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# Assessments of Atlantic salmon stocks in selected rivers of Cape Breton Island, 1999 

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#### Abstract

Assessments of the stock status of Atlantic salmon were conducted on the Margaree, Middle, Baddeck, North, and Grand rivers of SFAs 18 and 19, Cape Breton Island. These rivers account for $90+\%$ of the total recreational fishing effort exerted on the Island's 22 rivers reportedly fished for salmon in 1999. Juvenile salmon abundance was also assessed on the Sydney, Tillard, Skye, Cheticamp, Inhabitants, Gaspereaux, and Mabou rivers.

Conservation requirements in 1999 continue to have been met and are expected to be exceeded in 2000 on the Margaree and probably other West Coast Cape Breton rivers. Conservation requirements have generally not been achieved in recent years on the Middle and Baddeck rivers and perhaps other tributaries of Bras d'Or Lakes. Expectations are that returns to rivers of Bras d'Or will not meet requirements in 2000. North River conservation requirements may have been met in 1999, and, based on the five-year mean, there is an $88 \%$ probability that returns in 2000 will be sufficient to meet conservation requirements. Returns to the Grand River fishway in 1999 met less than one-half the conservation requirement for the area upriver of the fishway and there is a $<1 \%$ probability that conservation requirements will be met in 2000.

Densities of fry and parr for most stocks of Gulf Cape Breton and Bras d'Or Lakes rivers (excepting Skye) suggest that these stocks are meeting or exceeding egg conservation requirements. Juvenile densities in Atlantic coast rivers are relatively low.

Comparison of now similarly derived conservation requirements for the Margaree, Middle, Baddeck and North rivers does not adequately resolve the inconsistencies between estimated escapements and resultant juvenile densities.


## Résumé

L'état des stocks de saumons de l'Atlantique a été évalué dans les rivières Margaree, Middle, Baddeck, North et Grand des ZPS 18 et 19, sur l'île du Cap-Breton. Ces rivières ont fait l'objet de plus de $90 \%$ de tout l'effort de pêche récréative exercé sur les 22 rivières de l'île où on a pratiqué la pêche du saumon en 1999. L'abondance des saumons juvéniles a également été évaluée dans les rivières Sydney, Tillard, Skye, Chéticamp, Inhabitants, Gaspereaux et Mabou.

Dans la Margaree et sans doute dans d'autres rivières de la côte Ouest de l'île du Cap-Breton, les impératifs de conservation ont encore été atteints en 1999 et ils devraient être dépassés en 2000. Depuis quelques années, les impératifs de conservation n'ont généralement pas été atteints dans les rivières Middle et Baddeck, et peut-être aussi dans d'autres tributaires des lacs Bras d'Or. On s'attend à ce que les remontes dans les tributaires des lacs Bras d'Or n'atteignent pas les impératifs en 2000. Les impératifs de conservation pourraient avoir été atteints dans la rivière North en 1999 ; la moyenne quinquennale indique qu'il y a une probabilité de $88 \%$ que la remonte de 2000 soit suffisante pour atteindre les impératifs de conservation dans cette rivière. En 1999, la remonte jusqu'à la passe migratoire de la rivière Grand a représenté moins de la moitié de l'impératif de conservation pour le secteur en amont de la passe ; la probabilité que cet impératif soit atteint en 2000 est inférieure à $1 \%$.

Les densités d'alevins et de tacons de la plupart des stocks des rivières de l'île du Cap-Breton dans les lacs Bras d'Or (à l'exception de la rivière Skye) portent à croire que la ponte atteint ou dépasse les impératifs de conservation pour ces stocks. Les densités de juvéniles sont relativement faibles dans les rivières de la côte atlantique.

La comparaison des impératifs de conservation maintenant déterminés de façon semblable pour les rivières Margaree, Middle, Baddeck et North ne permet pas de bien expliquer les discordances entre les échappées estimées et les densités de juvéniles qui en résultent.

## Introduction

Salmon stocks of Cape Breton Island (SFAs 19 and part 18) include those which typically exceed conservation requirements (Margaree and North), fluctuate about requirements (Grand River; with hatchery assistance) and fall short of requirements (Middle and Baddeck rivers). With minor exceptions, recent management strategies for SFA 18 (Cape Breton) have permitted a recreational fishery with retention of 1SW (small) salmon and hook-and-release of MSW fish (large salmon). An Aboriginal food fishery for 130 small and 650 large salmon is permitted for the Margaree. In SFA 19, recreational fisheries have generally been limited to hook-and-release grilse (occasional closure) and in 1999 a modest Aboriginal food fishery for 50 small and 50 large salmon from the North River.


## Margaree River

## Fishery

In 1999, 130 small and 650 large salmon were allocated to five First Nations. A total of 30 small and 150 large fish were allocated to the period June 1-August 31, the remainder were to be taken September 1- October 31, except where extensions were granted for seining in November and December. Harvest records solicited from three First Nations totalled only 8 small and 45 large salmon (Table 1) taken mostly by river seining.

Regulations for the recreational fishery in 1999 were identical to those of 1997 and 1998, retention of small salmon and hook-and-release of large salmon, June 1- October 31 (Appendix 1). Interim estimates of catch from voluntary returns of the Nova Scotia

Salmon License stubs (data resulting from reminder letters was unavailable at time of writing) suggest a retention of 246 small salmon and release of 130 small and 927 large salmon (Appendix II). Based on the difference between December interim and spring "final" estimates in 1998, the final estimate for 1999 could drop to about 800 large salmon. The current estimate of total catch in 1999 is the lowest since 1984, $78 \%$ of that of 1998 and $48 \%$ of the most recent high in 1996. The relatively higher catch-per-unit effort values since 1995 are consistent with a reduction in angling effort thereafter (Appendix III).

## Margaree R. Angling



The low salmon catch estimated from voluntary licence stub return data is consistent with more detailed data provided by anglers who kept a daily log of their activities and catch on the Margaree (Appendix V).

Margaree Logbooks



Removals (Table 1) include an assumed 5\% hook-and-release induced mortality. Thirtyseven summer-run fish were collected for broodstock by the Aquatic Development Association of Margaree (ADAM) and yielded 184,000 eggs for incubation and release back to the river as age- $0^{+}$fry.

## Status

## Habitat

The Margaree River, like the Middle, Baddeck and North rivers which originate in the Cape Breton Highlands of Inverness and Victoria counties, is unobstructed, unimpacted by acid precipitation and only modestly exposed to agricultural practices in the lower valley. Flow regimes have changed within the Margaree drainage. Pol (MS1975) indicated that for the period 1967-1973, there had been an increase in the frequency and magnitude of peak flows and lower and more frequent low flows than in preceding years. Causative agents were not fully identified by Pol (op. cit.; there had been a $10 \%$ increase in rainfall over the period) but flood frequency and magnitude could have been enhanced by the mortality and harvesting of much of the Highland's forests as a result of a spruce budworm infestation.

The Margaree River is not affected by the aquaculture industry. ADAM released 99,476 ( $35 \%$ marked) age- $0^{+}$juveniles back to the river in 1999. A private hatchery rearing trout for private catch-out is believed to be the source of the occasional large adult rainbow trout (Oncorhynchus mykiss) observed in the recreational catch and past assessment operations. Bacterial kidney disease (Renibacterium salmonarium) is ubiquitous within the drainage (Paterson et al. 1979) and although known to cause post-winter mortality in the hatchery located on the Northeast Margaree, the disease has not been demonstrated to cause mortalities among juvenile salmon in the wild.

## Stock

Returns of large salmon to the Margaree were estimated from preliminary estimates of recreational catch (Nova Scotia License stub returns) and catch rates 1991-1996 (Marshall et al. MS 1998). Catch rates are the product of catch from NS License stub returns and the reciprocal of mark-and-recapture based estimates of adult returns when DFO operated Levi's trapnet in the Margaree estuary. For small salmon, the estimate is based on a significant regression between catch and estimated returns, 1991-1996 (Marshall et al. MS1998).

Interim catch estimates of 376 small and 927 large salmon on the Margaree in 1999 contribute to interim estimates of 820 ( $90 \%$ CL 20-1,614) small and 2,060 ( $90 \%$ CL $1,444-2,402$ ) large salmon returning to the Margaree. Small salmon returns are similar to those of four of the last five years. Large salmon were down $30 \%$ from 1998 and are the lowest estimate since 1988. After deduction of removals and losses to hook-and-release mortality, interim escapements number 550 small and 1,901 large salmon.

MAREARESFA 18



The conservation requirements for the Margaree River are based on an egg deposition of 2.4 eggs per $\mathrm{m}^{2}$, historical biological characteristics and 2.798 million $\mathrm{m}^{2}$ of habitat. Required fish to provide those eggs are 1,036 large salmon and for sufficient males, 582 small salmon although current biological data (Marshall et al. MS 1999b) suggests that 1,250 large and 660 small would be more appropriate. In 1999, small salmon escapement was about $95 \%$ of traditional requirement, large salmon were about $185 \%$ of traditional requirement. Total egg requirements have been exceeded in every year since 1985.

Mean juvenile densities for a site on each of Forest Glen, MacFarlanes and Big brooks in 1999 were 132 age- $0^{+}$per $100 \mathrm{~m}^{2}$ and 90 age $-1^{+}$and $-2^{+}$parr per $100 \mathrm{~m}^{2}$ and are 4.6 and 2.5 times the Elson (1967) norm of 29 fry and 38 parr per $100 \mathrm{~m}^{2}$. Monitoring at the same sites since 1992 (below), and also at a large mainstem site reveals densities consistently above the norms and consistent with escapements of two to six times the conservation requirements since 1991.

