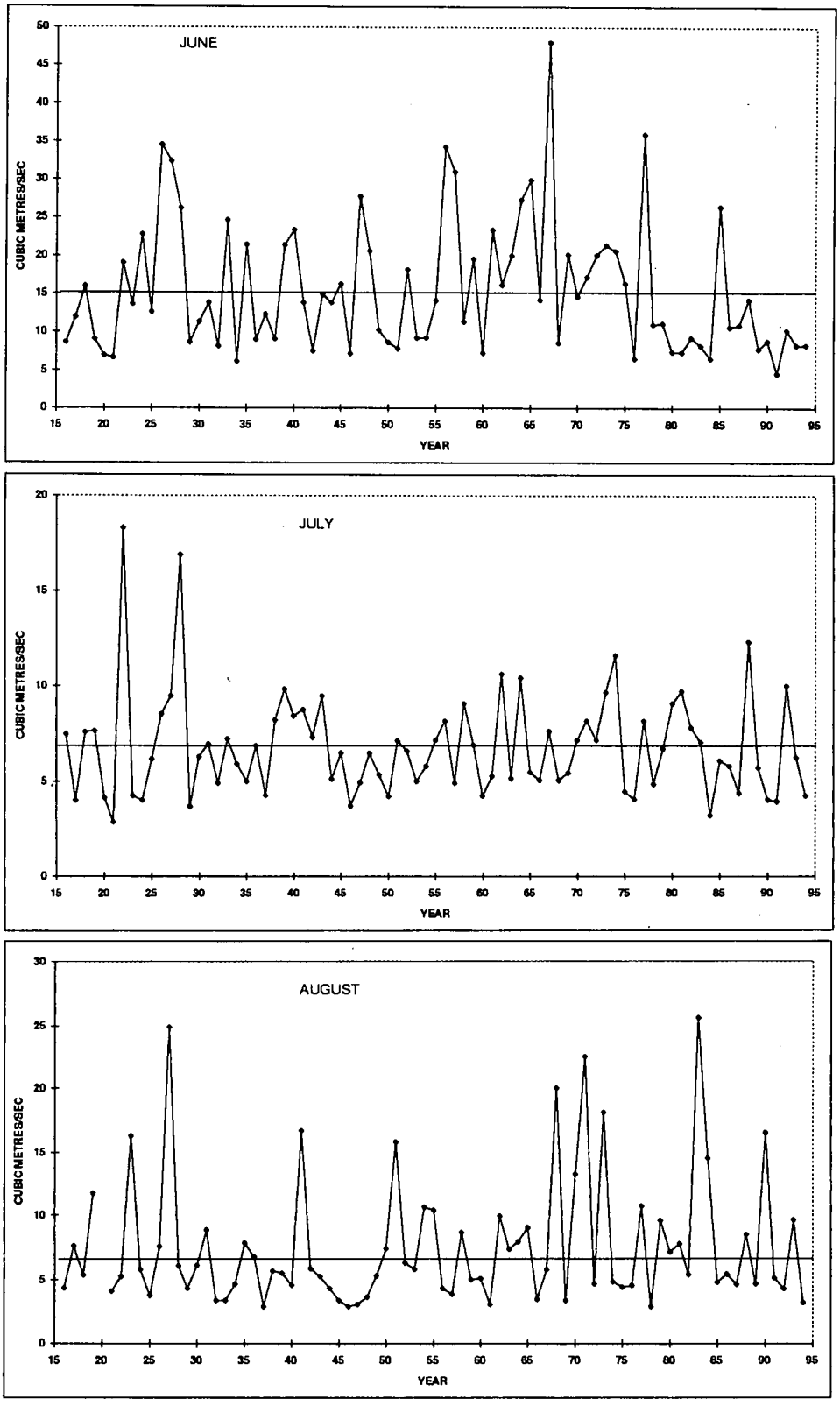


Fig. 9. Historical summer discharges on NE Margaree. Horizontal line is long term mean.

