STATUS OF ATLANTIC SALMON IN SALMON FISHING AREAS (SFAs) 19-21 and 23

Context

Atlantic salmon populations of the Maritimes Region have experienced two or more decades of decline. Atlantic salmon commercial fisheries were closed by 1985. In-river closures of recreational fisheries began in 1990 in the inner Bay of Fundy and expanded to all outer Bay (SFA 23) and many eastern and southern shore rivers (SFAs 20 and 21) by 1998. In addition, Aboriginal communities have either reduced or curtailed their fishing activity. Many populations are extirpated, and inner Bay of Fundy salmon (SFA 22 and a portion of 23) are listed as endangered under the Species at Risk Act. As part of a broader assessment of Atlantic salmon in Canada, the status of the outer Bay of Fundy (western part of SFA 23), Nova Scotia Southern Upland (SFAs 20 and 21) and eastern Cape Breton populations (SFA 19) is being reviewed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). In support of COSEWIC's assessment, DFO held a meeting from Feb. 9 to Feb. 13, 2009 to review their information about all Atlantic salmon populations in Canada. Information pertaining to the status of populations in SFAs 19-21 and 23 was presented in three research documents which were reviewed at the meeting; the results of which are summarized here. Previous to this document, the most recent assessment report for Atlantic salmon in SFAs 19-21 and 23 updated their status to 2008 (DFO 2008).

Science advice on the status of salmon in SFAs 19-21 and 23 was requested by Fisheries and Aquaculture Management (FAM) on 4 April 2009. This advice is required in advance of the 2009 advisory committee meetings. These are the formal consultative forums at which DFO solicits input from stakeholders prior to developing the 2009 recreational salmon fishing plan. Given constraints in timing as well as the review of status at the aforementioned meeting, it was decided to provide this status report through the Science Special Response Process. A meeting was held by DFO Maritimes Science (April 16, 2009) to review the information in this document. This Science Response report is a product of that meeting.

Evaluation of the status of Atlantic salmon in the Maritime Provinces is based on a comparison of the abundance of salmon relative to a reference point known as the conservation spawner requirement (CSR). The CSR is generally a river-specific estimate of the number of salmon required to produce an egg deposition of 2.4 eggs/m^2 of fluvial habitat. The CSR was originally adopted by the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) as the level below which CAFSAC would strongly advise that no fishing should occur. CAFSAC considered that this level provided a modest margin of safety but that the possibility of irreversible damage to the stock increased the further spawning escapement was, and the longer it remained, below the CSR, even at levels only slightly below (CAFSAC 1991).

Analyses and Responses

Eastern Cape Breton (SFA 19)

Salmon population monitoring in eastern Cape Breton is focused on five major river systems: **Middle, Baddeck, North, Grand and Clyburn** (Appendix 1). Of these, the Grand River has the lowest mean stream gradient, and its seasonal water flow and temperature are influenced by mid-reach lakes. The remaining four rivers originate in the Cape Breton Highlands and are characterized by steeper stream gradients as well as relatively good water quality. Over 80% of the annual recreational fishing effort in eastern Cape Breton takes place on the Baddeck, North and Middle rivers.

Assessments of salmon by the Department of Fisheries and Oceans (DFO) in Salmon Fishing Area 19 (SFA 19) are based on recreational catches, which are reported through a license-stub return program, as well as fishery-independent counts of adult salmon by diver surveys in Middle, Baddeck and North rivers. Parks Canada monitors adult abundance on the Clyburn River using similar diver surveys. Recreational catch data from 2008 was used to assess abundance in smaller rivers, and juvenile electrofishing time series were updated to include data collected during 2007.

Prior to 1998, recreational fishing was open from June 1st to October 31st in eastern Cape Breton. Since 1998, the season has been shortened with the implementation of a mid-season warm water closure (July 16th – August 31st, Appendix 2). All rivers within SFA 19, with the exception of Indian Brook and the North River above the Benches, were open to catch-and-release angling in 2008 (Appendix 2).

Status

Data available for assessing the status of salmon in **Middle River** include annual recreational catch estimates from license stub returns and counts of adult salmon made during dive surveys, as well as intermittent electrofishing data. The conservation requirement for Middle River is 2.07 million eggs, calculated based on an estimated 864,600 m^2 of habitat and a target egg deposition density of 2.4 eggs/m^2. This egg deposition is expected from about 470 large and 80 small salmon.