Margaree River Age-0+ (4 \& 5-site mean \& st. error)


## Margaree River Age-1+, 2+ (4 \& 5-site mean \& st. error)



## Outlook

Past forecasts of large returns to the Margaree have been derived from stock-recruit relationships, 1947- to present, using tabular, Ricker, Beverton-Holt and "mean" models (Marshall et al. MS 1998). Never in the 40 years of data have recruits been estimated to be less than conservation requirements. The prognoses for returns in the year 2000, based on the mean of the last five-years, is about 3,000 ( $90 \%$ CL $1,200-4,860$ ) MSW fish. Based on the mean, there is a greater than $96 \%$ probability (Bayes procedures) that traditional conservation requirements will be met. Prognoses of small salmon returns have typically been presented as the mean of the previous five years. On this basis, forecast returns are about 950 ( $90 \%$ CL 300-1,630) fish and the probability of meeting the 582 fish conservation requirements is about $80 \%$.

## Fisheries Management Considerations

Conservation requirements continued to have been met and are expected to be exceeded in 2000 on the Margaree and probably other east coast Cape Breton rivers (see 'Other Rivers of SFA 18 and 19). Small salmon are predominantly male, usually are less abundant than large salmon, and generally are not constraining to stock conservation.

Exploitation levels, both realized (harvests by Aboriginal peoples have rarely exceeded $25 \%$ of allocation) and potential on the Margaree River have not, to date, been a conservation concern.

## Middle River

## Fishery

In 1999, there was a total allocation of 100 small salmon from Middle River, Nyanza Bay and Bras d'Or Lakes to Wagmatcook First Nation. Fishing was to commence once conservation requirements had been met on the Middle River, i.e., following mid-/late fall assessment of returns; a harvest of only five small and nine large salmon was
reported. Gillnetting was actively discouraged by Aboriginal guardians prior to the fall assessment of returns. However, an active rod-and-line winter fishery for kelts (fish which spawned in the fall of 1998) was again acknowledged. This "opportunistic" fishery was the result of a mild winter with open-ice periods, and apparently flourished under similar conditions the previous winter.

The hook-and-release (small and large salmon) recreational fishery for the Middle and other rivers of SFA 19 was reduced from the June 1-October 31 season in 1997, to that of June 1-July 15 and September 1-October 31 in 1998 and 1999. The split season was implemented after consultation with Cape Breton First Nations who sought to reduce the risk of hook-and-release mortality on returns which, with few exceptions, were forecast pre-season to be less than conservation requirements. The reduced season should have had little impact on the overall recreational effort and therefore hook-and-release mortality on the Middle River. Estimates of catch from voluntary returns of the Nova Scotia Salmon License stub were 40 small and 134 large salmon, both values exceeding those of 1998 (Appendix II). Total angled salmon were about double those of 1998 and only slightly fewer than two of the last eight years.

Middle R Angling


Removals (Table 1) include an assumed 5\% hook-and-release induced mortality prior to 1998 and $3 \%$ in 1998 and 1999.

## Status

## Habitat

The Middle River, like the Margaree, Baddeck and North rivers which originate in the Cape Breton Highlands of Inverness and Victoria counties, is unobstructed, unimpacted by acid precipitation but exposed to agricultural practices in the lower valley. Possible changes in flow regimes from the Highlands were mentioned for the Margaree River. The
course of the lower Middle River appears to have shifted more dramatically than other assessed rivers of Cape Breton.

The Middle River has on occasion had small numbers of farmed escapees coincident with reported escapes from industry grow-out sites in Bras d'Or Lakes, i.e., from Whycocomagh Bay to Seal Island. Occasional adult rainbow trout are observed and sometimes reported. Juvenile rainbow trout are rare among juvenile salmon when assessed by electrofishing. Bacterial kidney disease has also been reported from Middle River (Paterson et al. 1979). There is currently no stocking of hatchery-reared salmon.

## Stock

Returns of salmon to the Middle River were derived using mark-and-recapture methods and Bayes estimation procedures (Marshall et al. MS1998) even though no marks were applied in 1999. Counts of unmarked fish were obtained by divers floating virtually all of the river's salmon holding areas on October 18 and all except the upper most reach again on November 3. The October 18 count occurred on the only day of the "traditional" assessment week of ( $\sim$ October 18-23) on which there was low enough river discharge and adequate visibility. The November 3 repeat followed reports of "new" fish in the previously near-vacant lower sections of the river.

On October 18 the count was conducted in the traditional sections downstream of Highway \#19, as well as 5 pools at and below Second Gold Brook. An additional 9-10 km . section was floated from just above Fionnar Brook down to and including the traditional Gold Brook pools. River discharge was higher than any of the previous gauged years (3) and visibility deteriorated later in the day under continuous rain. The count was 105 fish ( 72 large and 33 small). An additional 12 large and three small were counted in the above-Fionnar to First Gold brooks section but not used in the Oct 18 "traditional area" estimate.

For the purposes of estimating a population, Bayes procedures were used to generate mark-recapture estimates under the assumption that if there had been marked fish within the population, only 0.5 , the lowest of record, would have been "recaptured" (seen during the count). The uncertainty of the estimate was captured by assuming (on the basis of counts in seinable pools, and previous seining history at these pools) that only nine fish might have been marked and available for recapture during the float count. By assuming a 0.5 recovery efficiency it followed that 4.5 fish were assumed to have been recaptured in the float count. These hypothetical "mark" and "recapture" data suggest a population estimate for the traditional river area of 211 fish (145 large and 66 small) and a $15 \%$ probability that conservation requirements of 550 salmon may have been met (see Figure below).

On November 3 the count was repeated in only the traditional census areas. Float conditions were excellent, i.e., river discharge was less than October 18 and visibility was excellent. The count was 232 fish (187 large and 45 small); conditions suggested that about 0.75 of the fish would have been seen, i.e., equal to the best previous recovery efficiency to date. It was assumed that about 15 fish had the potential to have been
marked prior to this float count, and on the basis of the assumed 0.75 recovery rate, 11 fish would have been recaptured in the float count. These data suggest a total population estimate for the traditional river areas of just over 300 fish ( 256 large and 62 small) and a $3 \%$ chance that conservation requirements may have been met (see Figure).

A second estimate for Nov 3 incorporated fish observed above Second Gold Book on Oct 18, raised by the fraction of fish counted in the five pools downstream of Second Gold Brook Oct 18 and Nov 3, minus the Gold Brooks area count on Nov 3, i.e., [(21/((6/35)35)] into the "count". This estimate of population is 436 fish ( 351 large and 85 small; based on count composition) with a $36 \%$ chance that conservation requirement was met.


Total returns would number 450 fish and include an estimated 14 fish lost in the estuary. These returns are $198 \%$ of those in 1998 (Table 2). The November 3 population is assumed to be the escapement.


Middle SFA 19


Conservation requirements for the Middle River are 2.07 million eggs from 470 large and 80 small salmon (Marshall et al. MS1998) although current biological data (Marshall et al. MS 1999b) suggests that 590 large and 140 small would be more appropriate. Assuming that late-season estimates of returns equal escapement, small salmon were about $99 \%$ and large salmon were $72 \%$ of traditional requirement. In total, the probability that returns equaled traditional conservation requirements was $36 \%$.

Mean juvenile densities of 41 age- $0^{+}$per $100 \mathrm{~m}^{2}$ and 38 age $-1^{+}$and $-2^{+}$parr per $100 \mathrm{~m}^{2}$ for two mainstem sites on Middle River in 1999 were 1.4 and 1.0 times the Elson (1967) norm. Monitoring since 1995 indicates densities to be consistently at or slightly above the norms even though escapement for egg requirements are not estimated to have been met.

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Middle River Age-0+(2 site mean & st.error)
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Middle River Age-1+, 2+(2 site mean \& st.error)


## Outlook

For the Middle River, prognoses of returns were based on the previous five-year returns. The mean of combined small and large returns in the past five years is 414 fish ( $90 \%$ CL 199-629 fish). Based on this mean and standard deviation, the Bayes derived probability of the 1999 return exceeding the 550 fish requirement is $14 \%$ ( $<1 \%$ based on recent biological characteristics and egg carrying capacity). It is uncertain if normal or abovenormal parr densities on the Middle River will contribute to the near-future attainment of conservation requirements.

## Fisheries Management Considerations

Conservation requirements have generally not been achieved in the Middle River and there is only $14 \%$ expectation that returns will meet requirements in 2000.

## Baddeck River

## Fishery

There has been no specific allocation of Baddeck River fish to Aboriginal peoples. However, it is assumed that a gillnet fishery for 100 small salmon from Middle River outflow, Nyanza Bay and Bras d'Or Lakes to Wagmatcook First Nation would impact 30 fish of Baddeck River origin. The impact would only have been after conservation requirements had been met on the Middle River, i.e., following mid/late fall assessment of returns. No harvests have been reported although gillnetting was actively discouraged by Aboriginal guardians prior to the fall assessment of returns to Middle River (Table 1).

The hook-and-release (small and large salmon) recreational fishery for the Baddeck and other rivers of SFA 19 was reduced from June 1-October 31 in 1997, to that of June 1July 15 and September 1-October 31 in 1998 and 1999. The reduced season should have had little impact on the overall recreational effort on the Baddeck River, given that returns rarely enter the river before fall. Estimates of catch from voluntary returns of the Nova Scotia Salmon Licence stub were 11 small and 81 large salmon; less than those of

1998 (Appendix II). Catch-per-unit of effort was lower than values since 1995 but does not differ from the long-term mean (Appendix III).

Baddeck R. Angling


Removals (Table 1) include an assumed 5\% hook-and-release induced mortality prior to 1998 and $3 \%$ in 1998 and 1999.

## Status

## Habitat

The Baddeck River, like the Margaree, Middle and North rivers which originate in the Cape Breton Highlands of Inverness and Victoria counties, is unobstructed, unimpacted by acid precipitation and only modestly exposed to agricultural practices in the lower valley. Possible changes in flow regimes from the Highlands were mentioned previously.

The Baddeck River has on occasion had small numbers of farmed escapes coincident with reported escapees from industry grow-out sites in Bras d'Or Lakes, i.e., from Whycocomagh Bay to Seal Island. Occasional adult rainbow trout are observed/reported; juvenile rainbows have not been observed among juvenile salmon assessed by electrofishing. Bacterial kidney disease has also been reported from Baddeck River (Paterson et al. 1979). There is currently no stocking of hatchery-reared salmon.