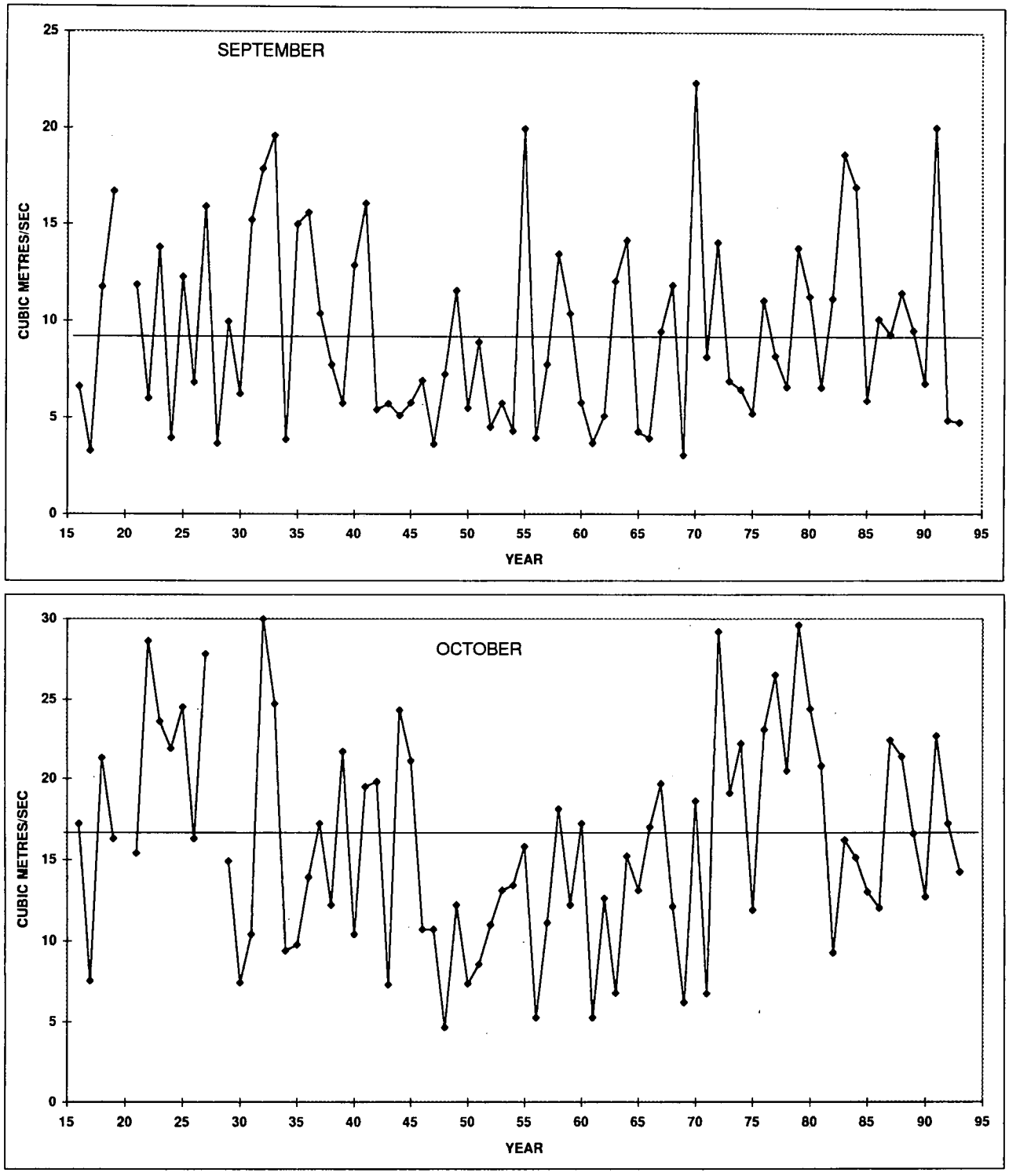


Fig. 10. Historical fall discharges on NE Margaree. Horizontal line is long term mean.