Data from the recreational fishery was collected from salmon license stub returns for the years 1983 to 2008, with large salmon (63 cm or larger) and small salmon (less than 63 cm) being recorded separately. The data include the number of salmon caught and released, the number harvested and fishing effort in each year. Effort is estimated in rod days where any portion of a day fished by one angler is recorded as one rod day. Values are adjusted for non-returned stubs using a relationship based on the reported catch as a function of the number of reminder letters sent to licensed anglers. The preliminary (Feb. 1/09 database query) estimates of the recreational catch in 2008 were 30 small and 51 large salmon and an estimated effort of 331 rod days. These values are lower than in 2007.

The numbers of large and small salmon counted during dive surveys in Middle River from 1994 to 2008 provide indices of spawning escapement for this population. These surveys typically take place during the last week of October, just prior to the end of the fishing season. During the dive survey in 2008, 83 small and 134 large salmon were counted, values that were higher than in 2007.

An abundance time series for Atlantic salmon in Middle River was derived using a model that combines the recreational catch, dive survey and electrofishing data to estimate abundance using maximum likelihood. This differs from previous assessments in which separate abundance time series were derived from the recreational catch and diver counts. The resulting time series (Figure 1) shows an increasing trend until 1996, followed by a slight decrease to present. During the 1984 to 1988 time period, spawning escapement averaged 259 fish. From 1994 to 1998 it averaged 399 fish and from 2004 to 2008 it averaged 317 fish. The 5-year mean population size has likely decreased during the last 10 years, but increased over 15 and 20 year time periods. Estimates of the percent of the CSR met annually (Figure 1) show a similar pattern with very little chance that the population has met its conservation requirement at any time since 1983. An assumption of a 4% catch-and-release mortality is used in the assessment model. Based on the preliminary estimated recreational catch, the number of mortalities resulting from the recreational fishery is estimated to be 3 to 4 salmon. Overall, the analyses indicate a stable or slightly declining abundance trend with the population presently in the range of 30% to 40% of its conservation requirement.

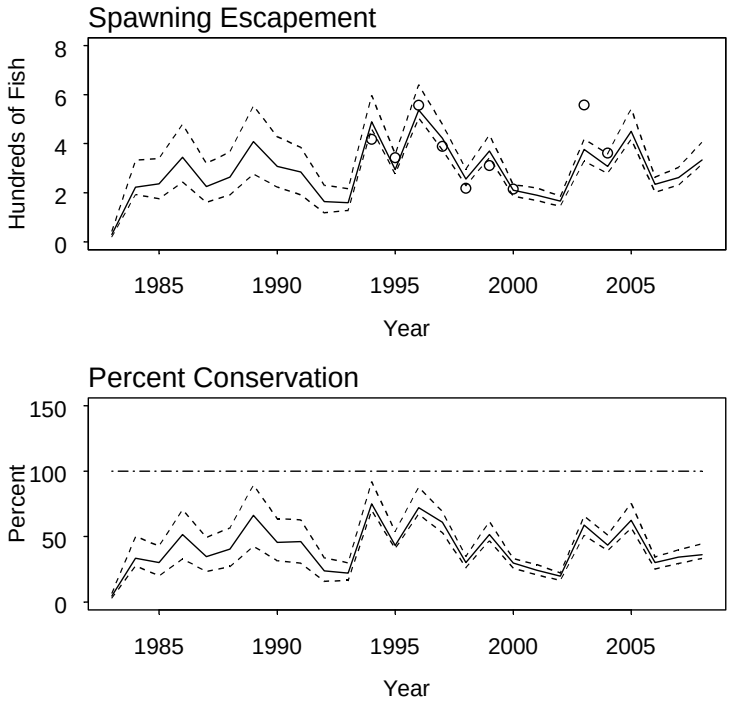

Figure 1. Estimated total number of spawners (top panel) and the percent of the conservation requirement attained (bottom panel) in Middle River, NS, from 1983 to 2008. The solid lines are the estimated values and the dashed lines are the 10th and 90th percentiles of the posterior probability densities for the estimates (indicative of the uncertainty of the estimates). The points in the upper panel are the population estimates obtained by mark recapture during the dive surveys. The horizontal dashed line in the bottom panel indicates 100% of the conservation requirement.