## Stock

High water conditions during the scheduled fall assessment of adults returns and lack of adequate person resources for any re-scheduled efforts precluded the estimate of returns and escapement to the Baddeck River in 1999. Conservation requirements for the Baddeck River are 2.0 million eggs from 450 large and 80 small salmon (Marshall et al. MS1998) although current biological data (Marshall et al. MS 1999b) suggests that 390 large and 230 small salmon would be more appropriate. Since adult assessments began on the Baddeck in 1994, conservation requirements have never been estimated to have been met, and the proportion of requirements met by large salmon, the significant contributors
to egg deposition, has always been equal to (1998) or less than that of the Middle River (Marshall et al. 1999b). A 13\% reduction in the requirement for large salmon would not dramatically alter the picture.


Mean juvenile densities of 95.2 age- $0^{+}$per $100 \mathrm{~m}^{2}$ and 32.6 age- $1^{+}$and $-2^{+}$parr per 100 $\mathrm{m}^{2}$ for three mainstem sites on Baddeck River in 1999 were 3.2 and 0.8 times the Elson (1967) norm. Monitoring since 1996 indicates that densities of age- $0^{+}$fluctuate above while densities of age $-1^{+}$and $-2^{+}$parr fluctuate around the Elson norms even though escapement requirements are not estimated to have been met.



## Outlook

For the Baddeck River, in 1999, prognoses of returns were based on returns in 19951999, assuming that conservation requirements of 530 salmon had been met. The mean return would have been 335 fish ( $90 \%$ CL 131-542 fish). The probability of returns in the year 2000 exceeding the 530 fish conservation requirement would be less than $7 \%$. Parr densities, which are near the Elson (1967) norm, are not necessarily indicative of increasing returns beyond the year 2000.

## Fisheries Management Considerations

Conservation requirements have not been achieved in the Baddeck River and there is little evidence to suggest that returns will meet requirements in 2000.

## North River

## Fishery

Ten large and 10 small salmon from the North River were allocated (nets not permitted) to each of the five First Nations on Cape Breton (100 fish total). This was the same as in 1998 but down from the 20 large and 15 small salmon allocated in 1997. No harvests have been reported in 1999 or in the recent past (Table 1).

The hook-and-release (small and large salmon) recreational fishery for the North River, unlike other rivers of SFA 19, remained June 1-October 31. Estimates of catch from voluntary returns of the Nova Scotia Salmon License stub were 29 small and 60 large salmon (Appendix II). The catch is the lowest of the time series; the catch-per-unit of effort is the lowest of the previous five years and third lowest of the time series (Appendix III).

## North R Angling



Removals (Table 1) include an assumed 5\% hook-and-release induced mortality prior to 1998 and $3 \%$ in 1998 and 1999.

## Status

## Habitat

The North River, like the Margaree, Middle and Baddeck rivers which originate in the Cape Breton Highlands of Inverness and Victoria counties, is unobstructed and unimpacted by either acid precipitation or agricultural practices in the lower valley. Possible changes in flow regimes from the Highlands were mentioned previously.

The North River has on occasion had small numbers of farmed escapees coincident with reported escapees from industry grow-out sites in Bras d'Or Lakes, especially Seal Island. Occasional adult rainbow trout are observed/reported; juvenile fish have not been observed among juvenile salmon assessed by electrofishing. Bacterial kidney disease has also been reported from North River (Paterson et al. 1979). There is currently no stocking of hatchery-reared salmon.

## Stock

North River salmon are primarily a 2 SW June/July- running stock that in recent years has been suspect of having a "delinquent" component which ascends in the fall (Marshall et al. MS 1996). Previous assessments indicate that conservation requirements 1985-1998, have always been attained.


As was the case on the Baddeck River, high water conditions during the scheduled fall assessment period precluded diver counts of adult returns. An assessment based on the preliminary estimate of sport catch (NS Licence stub returns) and a catch rate of 0.5 (Amiro and Harvie MS 1996) for large salmon, as was done 1985-1993, suggests that river return may have numbered only 120 fish (approximately 60 fish were observed by diving in the two main summer holding pools upriver of the gorge in July). There is no correlation between returns estimated from diver counts and angling ( $\mathrm{p}=0.62$ ), 19941998. However, diver count-based estimates exceeded angler catch based estimates (average of $50 \%$ ) in four years out of five and offer the possibility that large salmon returns and escapement approximate conservation requirements of 200 large salmon. Conservation requirements for the North River are 0.85 million eggs from 200 large and 30 small salmon (Marshall et al. MS1998) although current biological data (Marshall et al. MS 1999b) suggests that 220 large and 160 small would be more appropriate.

Mean juvenile densities of 41.6 age- $0^{+}$per $100 \mathrm{~m}^{2}$ and 42.1 age $-1^{+}$and $-2^{+}$parr per 100 $\mathrm{m}^{2}$ for four mainstem sites on North River in 1999 were 1.4 and 1.1 times the Elson (1967) norm (Appendix IV). Monitoring at two of the same sites in 1998 yielded onethird as many age- $0^{+}$per $100 \mathrm{~m}^{2}$ and two-thirds as many age- $1^{+}$and $-2^{+}$parr per $100 \mathrm{~m}^{2}$.

## Outlook

Stock-and-recruit data have been developed for the North River but recent prognoses relative to the attainment of conservation requirements could just as easily have been based on the mean of recent years. The mean of wild salmon returns in the past five years, even with an escapement of just 120 large fish and 58 (angler catch of 29/0.5) small fish is 476 ( $90 \%$ CL 145-824 fish). The Bayes derived probability of the estimate exceeding the 230 fish requirement in 2000 is greater than $88 \%$. Under the assumption that the 1999 estimate of returns is realistic and in light of the evidence that returns have declined to sub-conservation requirements in the last three years, it would be prudent to heed the values encompassing the lower bounds of the prognoses.

## Fisheries Management Considerations

Conservation requirements of North River may not have been met in 1999, but there is an $88 \%$ chance that fish conservation requirements will be met in the year 2000. Continued allocation of North River fish to Aboriginals should consider the possibility that the stock is in decline and that there is slightly better than one chance in ten that conservation requirements will not be met.

## Grand River

## Fishery

There has been no recent allocation of Grand River salmon to First Nations and to date, no reported removals (Table 1). The hook-and-release (all salmon) recreational fishery for the Grand River was also reduced from June 1-October 31 in 1997, to that of June 1July 15 and September 1-October 31 in 1998 and 1999. Estimates of catch from only four voluntarily returned Nova Scotia Salmon Licence stubs were 25 small and seven large salmon (Appendix II). The estimated catches are the lowest of any year since 1984 (the few fish reported in 1995 were taken during a season closure).

## Grand R. Angling



Removals (Table 1) include an assumed 7\% hook-and-release induced mortality prior to 1999 (including 1995 when the season was closed) and an assumed $4 \%$ without a summer season in 1998 and 1999.

## Status

## Habitat

Grand River, Richmond County, is a low gradient river in which the mainstem flow and temperature is moderated by headwater lakes, including Monroe, Uist and Loch Lomond. Grand River Falls is an obstruction to salmon at low discharge and is located 10.2 km
above head-of-tide. A fishway at the Falls is estimated to pass an average $60 \%$ of small and $43 \%$ of large salmon that approach it (Amiro and Longard MS 1990 and MS 1995). It is estimated that $45 \%$ of the juvenile production area is above the falls (Amiro and Longard op. cit.).

The Grand River fishway is not known to have passed farmed escapees but the river does support a small population of resident brown trout (Salmo trutta). Atlantic salmon stocked in 1996 (23,500 age $0^{+}$parr) contributed to $33 \%$ of small salmon returns in 1999.

## Stock

Unlike most other Cape Breton stocks, salmon of the Grand River are principally small (1SW) and of June/July ( $80 \%$ ) run timing. The few large salmon are almost all repeatspawning 1SW fish. Returns have declined in recent years despite significant hatchery supplementation with Grand River stock (Marshall et al. MS 1998) and the elimination of south coast Newfoundland commercial fisheries. Partial counts of salmon were made at a trap in a fishway at Grand Falls through August 31, total returns were estimated as [[Count/[1- by-pass rate ( 0.4 )]/0.8 the counted component]].

The count of wild and hatchery-origin salmon in 1999 was 42 small and two large fish; the estimate of returns, including an estimated "removal" of nine fish from either the fishway or below, is 101 salmon of which $34 \%$ were of hatchery origin. Since 1994, escapements have approximated total returns. Wild escapements in 1999 numbered an estimated 73 fish, the third lowest of the series beginning in 1988.


Conservation requirements for the entire Grand River are 1.1 million eggs from 545 salmon (mostly small). Required above the fishway are 234 salmon (475,000 eggs). In 1999, escapement of wild and hatchery salmon above the fishway was $43 \%$ of requirement, the second lowest of the 12-year data set. Wild salmon escapement, as in 1998 , is again under $30 \%$ of requirements.

Juvenile densities at four sites on the main stem (two above and two below the falls) averaged 16.3 age $-0^{+}$and 2.3 age $-1^{+}$and $-2^{+}$parr per $100 \mathrm{~m}^{2}, 56 \%$ and $6 \%$ of respective
norms. The decline in densities is consistent with the estimated decrease in egg depositions since 1996.


Grand R. age-1+, 2+ parr (4-site mean \& st. error)


## Outlook

There is no precedent for forecasting returns to the Grand River. A forecast based on the mean of wild returns, 1995-1999, (the last stocking of hatchery fish i.e., 23,500 age- $0^{+}$ parr in 1996, is unlikely to contribute more than a few returns in 2000) is 113 fish ( $90 \%$ CL 34-198) comprised mostly of small salmon. Bayes procedures indicate a <1\% probability that the conservation requirements of 234 fish could be met by wild returns in 2000. Recent low and declining parr densities are not suggestive of future increases in adult returns.

## Fisheries Management Considerations

In the absence of any fishery, returns to the Grand River fishway met less than one-half the conservation requirement for the area upriver of the fishway. Returns to the area above the falls in 2000 will be dependent on wild production, and the probability of meeting fish conservation requirements is $<1 \%$.