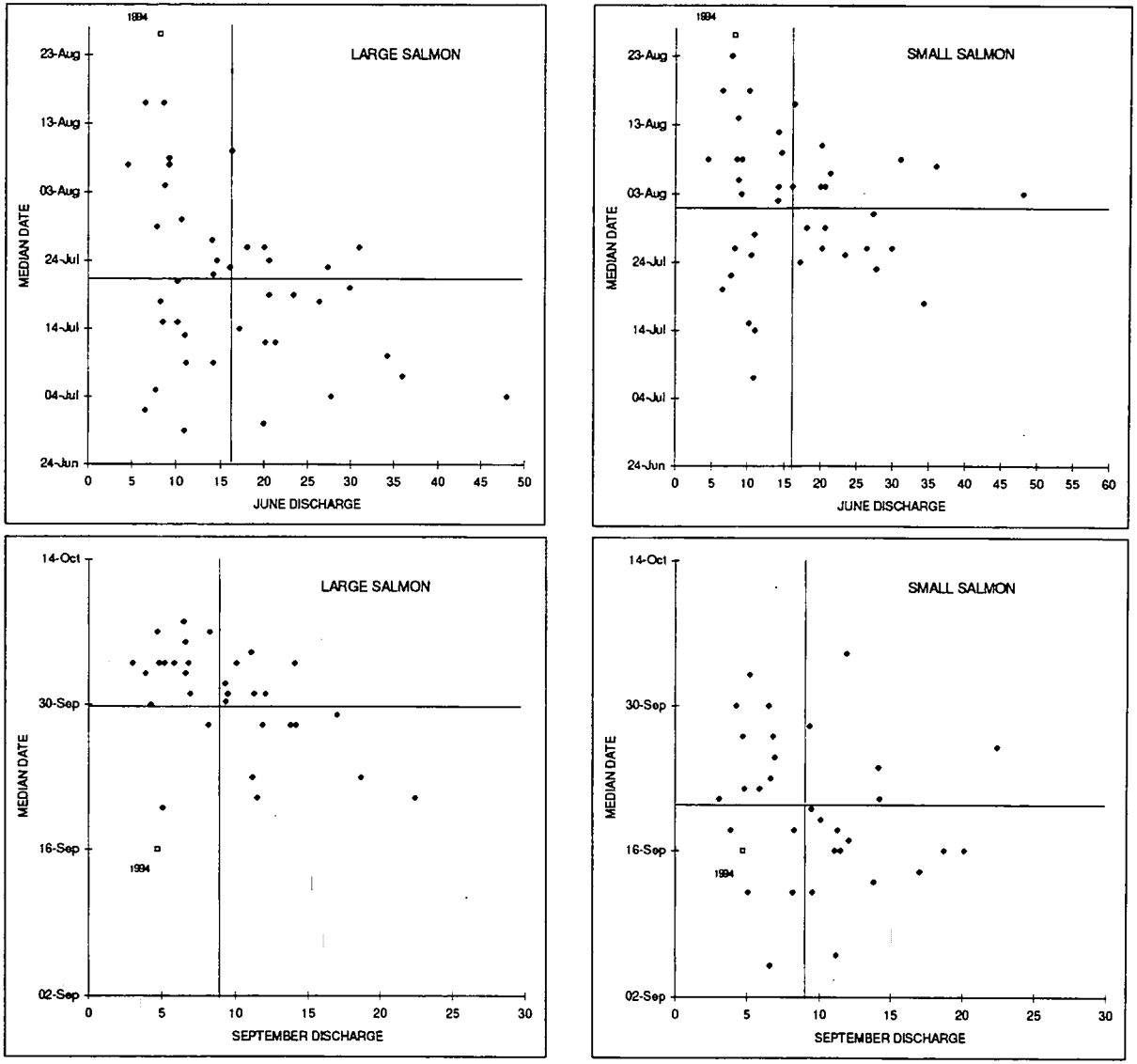
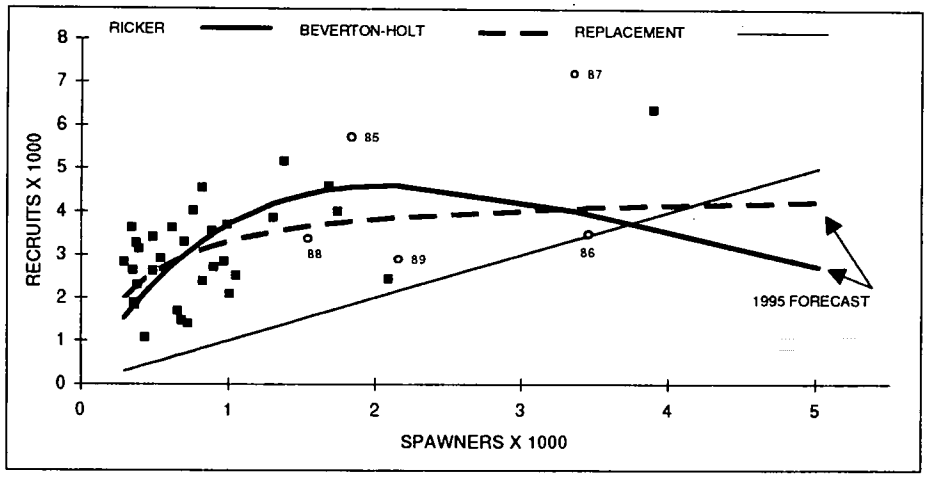
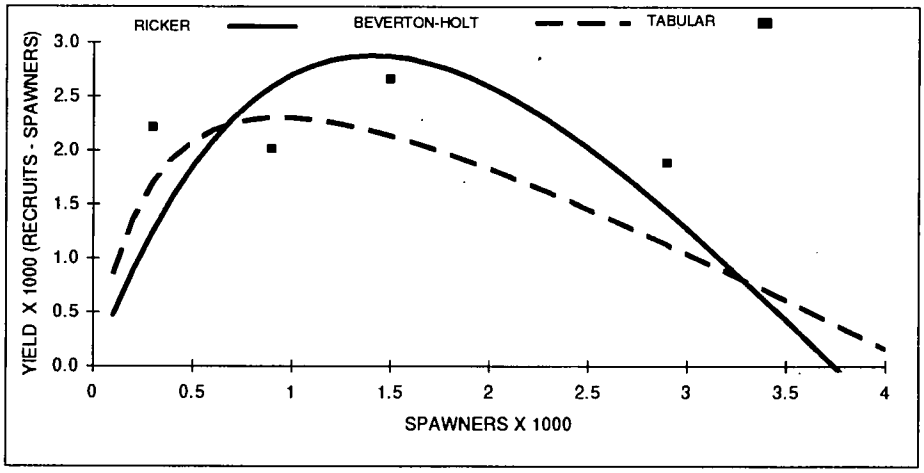