The assessment methods and data available for Atlantic salmon in **Baddeck River** are similar to those for Middle River. The conservation requirement for the Baddeck River is 2.0 million eggs, calculated based on an estimated 836,300 m^2 of habitat and a target egg deposition density of 2.4 eggs/m^2. This egg deposition is expected from about 450 large and 80 small salmon.

In 2008, the preliminary (Feb. 1/09 database query) estimate of the recreational catch was 21 small salmon and 35 large salmon with an estimated effort of 256 rod days. The catch of large salmon was slightly more than half that of 2007, whereas the catch of small salmon increased

by just over 30%. During the dive survey in 2008, 63 small salmon and 74 large salmon were counted; increases of just over 100% for small salmon and about 10% for large salmon.

Annual estimates of salmon escapement after the recreational fishery (Figure 2) show an increasing trend until 1996, followed by a slight decrease. During the 1984 to 1988 time period, spawning escapement averaged 192 fish, while from 1994 to 1998 it averaged 255 fish, and from 2004 to 2008 it averaged 189 fish. The 5-year mean population size has decreased during the last 10 years, but has been relatively stable over 15-year and 20-year time periods. Estimates of the percent of the CSR met annually (Figure 2) show a similar pattern with very little chance that the population has met its conservation requirement since 1983, and has been less than 25% for the last three years. Based on the preliminary estimated recreational catch, the number of mortalities as a result of the recreational fishery in the Baddeck River is estimated to be 2 salmon. Overall, the analyses indicate a stable or slightly increasing abundance trend with the population in the range of 20% to 25% of its conservation requirement.

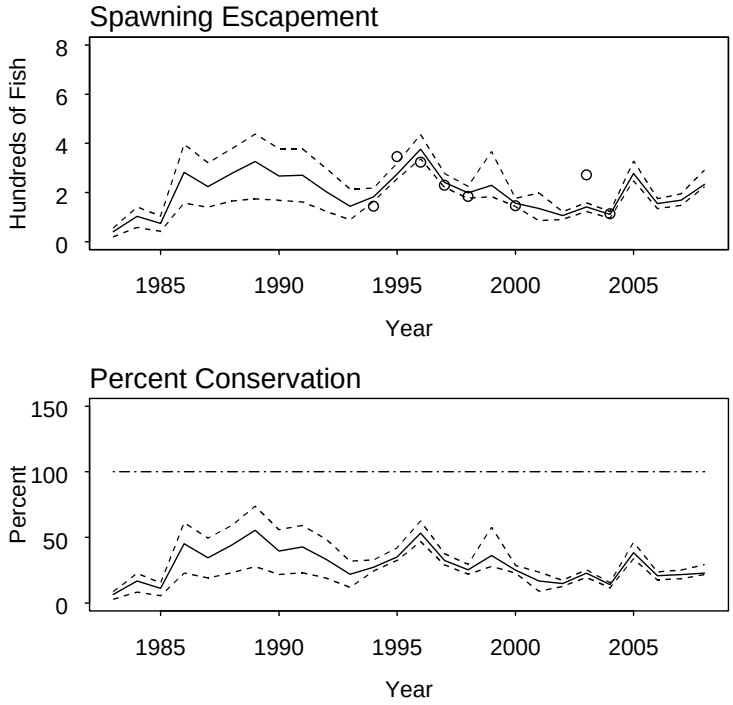

Figure 2. Estimated total number of spawners (top panel) and the percent of the conservation requirement attained (bottom panel) in Baddeck River, NS, from 1983 to 2008. The solid lines are the estimated values and the dashed lines are the 10th and 90th percentiles of the posterior probability densities for the estimates (indicative of the uncertainty of the estimates). The points in the upper panel are the population estimates obtained by mark recapture during the dive surveys. The horizontal dashed line in the bottom panel indicates 100% of the conservation requirement.

Similar to the Middle and Baddeck rivers, recreational catch estimates from license stub returns and counts of adult salmon made while snorkelling are available for assessing the status of salmon in **North River**. The conservation requirement for the North River is based on an estimated 382,700 m^2 of habitat and a target egg deposition rate of 2.4 eggs/m^2. The requirement of 0.85 million eggs is expected from about 200 large and 30 small salmon.