## Other Rivers of SFA 18 and SFA 19

In 1999, juvenile salmon surveys were again conducted on the Cheticamp and Mabou rivers in SFA 18 and Skye, Sydney, Gaspereaux, Tillard and Inhabitants rivers in SFA 19. Mean river densities (number of sites in brackets) of fry (age $-0^{+}$) and parr (age $-1^{+}$ and $2^{+}$) for sites surveyed in 1999 relative to Elson (1967) norms are shown below. The paucity of sites on some rivers and the potential for fry to remain concentrated in areas proximate to egg deposition renders fry data less valuable than the usually more spatially distributed parr.


In general, estimated parr densities relative to norms and estimates of numbers of returning salmon and escapements among fully assessed stocks contribute to the following generalized fishery management considerations: (1) Stocks of SFA 18 Gulf Cape Breton may all be meeting and, with a high degree of probability, be expected to meet conservation requirements in 2000. (2) Stocks of the Bras d'Or Lakes have in general terms not met or have been borderline to conservation requirements and should not be expected to improve in 2000. Of special note is the Skye River where in 1998, 100 grilse-sized salmon were reported harvested by Aboriginal fishers (no report in 1999) at sites proximate to the river and where in 1999 the average density age $-0^{+}$parr fell to 0.2
per $100 \mathrm{~m}^{2}$. Fishing mortality on this stock, in particular, should as a precaution be minimized. (3) Stocks of Atlantic coast rivers exhibit, on average, lower parr densities than Gulf and Bras d'Or rivers (excluding Skye River). These parr densities indicate a need for caution and river specific assessments before more liberalized fishing is permitted.

## Summary

Stocks of SFA 18 Cape Breton may all be surpassing conservation requirements. Exploitation levels both realized and potential have not been a conservation concern. Small salmon are predominantly male and generally are less abundant than large salmon. Returns in 2000 to the Margaree River are expected to be above conservation ( $96 \%$ chance). Directed fisheries within the limits of existing Aboriginal agreements would not be expected to jeopardize the attainment of conservation requirements. However, the estimated decline since 1997 in large salmon returns to the Margaree suggest that fishing mortality be better monitored and that as a precaution, in-season assessments be implemented prior to increases to fishing mortality from recent documented levels.

The status of stocks tributaries of the Bras d'Or Lakes (SFA 19) are generally not meeting conservation requirements. Small salmon are predominantly male and are less abundant than large salmon. Conservation requirements have generally not been met and expectations for 2000 are that returns will be below conservation. The Skye River is of particular concern. Fishing mortality should not be increased on Bras d'Or Lakes stocks and in the case of the Skye River, where fry and parr are seriously reduced, should as a precaution be minimized.

Stocks of Atlantic coast rivers (SFA 19) exhibit, on average, lower parr densities than Gulf and Bras d'Or, even though North River had, until perhaps this year, been exceeding conservation requirements. Juvenile densities for Sydney, Tillard and Inhabitants rivers suggests a group of Atlantic coast rivers whose status is no worse than those of Bras d'Or. With the exception of the Grand River, large salmon are dominant and small salmon are predominantly male. The returns to North River in 2000 should exceed conservation ( $88 \%$ chance) but full directed fisheries on small and large salmon could remove in excess of $15 \%$ (Marshall et al. MS 1999a) of the potential eggs on a stock that since 1997 may be in serious decline. Salmon from the Grand River are comprised primarily of small salmon with the few large salmon being repeat-spawning 1SW fish. The wild stock on which the river is now totally dependent has been declining since 1995, has not met conservation requirements since 1990 and is highly unlikely to meet conservation requirements in 2000. As a precaution it would be unwise to increase fishing mortality on Atlantic coast rivers without additional river-specific assessments.

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Table 1. Fisheries removals (number of fish) of Atlantic salmon from rivers of the Maritime Provinces 1995 to 1999. Removals refers to losses to spawning resulting from the fishing activity. For the recreational fisheries, the removals include losses estimated to have occurred as a result of hook-and-release induced mortality. 1999 data are provisional.

| River | SFA | Index | Aboriginal Fisheries Removals ${ }^{\text {a }}$ |  |  |  |  |  |  |  |  |  | Recreational Fisheries Removals ${ }^{1}$ |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Small Salmon |  |  |  |  | Large Salmon |  |  |  |  | Small Salmon |  |  |  |  | Large Salmon |  |  |  |  |
|  |  |  | '95 | '96 | '97 | '98 | '99 | '95 | '96 | '97 | '98 | '99 | '95 | '96 | ${ }^{9} 97$ | '98 | '99 | '95 | '96 | '97 | ${ }^{6} 98$ | 99 |
| Margaree | 18 | 22 | 2 | 7 | 20 | 30 | 8 | 4 | 89 | 124 | 120 | 45 | 206 | 306 | 204 | 213 | 253 | 53 | 93 | 105 | 66 | 46 |
| Middle ${ }^{2}$ | 19 | 23 | 1 | 4 | 3 | 5 | 5 | 7 | 16 | 15 | 9 | 9 | 2 | 5 | 4 | 6 | 1 | 3 | 7 | 4 | 2 | 4 |
| Baddeck | 19 | 24 | 2 | 2 | 5 | 3 | 3 | 5 | 7 | 13 | 7 | 7 | 10 | 2 | 1 | 2 | 1 | 4 | 8 | 3 | 3 | 2 |
| North | 19 | 25 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 9 | 9 | 4 | 4 | 1 | 10 | 6 | 7 | 4 | 2 |
| Grand | 19 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 5 | 4 | 2 | 1 | 1 | , | 1 | 1 | 1 |

1 "Closed" means no salmon fishing was allowed, "-" means no data were available, "0" means no removals occurred.
${ }^{2}$ Significant removals of "black" salmon in the winters of 1997-'98, and 1998-'99.

Table 2. Summary of stock status of Atlantic salmon in selected rivers of Cape Breton Island, Nova Scotia. All 1999 information is provisional.

| River | SFA | Method | $\begin{aligned} & \text { Map } \\ & \text { Index } \end{aligned}$ | Returns in 1999 |  | $\begin{gathered} \% \text { hatchery } \\ \text { origin } \\ \hline \end{gathered}$ | Conservation met |  | Qualitative estimate of abundance |  |  | Status in 1999 |  | Constraints |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | Juveniles |  |  | Adults |  | $\begin{gathered} \text { rel. to } \\ 1998 \\ \hline \end{gathered}$ | $\begin{gathered} 1984 \text { to } \\ 1998 \\ \hline \end{gathered}$ |  |
|  |  |  |  | Small | Large |  | 1999 | 1984-1999 | Wild | Hatchery |  |  |  |
| Margaree | 18 | Ang | 22 | 820 | 2060 | 5 to 10\% | Yes | 15 of 15 | High $\Leftrightarrow$ | High $\Leftrightarrow$ | Low $\Leftrightarrow$ | $(1)$ | (1) |  |
| Middle | 19 | ViM | 23 | 90 | 360 | 0\% | No | 2 of 11 | High $\Leftrightarrow$ | Low $\Leftrightarrow$ | Na | 介 | (1) |  |
| Baddeck | 19 | - | 24 | - | - | 0\% | Unlikely | 0 of 6 | High $\Leftrightarrow$ | Low $\Leftrightarrow$ | Na |  |  |  |
| North | 19 | Ang | 25 | 58 | 120 | 0\% | Likely | 14 of 15 | Med $\Leftrightarrow$ | Low | Na | $(1)$ | (1) |  |
| Grand | 19 | Fw | 26 | 105 | 5 | 34\% | No | 7 of 12 | Low $\Leftrightarrow$ | Low 1 | Med ${ }^{\text {d }}$ | $(1)$ | (1) | Fp |


| Assessment methods: | Ang $=$ angling catches and assumed exploitation rates <br> $\mathrm{Fe}=$ counting fence |
| :--- | :--- |
|  | $\mathrm{Fh}=$ fishway |

$\mathrm{CR}=$ catch rate index $\mathrm{MR}=$ mark and recapture experiment
ViM = snorkel count and mark/recapture calibration
Map index numbers refer to text figure and legend.

| Trend symbols (over recent ten years): | $\boldsymbol{U}=$ decline | $\Leftrightarrow=$ no change | $\hat{0}=$ increase (Low, Med \& High = qualitative) |
| :--- | :--- | :--- | :--- |
| Potential constraints to production: | $\mathrm{Ac}=$ acid impacted rivers | $\mathrm{Aq}=$ aquaculutre escapees |  |
|  | $\mathrm{Fp}=$ fish passage constraints | $\mathrm{LU}=$ land use practices | WU = water use practices |