Fig. 11. Relationship between NE Margaree discharge and run-timing as measured by date when 50% of the small or large salmon have returned during the summer or fall. DFO angling data is used from 1962 to 1991 and Levi's trap data from 1992 to 1994. Horizontal lines are mean run-timing and discharge levels. 1994 is indicated by open squares.





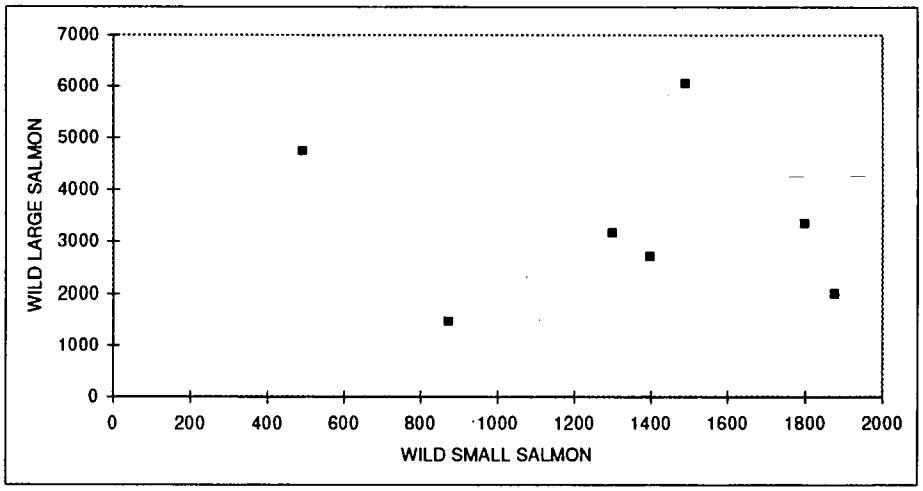


Fig. 12. Stock recruitment relationships with replacement line for Ricker and Beverton-Holt models and small salmon to large salmon relationships. Open circles indicate spawning escapement years since the commercial fishery has been closed.