In 2008, the preliminary (Feb. 1/09 database query) estimate of the recreational catch was 98 small salmon and 148 large salmon with an estimated effort of 445 rod days. Catches of both

small and large salmon were about 10% higher than in 2007. A dive survey was not conducted in 2008 on North River due to high flow conditions.

Returns to North River in 2008 were estimated using the preliminary recreational catch data and mean catch rates (fish per rod day) for this river. Based on these rates (0.41 for large and 0.69 for small salmon), the estimated returns are 404 large and 153 small salmon. Based on the preliminary estimated recreational catch, the number of mortalities as a result of the recreational fishery in North River (4% mortality rate assumed) is estimated to be 9 to 10 salmon. This population has shown a declining trend since the 1980's, but based on the recreational catch, appears to be above its conservation requirement at present (Figure 3).

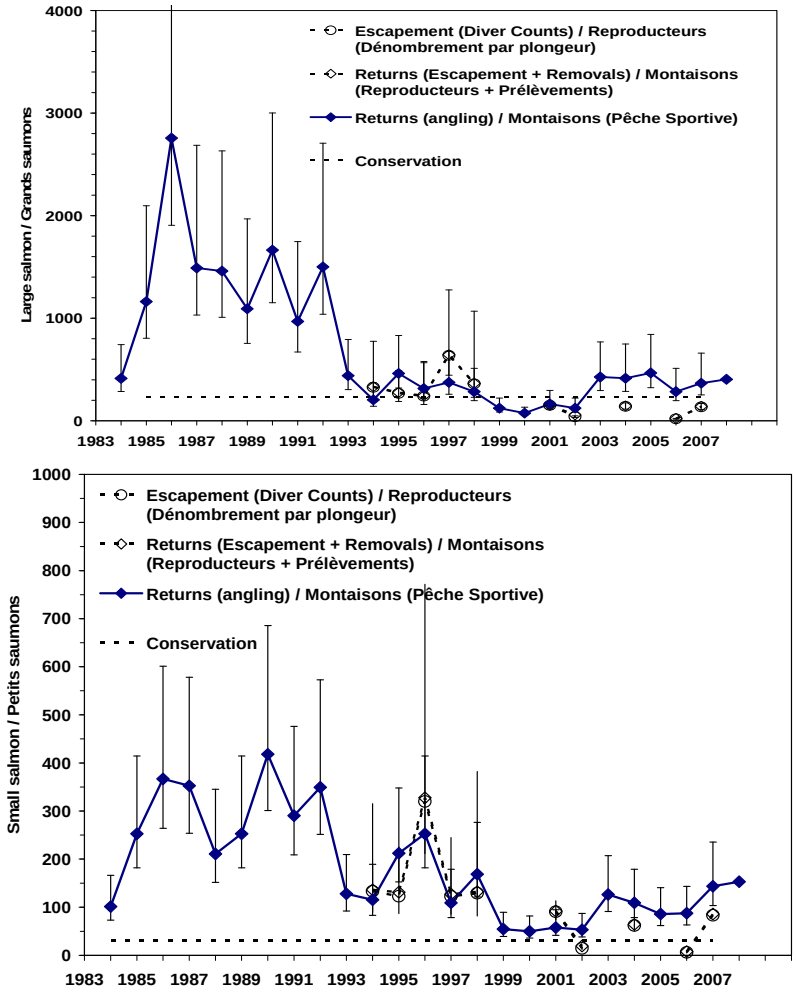

Figure 3. Estimates of the number of salmon returning to spawn and the spawning escapement for large and small salmon in the North River, NS, as derived from diver counts and from recreational catch data. The expected number of large or small salmon necessary to meet the conservation requirement is shown by the horizontal dashed line. Error bars are 90% confidence intervals.

Salmon status on the **Grand River** is assessed using recreational catch data from 1983 to 2008, at an assumed catch rate of 0.5. The conservation requirement upstream of the fishway is 475,000 eggs, which is expected from about 234 salmon (large and small combined).

The preliminary (Feb. 1/09 database query) estimate of the recreational catch in 2008 was five small and zero large salmon, giving an estimate of total returns of 10 small salmon (Figure 4).