Appendix 1. Recreational catch and effort for Atlantic salmon on rivers of Cape Breton Island, 1999.
PRELIMINARY

| River |  | Seasondates |  | Observed No. of anglers | Numbers c Grilse |  | aught (includin Salmon |  | g releases) Total |  | Effort <br> No. of rod days |  | Catch per effort Fish/day | Percent large salmon |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Code | Name | D M | D M |  | Obs. | Est. | Obs. | Est. | Obs. | Est. | Obs. | Est. |  |  |
| 1 | Aconi Brook | 1/06 | 31/10** | 0 |  |  |  |  |  |  |  |  |  |  |
| 4 | Baddeck | $1 / 06$ | 31/10 * | 49 | 5 | 11 | 36 | 81 | 41 | 92 | 110 | 246 | 0.373 | 87.8 |
| 5 | Barachois | $1 / 06$ | 31/10* | 5 | 4 | 9 | 1 | 2 | 5 | 11 | 6 | 13 | 0.833 | 20.0 |
| 134 | Campbell's Brook | $1 / 09$ | 31/11 | 1 | 1 | 2 | 0 | 0 | 1 | 2 | 1 | 2 | 1.000 | 0.0 |
| 11 | Catalone | $1 / 06$ | 34/10 * | 0 |  |  |  |  |  |  |  |  |  |  |
| 12 | Cheticamp | $16 / 05$ | 30109 | 2 | 2 | 4 | 0 | 0 | 2 | 4 | 12 | 27 | 0.167 | 0.0 |
| 124 | Clyburne | 1/06 | 31/10** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 0.000 | 0.0 |
| 28 | Framboise | 1/06 | 31/10** | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 0.000 | 0.0 |
| 30 | Gaspereaux: C. Breton | $1 / 06$ | 31/10* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0.000 | 0.0 |
| 34 | Gerratt | 1/06 | 31/10** | 0 |  |  |  |  |  |  |  |  |  |  |
| 36 | Grand | 1/06 | 31/10** | 4 | 11 | 25 | 3 | 7 | 14 | 31 | 21 | 47 | 0.667 | 21.4 |
| 135 | Grantmire Brook | 1/06 | 31/10** | 3 | 4 | 9 | 10 | 22 | 14 | 31 | 10 | 22 | 1.400 | 71.4 |
| 41 | Indian Brook | 1/06 | 31/10* | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 4 | 9 | 0.250 | 0.0 |
| 42 | Ingonish | 1/06 | 31/10 * | 1 | 0 | 0 | 1 | 2 | 1 | 2 | 4 | 9 | 0.250 | 100.0 |
| 44 | Inhabitants | $1 / 06$ | 31/10* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 0.000 | 0.0 |
| 127 | Little Lorraine | $1 / 06$ | 31/10** | 0 |  |  |  |  |  |  |  |  |  |  |
| 56 | Lorraine Brook | 1/06 | 31/10 * | 0 |  |  |  |  |  |  |  |  |  |  |
| 119 | Mabou | 1109 | $31 / 10$ | 2 | 3 | 7 | 4 | 9 | 7 | 16 | 8 | 18 | 0.875 | 57.1 |
| 133 | MacAskill's Brook | 1/06 | 31/10* | 0 |  |  |  |  |  |  |  |  |  |  |
| 59 | Margaree | $1 / 06$ | 31/10* | 510 | 168 | 376 | 414 | 927 | 582 | 1303 | 3332 | 7461 | 0.175 | 71.1 |
| 60 | Marie Joseph | $1 / 06$ | 31/10** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0.000 | 0.0 |
| 66 | Middle: Victoria Co. | 1/06 | 31/10* | 83 | 18 | 40 | 60 | 134 | 78 | 175 | 191 | 428 | 0.408 | 76.9 |
| 67 | Mira | 1/06 | 31/10* | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 0.000 | 0.0 |
| 139 | Mull | $1 / 09$ | 31/10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0.000 | 0.0 |
| 77 | North : Victoria Co. | $1 / 06$ | 31/10** | 33 | 13 | 29 | 27 | 60 | 40 | 90 | 138 | 309 | 0.290 | 67.5 |
| 78 | North Aspy | $1 / 06$ | 31/10* | 4 | 1 | 2 | 2 | 4 | 3 | 7 | 12 | 27 | 0.250 | 66.7 |
| 120 | Northwest Brook (River Ryan) | 1/06 | 31/10 * | 0 |  |  |  |  |  |  |  |  |  |  |
| 129 | River Bennett | $1 / 06$ | 31/10** | 1 | 1 | 2 | 0 | 0 | 1 | 2 | 10 | 22 | 0.100 | 0.0 |
| 122 | River Deny's | 1/09 | $31 / 10$ | 0 |  |  |  |  |  |  |  |  |  |  |
| 89 | River Tillard | 1/06 | 31/10* | 0 |  |  |  |  |  |  |  |  |  |  |
| 93 | Saint Esprit | 1/06 | 31/10** | 0 |  |  |  |  |  |  |  |  |  |  |
| 97 | Salmon: Cape Breton | $1 / 06$ | 31/10 * | 6 | 1 | 2 | 4 | 9 | 5 | 11 | 12 | 27 | 0.417 | 80.0 |
| 123 | Skye | $1 / 09$ | 31/10 | 0 |  |  |  |  |  |  |  |  |  |  |
| 125 | Sydney | $1 / 06$ | 31/10* | 0 |  |  |  |  |  |  |  |  |  |  |
| Cape | Breton totals |  |  | 716 | 233 | 520 | 562 | 1257 | 795 | 1779 | 3884 | 8695 | 0.205 | 70.7 |

Appendix II. Recreational catch and effort for Atantic salmon on rivers of Cape Breton Island, 1999 Preliminary 1998 and 1994-1998.


Appendix III. Annual summaries of catch, effort and estimated ISW fish retained from NS license stub returns for assessed rivers of Cape Breton, 1984-99. Mean = 1994 to 1998). The 1999 data are preliminary. (Unk. Obs. are undefined smal//large)

| Year | River | No. Angler | Small |  | Est. Ret. | Large |  | Unk. Obs. | Total |  | Roddays |  | CPUE | $\begin{gathered} \text { \% } \\ \text { Large } \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Obs. | Est. |  | Obs. | Est. |  | Obs. | Est. | Obs. | Est. |  |  |
| Baddeck |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1984 |  | 60 | 6 | 6 | 4 | 42 | 45 | 0 | 48 | 51 | 254 | 284 | 0.189 | 87.5 |
| 1985 |  | 34 | 4 | 5 | 4 | 12 | 14 | 0 | 16 | 19 | 94 | 100 | 0.170 | 75.0 |
| 1986 |  | 68 | 25 | 26 | 20 | 133 | 139 | 0 | 158 | 165 | 364 | 383 | 0.434 | 84.2 |
| 1987 |  | 90 | 40 | 40 | 26 | 126 | 126 | 0 | 166 | 166 | 411 | 435 | 0.404 | 75.9 |
| 1988 |  | 86 | 31 | 36 | 19 | 149 | 175 | 0 | 180 | 211 | 366 | 444 | 0.492 | 82.8 |
| 1989 |  | 98 | 15 | 18 | 8 | 204 | 247 | 0 | 219 | 265 | 392 | 490 | 0.559 | 93.2 |
| 1990 |  | 103 | 56 | 71 | 40 | 144 | 182 | 0 | 200 | 253 | 445 | 580 | 0.449 | 72.0 |
| 1991 |  | 110 | 40 | 51 | 28 | 166 | 213 | 0 | 206 | 264 | 483 | 640 | 0.427 | 80.6 |
| 1992 |  | 129 | 45 | 57 | 50 | 131 | 165 | 0 | 176 | 221 | 538 | 698 | 0.327 | 74.4 |
| 1993 |  | 146 | 45 | 48 | 33 | 101 | 108 | 0 | 146 | 156 | 689 | 785 | 0.212 | 69.2 |
| 1994 |  | 74 | 13 | 16 | 1 | 50 | 62 | 0 | 63 | 78 | 238 | 305 | 0.265 | 79.4 |
| 1995 |  | 61 | 49 | 61 | 7 | 57 | 71 | 0 | 106 | 131 | 263 | 336 | 0.403 | 53.8 |
| 1996 |  | 70 | 37 | 46 | 0 | 133 | 165 | 0 | 170 | 211 | 293 | 374 | 0.580 | 78.2 |
| 1997 |  | 42 | 11 | 15 | 0 | 48 | 64 | 0 | 59 | 79 | 115 | 157 | 0.513 | 81.4 |
| 1998 |  | 87 | 46 | 61 | 0 | 65 | 86 | 0 | 111 | 147 | 232 | 316 | 0.478 | 58.6 |
| 1999 |  | 49 | 5 | 11 | 0 | 36 | 81 | 0 | 41 | 92 | 110 | 246 | 0.373 | 87.8 |
|  | +/-1998 | -44\% | -89\% | -82\% | - | -45\% | -6\% | - | -63\% | -37\% | -53\% | -22\% | -22\% | 50\% |
|  | +/-Mean | -27\% | -84\% | -72\% | -100\% | -49\% | -10\% | - | -60\% | -29\% | -52\% | -17\% | -17\% | 25\% |
| Grand |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1984 |  | 268 | 367 | 393 | 338 | 32 | 34 | 11 | 410 | 438 | 2,777 | 3.110 | 0.148 | 8.0 |
| 1985 |  | 312 | 520 | 542 | 471 | 127 | 132 | 1 | 648 | 675 | 2,896 | 3,094 | 0.224 | 19.6 |
| 1986 |  | 326 | 336 | 360 | 298 | 181 | 194 | 0 | 517 | 554 | 2,865 | 3,015 | 0.180 | 35.0 |
| 1987 |  | 262 | 311 | 342 | 308 | 97 | 107 | 0 | 408 | 449 | 1,961 | 2,077 | 0.208 | 23.8 |
| 1988 |  | 277 | 276 | 324 | 303 | 86 | 101 | 0 | 362 | 425 | 2,731 | 3,311 | 0.133 | 23.8 |
| 1989 |  | 247 | 258 | 312 | 290 | 62 | 75 | 0 | 320 | 387 | 2,167 | 2,707 | 0.148 | 19.4 |
| 1990 |  | 240 | 327 | 413 | 335 | 80 | 101 | 0 | 407 | 514 | 2,192 | 2,858 | 0.186 | 19.7 |
| 1991 |  | 178 | 100 | 128 | 115 | 14 | 18 | 0 | 114 | 146 | 1,499 | 1,985 | 0.076 | 12.3 |
| 1992 |  | 182 | 127 | 160 | 148 | 35 | 44 | 0 | 162 | 204 | 1,483 | 1,925 | 0.109 | 21.6 |
| 1993 |  | 184 | 117 | 139 | 118 | 21 | 25 | 0 | 138 | 164 | 1,311 | 1,494 | 0.105 | 15.2 |
| 1994 |  | 44 | 58 | 72 | 0 | 16 | 20 | 0 | 74 | 92 | 321 | 411 | 0.231 | 21.6 |
| 1995 |  | 4 | 4 | 5 | 0 | 10 | 12 | 0 | 14 | 17 | 38 | 49 | 0.368 | 71.4 |
| 1996 |  | 26 | 72 | 90 | 0 | 20 | 25 | 0 | 92 | 115 | 227 | 290 | 0.405 | 21.7 |
| 1997 |  | 21 | 22 | 29 | 3 | 4 | 5 | 0 | 26 | 34 | 99 | 136 | 0.263 | 15.4 |
| 1998 |  | 20 | 43 | 57 | 0 | 16 | 21 | 0 | 59 | 78 | 163 | 222 | 0.362 | 27.1 |
| 1999 |  | 4 | 11 | 25 | 0 | 3 | 7 | 0 | 14 | 32 | 21 | 47 | 0.667 | 21.4 |
|  | +/-1998 | -80\% | -74\% | -56\% | - | -81\% | -67\% | - | -76\% | -59\% | -87\% | -79\% | 84\% | -21\% |
|  | +/-Mean | -83\% | -72\% | -51\% | -100\% | -77\% | -58\% | - | -74\% | -52\% | -88\% | -79\% | 105\% | -32\% |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1984 | Margaros | 678 | 233 | 242 | 190 | 293 | 305 | 4 | 530 | 551 | 5,952 | 6,665 | 0.089 | 55.7 |
| 1985 |  | 793 | 473 | 509 | 399 | 1,130 | 1,215 | 3 | 1,606 | 1.727 | 7,324 | 7,824 | 0.219 | 70.4 |
| 1986 |  | 1,131 | 748 | 782 | 650 | 2,522 | 2,636 | 2 | 3,272 | 3,420 | 9,724 | 10,232 | 0.336 | 77.1 |
| 1987 |  | 1,441 | 925 | 977 | 826 | 1,757 | 1,857 | 0 | 2,682 | 2,834 | 12,165 | 12,887 | 0.220 | 65.5 |
| 1988 |  | 1,455 | 749 | 879 | 752 | 1,647 | 1,932 | 0 | 2,396 | 2,810 | 11,582 | 14,042 | 0.207 | 68.7 |
| 1989 |  | 1,486 | 464 | 561 | 434 | 1,298 | 1,570 | 0 | 1,762 | 2,132 | 10,594 | 13,234 | 0.166 | 73.7 |
| 1990 |  | 1,383 | 514 | 649 | 498 | 1,193 | 1,507 | 0 | 1,707 | 2,156 | 10,792 | 14,073 | 0.158 | 69.9 |
| 1991 |  | 1,236 | 586 | 752 | 559 | 1,370 | 1,757 | 0 | 1,956 | 2,509 | 10,142 | 13,432 | 0.193 | 70.0 |
| 1992 |  | 1,426 | 539 | 678 | 551 | 1,541 | 1,938 | 0 | 2,080 | 2,616 | 11,483 | 14,909 | 0.181 | 74.1 |
| 1993 |  | 1,885 | 696 | 777 | 562 | 987 | 1,102 | 0 | 1,683 | 1,879 | 13,920 | 15,863 | 0.121 | 58.6 |
| 1994 |  | 1,382 | 346 | 429 | 291 | 1,193 | 1,479 | 0 | 1.539 | 1,908 | 10,452 | 13,376 | 0.147 | 77.5 |
| 1995 |  | 1,268 | 269 | 333 | 199 | 856 | 1,060 | 0 | 1,125 | 1,393 | 9,617 | 12,293 | 0.117 | 76.1 |
| 1996 |  | . 986 | 738 | 918 | 274 | 1,499 | 1,864 | 0 | 2,237 | 2,782 | 7,119 | 9,096 | 0.345 | 61.0 |
| 1997 |  | 1,158 | 237 | 316 | 198 | 1,575 | 2,098 | 0 | 1,812 | 2,413 | 6,436 | 8,809 | 0.282 | 86.9 |
| 1998 |  | 1,073 | 263 | 349 | 206 | 1,000 | 1,327 | 0 | 1,263 | 1,675 | 7,543 | 10,286 | 0.167 | 79.2 |
| 1999 |  | 510 | 168 | 376 | 246 | 414 | 927 | 0 | 582 | 1,302 | 3,332 | 7,461 | 0.175 | 71.1 |
|  | +/-1998 | -52\% | -36\% | 8\% | 19\% | -59\% | -30\% | - | -54\% | -22\% | -56\% | -27\% | 5\% | -10\% |
|  | +/- Mean | -57\% | -55\% | -20\% | 5\% | -66\% | -41\% | - | -64\% | -36\% | -60\% | -31\% | -17\% | -7\% |