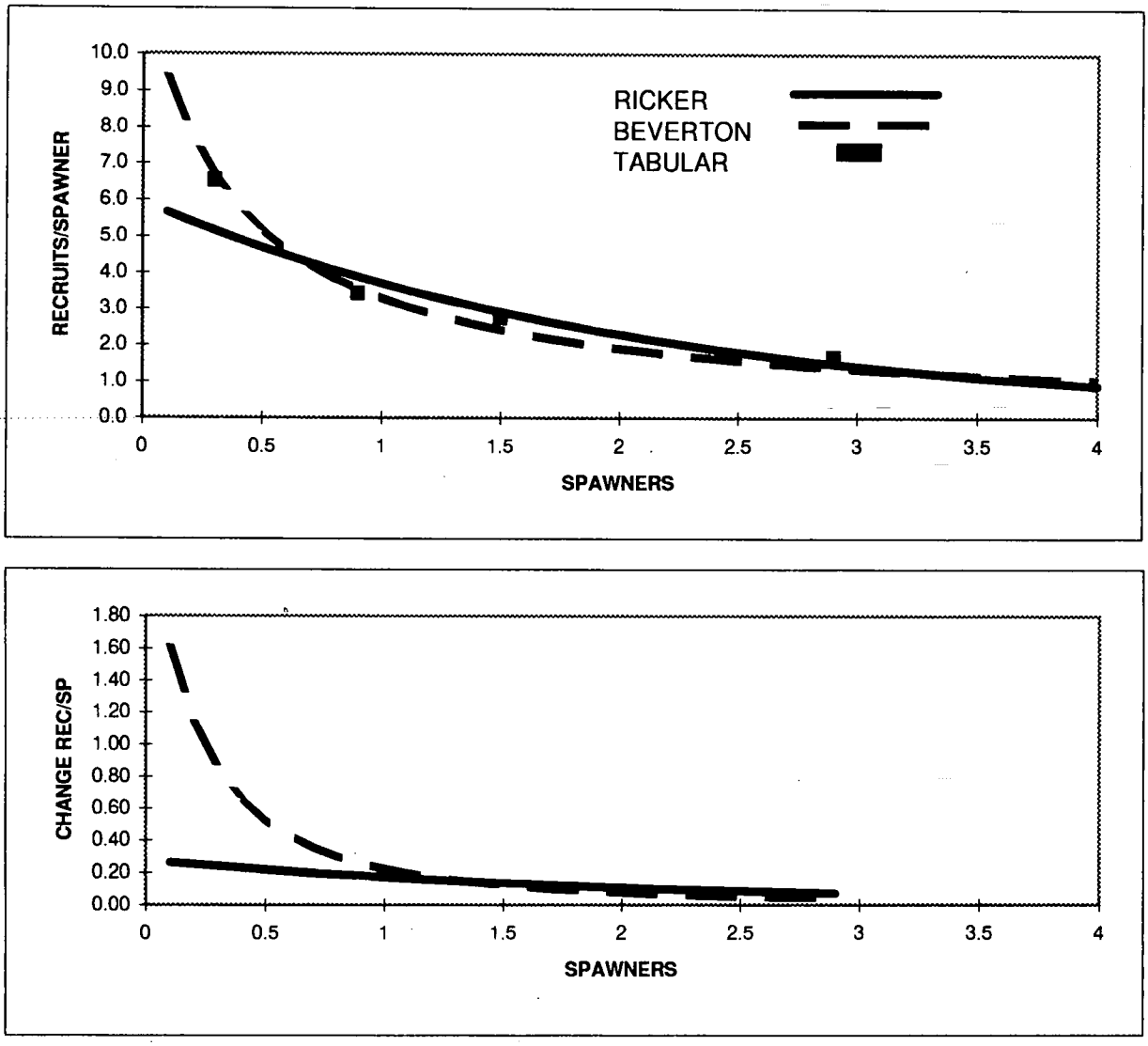


Fig. 13. Recruits/Spawner and change in recruits/spawner (recruits/spawner (year i+1) - recruits/spawner(year i) for Ricker and Beverton-Holt models.