This value is low relative to past abundance, yet may be underestimated given that it is based on an extremely low sample size (three anglers fishing for an estimated seven rod days). However, the population does appear to be well below its conservation spawner requirement. There are anecdotal reports of more salmon in the river than are estimated here (e.g. of about 30 salmon in a pool downstream of the fish ladder), but these values are also low relative to past abundance. The number of salmon mortalities in this river as a result of recreational fishing in 2008 is estimated to be less than one.

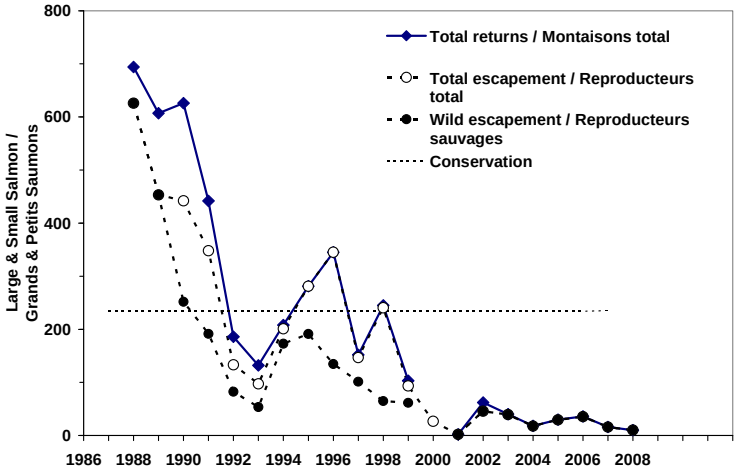

Figure 4. Total returns and escapement to the Grand River, NS, for large and small salmon combined, as derived from recreational catch data.

Clyburn Brook is found on the eastern side of Cape Breton Highlands National Park near Ingonish and runs over a length of 19.4 km. Parks Canada is responsible for management and has conducted annual dive surveys on this river from 1987 to 2008 where counts of large and small salmon are done at the end of the fishing season. Although the observation efficiency is not known, the time series provides a relatively consistent index of abundance for this river. Counts in this river were highest in 1987 at 175 salmon (Figure 5) and have only exceeded 20 salmon twice since 1999.

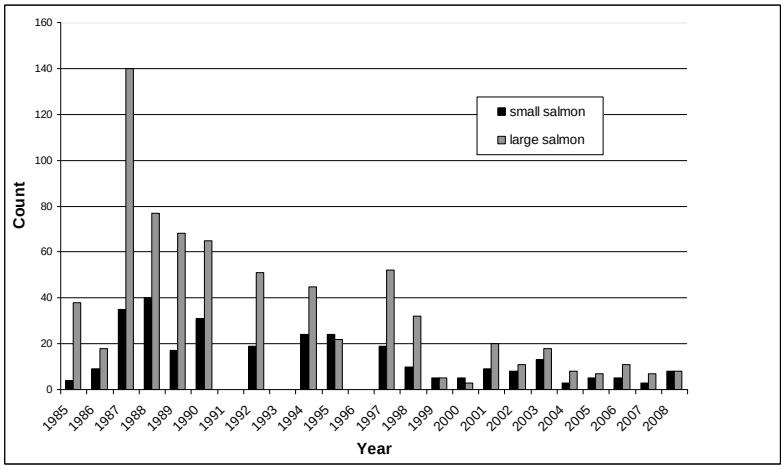

Figure 5. Counts of large and small salmon in Clyburn River, NS, from 1985 to 2008.

Abundance trends in eastern Cape Breton adult salmon populations were analyzed using a log-linear regression and a ratio model. The ratio model estimated the extent of decline by

comparing the 5-year mean population size at the beginning and end of a given time period. The total decline over a given time period from the regression model is estimated from the rate of decline (the slope of the line). The models were fit over a time period of 15 years, corresponding roughly to 3 generations. Estimated rates of decline can be sensitive to the time period used. North River has declined markedly since the late 1980's, but appears to have increased during the last ten or more years (Figure 6). Grand and Clyburn show a declining trend irrespective of the time period used, and based on the regression model fits, have declined by 97% and 82% respectively during the last 15 years. Middle and Baddeck have both increased and decreased slightly over the range of available data, with declines of 31% (Middle) and 35% (Baddeck) over the last 15 years as estimated by the regression model. Confidence intervals on the rates of decline are large for these latter two populations and the data do not preclude the possibility that the populations may have increased in size during this time period.