Appendix III. Annual summaries of catch, effort and estimated ISW fish retained from NS license stub returns for assessed rivers of Cape Breton, 1984-99. Mean = 1994 to 1998). The 1999 data are preliminary. (Unk. Obs. are undefined small/large)

| 1984 M/dd/e |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 83 | 29 | 33 | 21 | 66 | 75 | 0 | 95 | 108 | 470 | 526 | 0.202 | 69.5 |
| 1985 | 39 | 18 | 21 | 15 | 24 | 29 | 0 | 42 | 50 | 150 | 160 | 0.280 | 57.1 |
| 1986 | 76 | 44 | 44 | 36 | 107 | 108 | 0 | 151 | 152 | 368 | 387 | 0.410 | 70.9 |
| 1987 | 114 | 55 | 58 | 53 | 111 | 116 | 0 | 166 | 174 | 684 | 725 | 0.243 | 66.9 |
| 1988 | 131 | 42 | 49 | 36 | 121 | 142 | 0 | 163 | 191 | 591 | 717 | 0.276 | 74.2 |
| 1989 | 144 | 43 | 52 | 41 | 231 | 279 | 0 | 274 | 332 | 694 | 867 | 0.395 | 84.3 |
| 1990 | 153 | 85 | 107 | 80 | 156 | 197 | 0 | 241 | 304 | 771 | 1005 | 0.313 | 64.7 |
| 1991 | 169 | 21 | 27 | 18 | 145 | 186 | 0 | 166 | 213 | 646 | 856 | 0.257 | 87.3 |
| 1992 | 66 | 9 | 11 | 8 | 24 | 30 | 0 | 33 | 41 | 167 | 217 | 0.198 | 72.7 |
| 1993 | 110 | 28 | 30 | 25 | 44 | 48 | 0 | 72 | 78 | 356 | 406 | 0.202 | 61.1 |
| 1994 | 122 | 19 | 24 | 0 | 134 | 166 | 0 | 153 | 190 | 389 | 498 | 0.393 | 87.6 |
| 1995 | 72 | 30 | 37 | 0 | 41 | 51 | 0 | 71 | 88 | 224 | 286 | 0.317 | 57.7 |
| 1996 | 125 | 48 | 60 | 2 | 114 | 142 | 0 | 162 | 202 | 395 | 505 | 0.415 | 69.5 |
| 1997 | 52 | 13 | 17 | 3 | 59 | 79 | 0 | 72 | 96 | 127 | 174 | 0.567 | 81.9 |
| 1998 | 99 | 24 | 32 | 5 | 47 | 62 | 0 | 71 | 94 | 230 | 314 | 0.309 | 66.2 |
| 1999 | 83 | 18 | 40 | 0 | 60 | 134 | 0 | 78 | 174 | 191 | 428 | 0.408 | 76.9 |
| +/-1998 | -16\% | -25\% | 25\% | -100\% | 28\% | 116\% | - | 10\% | 85\% | -17\% | 36\% | 32\% | 16\% |
| +/-Mean | $-12 \%$ | -33\% | 18\% | -100\% | -24\% | 34\% | - | -26\% | 30\% | -30\% | 20\% | 2\% | 6\% |
| North |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1984 | 162 | 60 | 65 | 56 | 139 | 151 | 1 | 200 | 217 | 1,091 | 1,222 | 0.183 | 69.8 |
| 1985 | 170 | 146 | 162 | 149 | 383 | 426 | 0 | 529 | 588 | 947 | 1,012 | 0.559 | 72.4 |
| 1986 | 298 | 235 | 235 | 185 | 1,010 | 1,010 | 0 | 1,245 | 1,245 | 1,945 | 2,047 | 0.640 | 81.1 |
| 1987 | 263 | 219 | 226 | 177 | 529 | 546 | 0 | 748 | 772 | 1,574 | 1,667 | 0.475 | 70.7 |
| 1988 | 202 | 115 | 135 | 118 | 456 | 535 | 0 | 571 | 670 | 1,305 | 1,582 | 0.438 | 79.9 |
| 1989 | 162 | 134 | 162 | 122 | 331 | 400 | 0 | 465 | 563 | 1,074 | 1,342 | 0.433 | 71.2 |
| 1990 | 219 | 212 | 268 | 202 | 483 | 610 | 0 | 695 | 878 | 1,416 | 1,846 | 0.491 | 69.5 |
| 1991 | 172 | 145 | 186 | 148 | 277 | 355 | 0 | 422 | 541 | 1,050 | 1,391 | 0.402 | 65.6 |
| 1992 | 205 | 178 | 224 | 184 | 437 | 550 | 0 | 615 | 773 | 1,421 | 1,845 | 0.433 | 71.1 |
| 1993 | 217 | 72 | 82 | 62 | 142 | 161 | 0 | 214 | 243 | 1,094 | 1,247 | 0.196 | 66.4 |
| 1994 | 73 | 60 | 74 | 0 | 78 | 97 | 0 | 138 | 171 | 317 | 406 | 0.435 | 56.5 |
| 1995 | 77 | 136 | 168 | 1 | 169 | 209 | 0 | 305 | 378 | 402 | 514 | 0.759 | 55.4 |
| 1996 | 81 | 140 | 174 | 0 | 100 | 124 | 0 | 240 | 298 | 457 | 584 | 0.525 | 41.7 |
| 1997 | 57 | 52 | 69 | 1 | 101 | 135 | 0 | 153 | 204 | 238 | 326 | 0.643 | 66.0 |
| 1998 | 84 | 85 | 113 | 0 | 82 | 109 | 0 | 167 | 222 | 328 | 447 | 0.509 | 49.1 |
| 1999 | 33 | 13 | 29 | 0 | 27 | 60 | 0 | 40 | 89 | 138 | 309 | 0.250 | 66.7 |
| +/1998 | -61\% | -85\% | -74\% | - | -67\% | -45\% | - | -76\% | -60\% | -58\% | -31\% | -51\% | 36\% |
| +/-Mean | -56\% | -86\% | -76\% | -100\% | -75\% | -55\% | - | -80\% | -65\% | -60\% | -32\% | -56\% | 24\% |