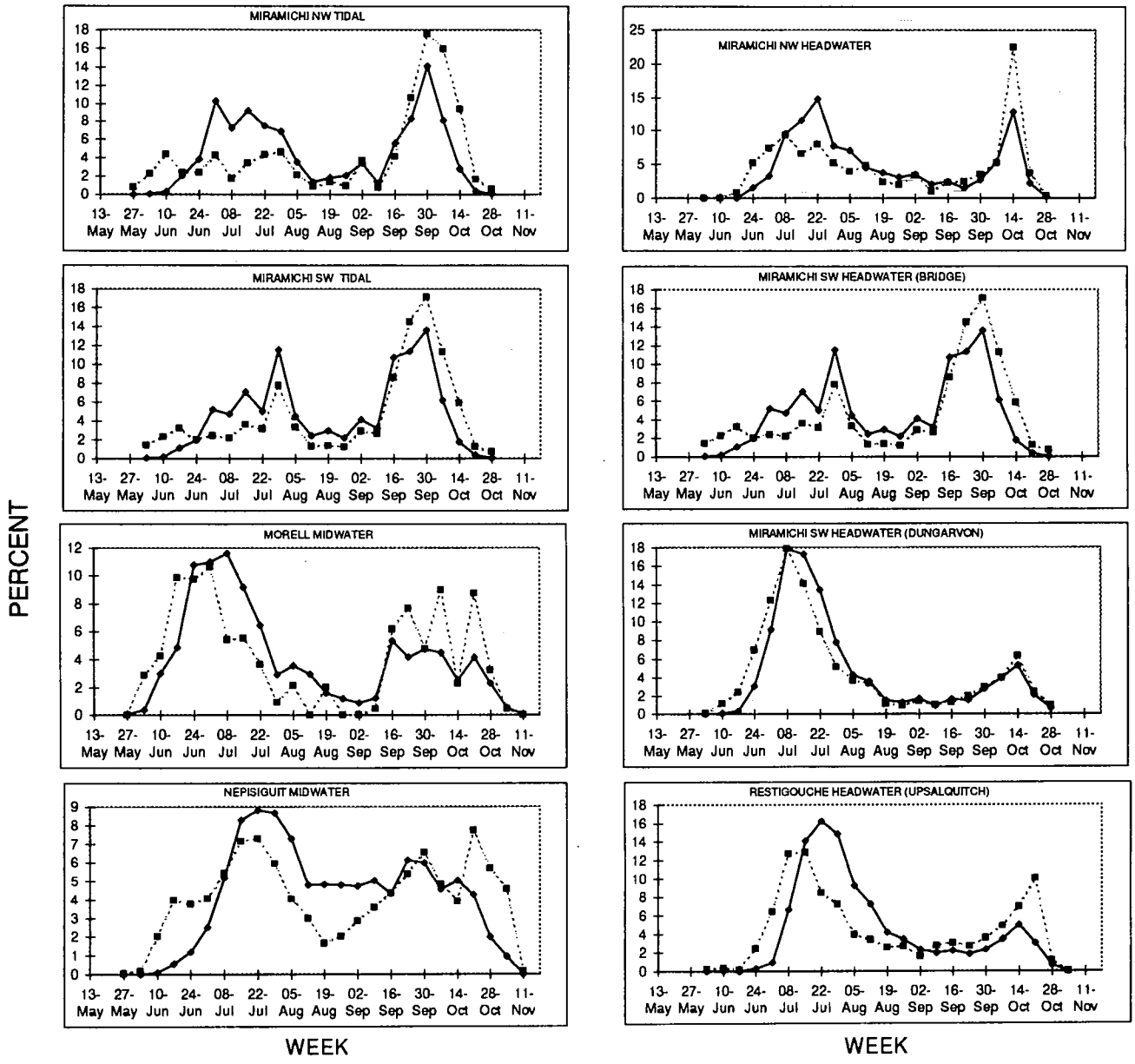


Fig. 14. Percent of large salmon (dotted line) and small salmon (solid line) returning to index sites for the entire season.