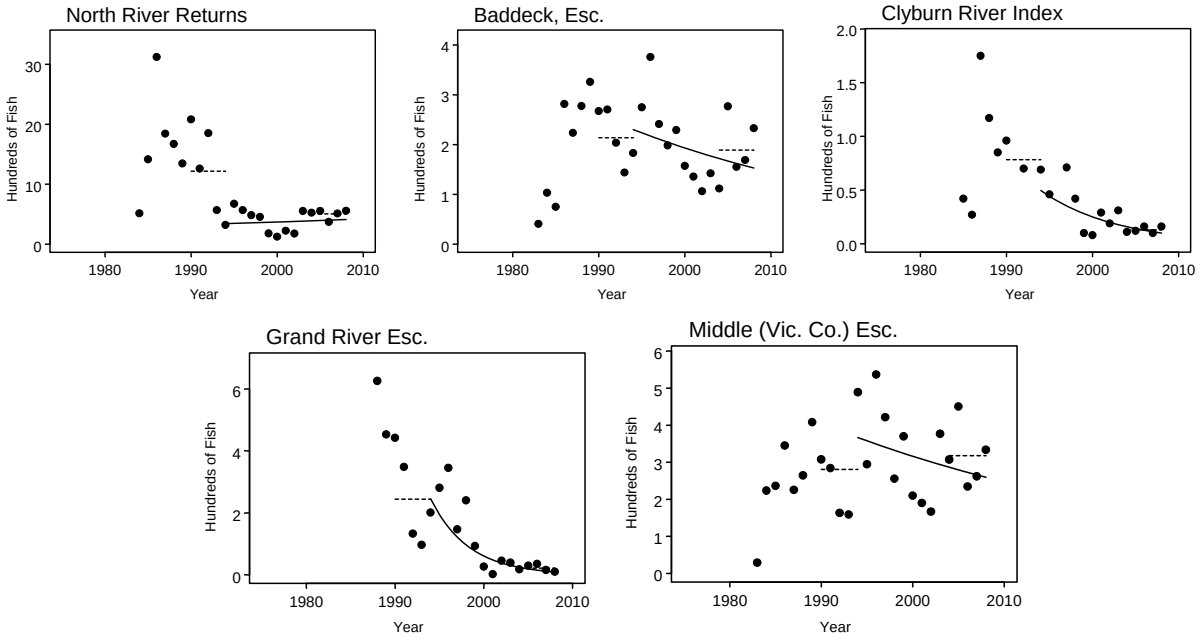

Figure 6. Trends in abundance of adult Atlantic salmon (size categories combined) in five eastern Cape Breton rivers during the last 15 years. The solid line is the predicted abundance from a log-linear model fit by least squares. The dashed lines show the ratio model, the 5-year mean abundance for 2 time periods separated by 15 years. The points are the observed data.

Comparatively little data exist for populations in **other SFA 19 rivers**, other than catch and effort data from the recreational fishery, as estimated from salmon license stub returns, for 30 rivers during the years 1983 to 2008 (Appendix 3). Although there are exceptions, recreational catches tended to be higher in the 1980's and early 1990's than at present (Figure 7). A comparison of the recreational catches for the 5-year time period ending in 1987 with the 5-year time period ending in 2007 indicates that the recreational catch has declined by more than 75% during that time in all but 4 rivers, although fishing effort in the earlier period was also higher. Of these four, one (Aconi Brook) had a very low catch throughout the time period. The other three rivers are Middle, North and Baddeck, which account for 87% of the recreational catch during the 2003 to 2007 time period. Although there are exceptions, the recreational catch typically declined prior to the fishing effort, which, when combined with the continued fishing effort on Middle, Baddeck and North rivers, is suggestive that the low reported catch is indicative of low abundance. In 2008, a preliminary (April 14/09 database query) estimate of the number of salmon caught and released in SFA 19 is 447 fish (Appendix 3). Assuming a 4% catch-and-

release mortality rate, 17 to 18 salmon are estimated to have died as a result of the recreational fishery in SFA 19 in 2008.