Appendix IV. Results of electrofishing surveys at barrier net sites in Cape Breton Island, 1995-1999.

| River | Site Name | $\begin{array}{r} \text { Area } \\ m 2 \end{array}$ | No. of sweeps | Age 0+ |  |  | Age 1+, $2+$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Catch | $\begin{array}{r} \text { Est } \\ \text { Pop'n } \end{array}$ | Density $100 \mathrm{~m}^{2}$ | Catch | $\begin{aligned} & \text { Est } \\ & \text { Pop'n } \end{aligned}$ | $\begin{gathered} \text { Density } \\ 100 \mathrm{~m}^{2} \end{gathered}$ |
| 1999 |  |  |  |  |  |  |  |  |  |
| Middle | Main, Finlayson | 545 | 4 | 101 | 105 | 19.2 | 226 | 248 | 45.5 |
|  | Main, Twin Churches* | 326 | 3 | 203 | 206 | 63.3 | 94 | 101 | 30.9 |
|  | Main, 2nd Gold Brook | 356 | 4 | 268 | 284 | 79.7 | 152 | 155 | 43.5 |
|  | MacKenzie 8k | 99 | 4 | 53 | 59 | 59.2 | 46 | 55 | 55.2 |
|  | Mean, 3 main river sites |  |  |  |  | 54.1 |  |  | 40.0 |
| Baddeck | Upper, Site \#2 (main) | 465 | 3 | 73 | 77 | 16.5 | 121 | 127 | 27.4 |
|  | $N \mathrm{Br}, \mathrm{Site} \# 3$ (main) | 599 | 4 | 997 | 1025 | 171.1 | 112 | 120 | 20.0 |
|  | N Br, Site \#4 (main) | 382 | 4 | 355 | 374 | 98.0 | 183 | 193 | 50.6 |
|  | Peter's Bk, SP\#5 | 300 | 3 | 165 | 181 | 60.3 | 50 | 52 | 17.4 |
|  | Mean, 3 main river sites |  |  |  |  | 95.2 |  |  | 32.6 |
| North | Main, Karr's | 340 | 3 | 148 | 154 | 45.3 | 51 | 57 | 16.9 |
|  | Main, Narrows | 388 | 3 | 50 | 51 | 13.2 | 134 | 136 | 35.2 |
|  | Main, MacLeans | 443 | 4 | 250 | 258 | 58.3 | 365 | 382 | 86.2 |
|  | Main Benches | 324 | 4 | 146 | 160 | 49.5 | 95 | 97 | 30.0 |
|  | Mean, 4 main river sites |  |  |  |  | 41.6 |  |  | 42.1 |
| Cheticamp | Robert's Brook | 493 | 3 | 514 | 524 | 106.2 | 204 | 208 | 42.3 |
|  | Main (Above Fairbault Bk) | 302 | 4 | 92 | 92 | 30.6 | 162 | 168 | 55.6 |
| Skye | Main | 245 | 3 | 1 |  | 0.4 | 12 | 15 | 6.2 |
|  | Mullach Brook | 167 | 3 | 0 |  |  | 10 | 11 | 6.5 |
| Mabou | Mull River | 190 | 3 | 6 | 8 | 4.0 | 156 | 168 | 88.4 |
|  | Mabou (MacLeod Brook) | 298 | 3 | 29 | 34 | 11.2 | 108 | 120 | 40.3 |
| Inhabitants | Main | 361 | 4 | 61 | 62 | 17.1 | 81 | 85 | 23.6 |
|  | Lamey Brook | 410 | 3 | 170 | 199 | 48.6 | 58 | 67 | 16.4 |
|  | Northwest Arm | 330 | 3 | 10 | 13 | 4.0 | 36 | 50 | 15.1 |
| 1998 |  |  |  |  |  |  |  |  |  |
| Middle | Main, Finlayson | 556 | 4 | 113 | 119 | 21.5 | 253 | 270 | 48.5 |
|  | Main, Twin Churches* | 369 | 4 | 134 | 135 | 36.7 | 196 | 201 | 54.7 |
|  | MacLeods Bk | 132 | 4 | 21 | 24 | 17.8 | 44 | 46 | 35.0 |
|  | MacKerzie Bk | 101 | 3 | 9 | 10 | 9.5 | 48 | 49 | 48.9 |
|  | Mean, 2 main river sites |  |  |  |  | 29.1 |  |  | 51.6 |
| Baddeck | Upper, Site \#2 | 456 | 4 | 196 | 208 | 45.7 | 149 | 153 | 33.5 |
|  | $N \mathrm{Br}$, Site \#3 | 515 | 3 | 227 | 234 | 45.5 | 95 | 101 | 19.6 |
|  | $N \mathrm{Br}$, Site \#4 | 419 | 3 | 388 | 431 | 102.8 | 141 | 156 | 37.2 |
|  | Peter's Bk, SP\#5 | 217 | 3 | 133 | 139 | 64.0 | 55 | 57 | 26.3 |
|  | Mean, 3 main river sites |  |  |  |  | 64.7 |  |  | 30.1 |
| North | Main, Karr's | 444 | 3 | 51 | 55 | 12.4 | 61 | 66 | 14.9 |
|  | Main, MacDonalds | 404 | 3 | 23 | 27 | 6.7 | 72 | 78 | 19.3 |
|  | Mean, 2 riverine sites |  |  |  |  | 9.6 |  |  | 17.1 |
| Cheticamp | Robert's Brook | 408 | 3 | 267 | 272 | 66.8 | 154 | 159 | 39.0 |
|  | Main (Above Fairbault Bk) | 400 | 4 | 282 | 285 | 71.1 | 184 | 188 | 47.0 |
| Skye | Main | 306 | 3 | 2 |  | 0.7 | 42 | 51 | 16.8 |
|  | MacDonald Brook | 132 | 3 | 0 |  |  | 17 | 20 | 14.9 |
|  | Mullach Brook | 256 | 3 | 23 | 24 | 9.5 | 10 | 10 | 4.1 |

Appendix IV. Results of electrofishing surveys at barrier net sites in Cape Breton Island, 1995-1999.

| Rlvar | Site Name | Area m2 | No. of sweeps | Age $0+$ |  |  | Age 1+, $2+$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Catch | Est Pop'n | $\begin{gathered} \text { Density } \\ 100 \mathrm{~m}^{2} \end{gathered}$ | Catch |  | $\begin{aligned} & \text { Density } \\ & 100 \mathrm{~m}^{2} \end{aligned}$ |
| Mabou | Mull River | 218 | 3 | 132 | 148 | 67.7 | 148 | 153 | 70.2 |
|  | MacLeod Brook | 315 | 3 | 74 | 75 | 23.9 | 118 | 125 | 39.6 |
| Inhabitants | Main | 385 | 3 | 75 | 82 | 21.3 | 138 | 140 | 36.4 |
|  | Lamey Brook | 527 | 3 | 23 | 25 | 4.7 | 158 | 161 | 30.6 |
|  | Northwest Arm | 358 | 3 | 85 | 89 | 24.8 | 27 | 28 | 7.7 |
| 1997 |  |  |  |  |  |  |  |  |  |
| Middle | Main, Finlayson | 533 | 3 | 147 | 152 | 28.6 | 330 | 353 | 66.3 |
|  | Main, Twin Churches* | 364 | 4 | 153 | 159 | 43.6 | 91 | 92 | 25.1 |
|  | MacLeods Bk | 260 | 4 | 165 | 167 | 64.1 | 143 | 156 | 60.1 |
|  | MacKenzie Bk | 122 | 4 | 0 | 0 | 0.0 | 148 | 152 | 124.2 |
|  | Mean, 2 main niver siltes |  |  |  |  | 36.1 |  |  | 45.7 |
| Baddeck | Upper, Site \#2 | 397 | 4 | 190 | 200 | 50.3 | 162 | 169 | 42.5 |
|  | N Br, Site \#3 | 457 | 3 | 774 | 819 | 179.2 | 97 | 116 | 25.3 |
|  | NBr, Site \#4 | 372 | 4 | 401 | 412 | 110.7 | 165 | 180 | 48.3 |
|  | Petor's Ek, SP\#5 | 161 | 4 | 187 | 190 | 118.2 | 56 | 58 | 35.8 |
|  | Mean, 3 main niver sites |  |  |  |  | 113.4 |  |  | 38.7 |
| North | Abv Church Pl (tidal infl.) | 414 | 3 | 6 | $6+$ | 1.5+ | 1 | $1+$ | $<1$ |
|  | Main, MacDonalds | 430 | 3 | 23 | 24 | 5.6 | 134 | 142 | 33.1 |
|  | MacLeans | 352 | 3 | 121 | 314 | 89.4 | 119 | 137 | 38.9 |
|  | Benches | 350 | 3 | 53 | 57 | 16.4 | 83 | 87 | 24.9 |
|  | Mean, 3 riverine sites |  |  |  |  | 37.1 |  |  | 32.3 |
| Skye | Main | 201 | 3 | 39 | 41 | 20.5 | 23 | 25 | 12.6 |
|  | MacDonald's Brook | 133 | 3 | 20 | 21 | 16.1 | 2 |  | 1.5 |
| Mabou | Mull River | 167 | 4 | 238 | 252 | 150.9 | 140 | 151 | 90.5 |
|  | MacLeod Brook | 301 | 4 | 596 | 624 | 207.3 | 109 | 134 | 44.5 |
| 1996 |  |  |  |  |  |  |  |  |  |
| Middle | Main, Finlayson | 530 | 4 | 194 | 196 | 36.9 | 279 | 287 | 54.2 |
|  | Main, Two Churches | 333 | 3 | 72 | 82 | 24.7 | 110 | 120 | 36.0 |
|  | MacLeods Bk | 224 | 4 | 55 | 56 | 24.8 | 138 | 147 | 65.8 |
|  | MacKenzie Bk | 103 | 4 | 175 | 176 | 171.0 | 64 | 67 | 64.6 |
|  | Mean, 2 main niver sites |  |  |  |  | 30.8 |  |  | 45.1 |
| Baddeck | Main, Glenhaven |  | 4 | 226 | 254 | 69.1 | 146 | 153 | 41.7 |
|  | N. Br, Picnic Pk | 491 | 4 | 261 | 281 | 57.3 | 87 | 99 | 20.1 |
|  | N. Br, Bridge | 378 | 4 | 235 | 240 | 63.6 | 168 | 174 | 46.1 |
|  | Peter's Bk | 168 | 4 | 248 | 253 | 150.1 | 39 | 39 | $23.2{ }^{+}$ |
|  | Mean, 3 main river sites |  |  |  |  | 63.3 |  |  | 36.0 |
| North | Main, MacDonalds | 408 | 3 | 40 | 41 | 10.1 | 114 | 121 | 29.8 |
|  | Main, Church | 357 | 3 | 116 | 118 | 33.0 | 49 | 51 | 14.3 |
|  | Mean, 2 main river sites |  |  |  |  | 21.6 |  |  | 22.1 |
| 1995 |  |  |  |  |  |  |  |  |  |
| Middle | Main, Hwy 19 | 181 | 4 | 191 | 197 | 108.9 | 59 | 62 | 34.3 |
|  | Main, ab Gold Bk | 251 | 3 | 261 | 267 | 106.3 | 43 | 46 | 18.3 |
|  | MacKenzie Bk | 95 | 4 | 159 | 174 | 174.1 | 63 | 72 | 75.8 |
|  | Mean, 2 main river sites |  |  |  |  | 107.6 |  |  | 26.3 |