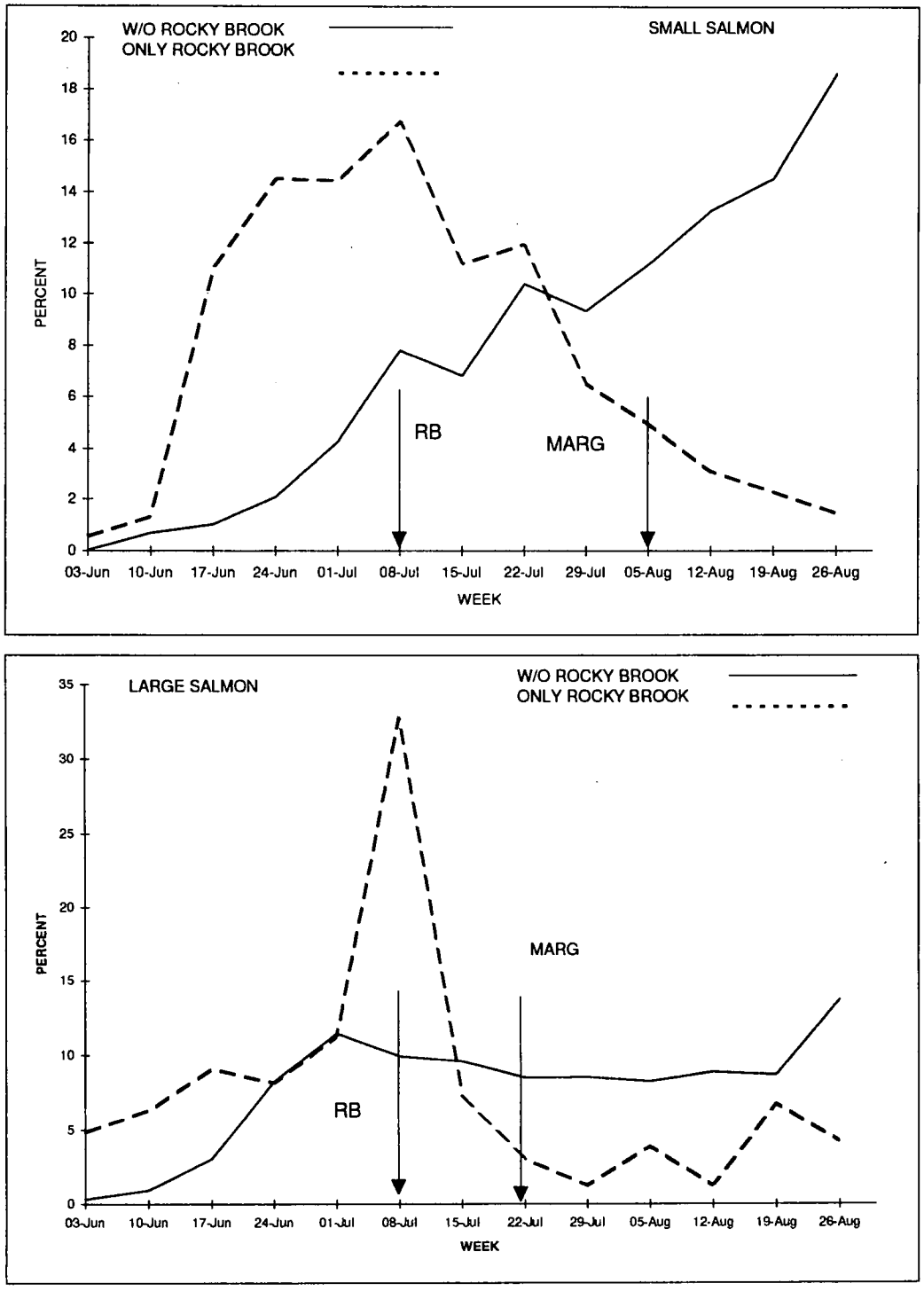


Fig. 15. Run-timing, based on DFO angling statistics from 1947 to 1990, of small and large salmon on the Margaree River for four years of Rocky Brook stocking and all other years without Rocky Brook. Arrows indicate date when 50% of fish have returned for Rocky Brook (RB) and Margaree (MARG). Hatchery and wild fish are combined.