"Minimum based on total catch, variance of estimate was negative.
Note: Skye main site 1998 and 1999 estimate based on total catch/site area.
Note: MacLeod Brook (Middle River) 1998 variances unreliable because $\mathrm{N}<50$
Nota: Mullach Brook site has several beaver dams below, may account for 0 fry during 1999.

Appendix V. Summary of effort, catch and CPUE from logbook anglers on Margaree River, 1991 to 1999.

| Year | Season | Month | Angler | Small |  | Large |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Days | Catch | CPUE | Catch | CPUE | Catch | CPUE |

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 |  |

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 |  |

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 | 41 | 4 | 0.098 | 8 | 0.195 | 12 | 0.293 |
|  | Oct. 1-31 | 195 | 10 | 0.051 | 34 | 0.174 | 44 | 0.226 |
| Sub-Total | 388 | 16 | 0.041 | 52 | 0.134 | 68 | 0.175 |  |
|  |  |  |  |  |  |  |  |  |
| Total Season | 883 | 63 | 0.071 | 82 | 0.093 | 145 | 0.164 |  |

Appendix V. Summary of effort, catch and CPUE from logbook anglers on Margaree River, 1991 to 1999.

| Year | Season | Month | Angler Days | Small |  | Large |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 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 | 5 | 0.051 | 14 | 0.143 |
|  | Sub-Total |  | 249 | 13 | 0.052 | 21 | 0.084 | 34 | 0.137 |
|  | Fall | September | 141 | 4 | 0.028 | 34 | 0.241 | 38 | 0.270 |
|  |  | Oct. 1-15 | 136 | 5 | 0.037 | 56 | 0.412 | 61 | 0.449 |
|  |  | Oct. 16-31 | 79 | 1 | 0.013 | 27 | 0.342 | 28 | 0.354 |
|  |  | Oct. 1-31 | 215 | 6 | 0.028 | 83 | 0.386 | 89 | 0.414 |
|  | Sub-Total |  | 356 | 10 | 0.028 | 117 | 0.329 | 127 | 0.357 |
|  | Total Season |  | 605 | 23 | 0.038 | 138 | 0.228 | 161 | 0.266 |
| 1995 |  |  |  |  |  |  |  |  |  |
|  | Summer | June | 56 | 1 | 0.018 | 6 | 0.107 | 7 | 0.125 |
|  |  | July | 90 | 2 | 0.022 | 12 | 0.133 | 14 | 0.156 |
|  |  | August | 71 | 3 | 0.042 | 8 | 0.113 | 11 | 0.155 |
|  | Sub-Total |  | 217 | 6 | 0.028 | 26 | 0.120 | 32 | 0.147 |
|  | Fall | September | 150 | 4 | 0.027 | 23 | 0.153 | 27 | 0.180 |
|  |  | Oct. 1-15 | 129 | 8 | 0.062 | 26 | 0.202 | 34 | 0.264 |
|  |  | Oct. 16-31 | 98 | 1 | 0.010 | 19 | 0.194 | 20 | 0.204 |
|  |  | Oct. 1-31 | 227 | 9 | 0.040 | 45 | 0.198 | 54 | 0.238 |
|  | Sub-Total |  | 377 | 13 | 0.034 | 68 | 0.180 | 81 | 0.215 |
|  | Total Season |  | 594 | 19 | 0.032 | 94 | 0.158 | 113 | 0.190 |
| 1996 |  |  |  |  |  |  |  |  |  |
|  | Summer | June | 94 | 5 | 0.053 | 15 | 0.160 | 20 | 0.213 |
|  |  | July | 225 | 62 | 0.276 | 41 | 0.182 | 103 | 0.458 |
|  |  | August | 214 | 49 | 0.229 | 43 | 0.201 | 92 | 0.430 |
|  | Sub-Total |  | 533 | 116 | 0.218 | 99 | 0.186 | 215 | 0.403 |
|  | Fall | September | 319 | 62 | 0.194 | 82 | 0.257 | 144 | 0.451 |
|  |  | Oct. 1-15 | 339 | 34 | 0.100 | 107 | 0.316 | 141 | 0.416 |
|  |  | Oct. 16-31 | 155 | 8 | 0.052 | 34 | 0.219 | 42 | 0.271 |
|  |  | Oct. 1-31 | 494 | 42 | 0.085 | 141 | 0.285 | 183 | 0.370 |
|  | Sub-Total |  | 813 | 104 | 0.128 | 223 | 0.274 | 327 | 0.402 |
|  | Total Season |  | 1346 | 220 | 0.163 | 322 | 0.239 | 542 | 0.403 |

Appendix V. Summary of effort, catch and CPUE from logbook anglers on Margaree River, 1991 to 1999.

| Year | Season | Month | Angler Days | Small |  | Large |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Catch | CPUE | Catch | CPUE | Catch | CPUE |
| 1997 |  |  |  |  |  |  |  |  |  |
|  | Summer | June | 130 | 1 | 0.008 | 22 | 0.169 | 23 | 0.177 |
|  |  | July | 164 | 8 | 0.049 | 18 | 0.110 | 26 | 0.159 |
|  |  | August | 190 | 9 | 0.047 | 18 | 0.095 | 27 | 0.142 |
|  | Sub-Total |  | 484 | 18 | 0.037 | 58 | 0.120 | 76 | 0.157 |
|  | Fall | September | 318 | 11 | 0.035 | 141 | 0.443 | 152 | 0.478 |
|  |  | Oct. 1-15 | 240 | 2 | 0.008 | 87 | 0.363 | 89 | 0.371 |
|  |  | Oct. 16-31 | 115 | 1 | 0.009 | 31 | 0.270 | 32 | 0.278 |
|  |  | Oct. 1-31 | 355 | 3 | 0.008 | 118 | 0.332 | 121 | 0.341 |
|  | Sub-Total |  | 673 | 14 | 0.021 | 259 | 0.385 | 273 | 0.406 |
|  | Total Season |  | 1157 | 32 | 0.028 | 317 | 0.274 | 349 | 0.302 |

1998

| Summer | June | 117 | 0 | 0.000 | 5 | 0.043 | 5 | 0.043 |
| :--- | :--- | :--- | ---: | :--- | ---: | :--- | ---: | :--- |
|  | July | 198 | 14 | 0.071 | 27 | 0.136 | 41 | 0.207 |
|  | August | 117 | 11 | 0.094 | 8 | 0.068 | 19 | 0.162 |
| Sub-Total |  | 432 | 25 | 0.058 | 40 | 0.093 | 65 | 0.150 |
|  |  |  |  |  |  |  |  |  |
| Fall | September | 247 | 14 | 0.057 | 47 | 0.190 | 61 | 0.247 |
|  | Oct. 1-15 | 200 | 5 | 0.025 | 36 | 0.180 | 41 | 0.205 |
|  | Oct. 16-31 | 121 | 1 | 0.008 | 28 | 0.231 | 29 | 0.240 |
|  | Oct. 1-31 | 321 | 6 | 0.019 | 64 | 0.199 | 70 | 0.218 |
| Sub-Total | 568 | 20 | 0.035 | 111 | 0.195 | 131 | 0.231 |  |
|  |  |  |  |  |  |  |  |  |
| Total Season | 1000 | 45 | 0.045 | 151 | 0.151 | 196 | 0.196 |  |

1999

| Summer | June | 33 | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 |
| :--- | :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
|  | July | 135 | 11 | 0.081 | 3 | 0.022 | 14 | 0.104 |
|  | August | 131 | 8 | 0.061 | 7 | 0.053 | 15 | 0.115 |
| Sub-Total |  | 299 | 19 | 0.064 | 10 | 0.033 | 29 | 0.097 |
|  |  |  |  |  |  |  |  |  |
| Fall | September | 177 | 9 | 0.051 | 23 | 0.130 | 32 | 0.181 |
|  | Oct. 1-15 | 182 | 1 | 0.005 | 20 | 0.110 | 21 | 0.115 |
|  | Oct. 16-31 | 94 | 2 | 0.021 | 9 | 0.096 | 11 | 0.117 |
|  | Oct. 1-31 | 276 | 3 | 0.011 | 29 | 0.105 | 32 | 0.116 |
| Sub-Total | 453 | 12 | 0.026 | 52 | 0.115 | 64 | 0.141 |  |
|  |  |  |  |  |  |  |  |  |
| Total Season | 752 | 31 | 0.041 | 62 | 0.082 | 93 | 0.124 |  |