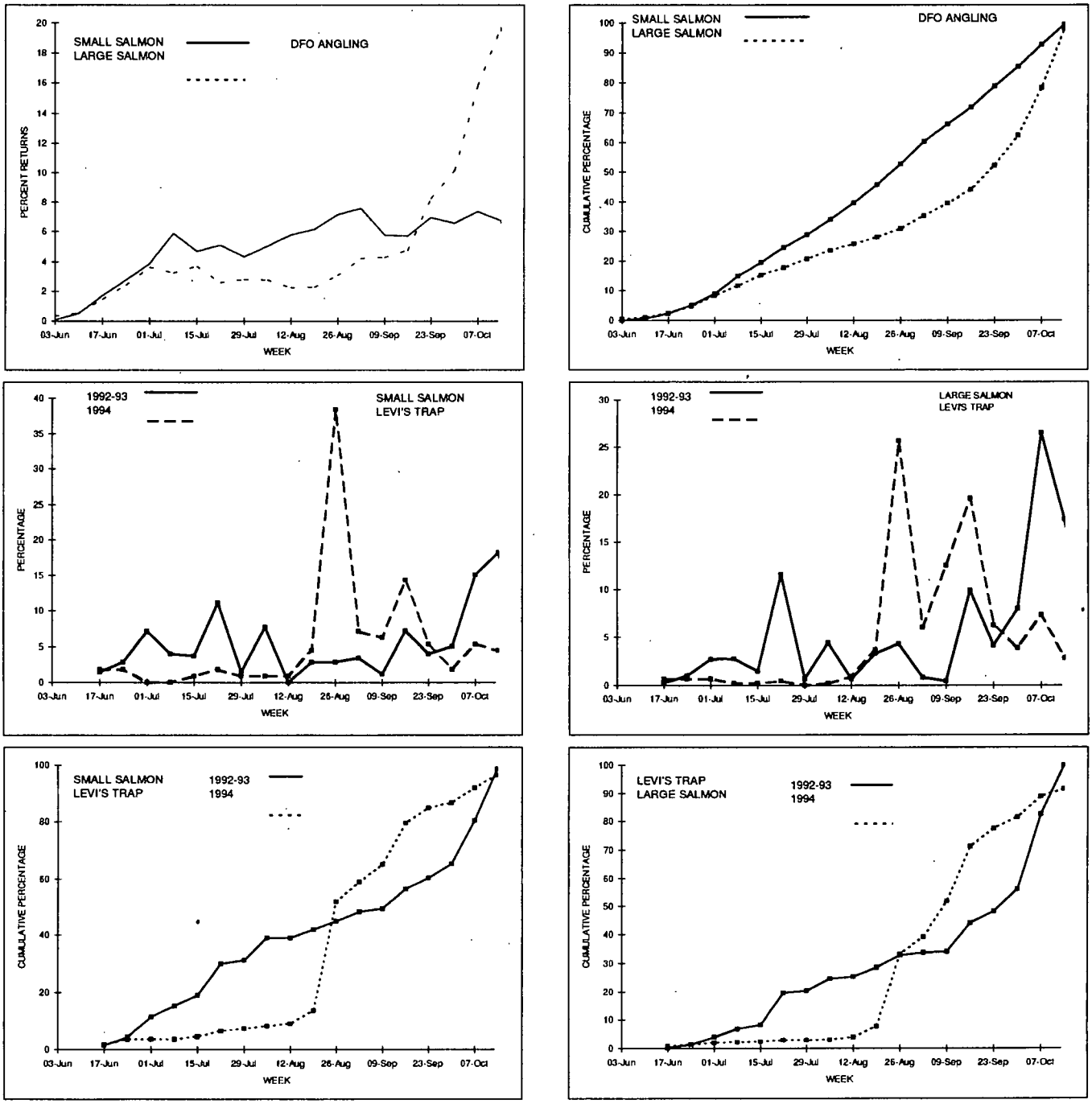


Fig. 16. Percent of run returning to the Margaree River by week using DFO Angling statistics, 1962-1990 and Levi's trap from 1992 to 1994. These data are used because they include years with consistent closing times, October 15, for the angling fishery and the years when Levi's trapnet was operated for the full, June to October season.