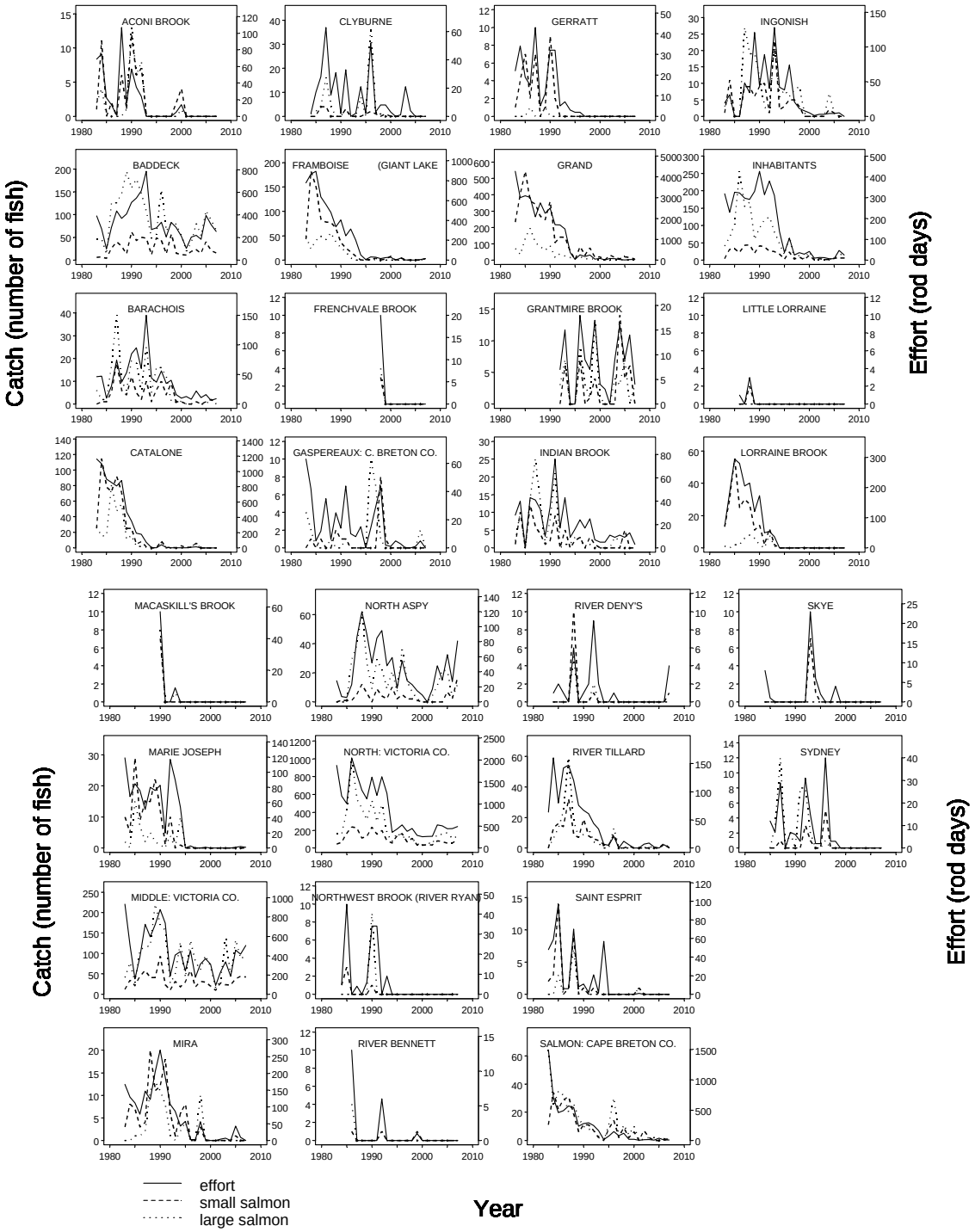

Figure 7. Estimated recreational catch of small and large Atlantic salmon and fishing effort for eastern Cape Breton rivers (SFA 19) from 1983 to 2007 based on salmon license stub returns. The scale of the Y-axes differs from river to river.

Electrofishing surveys have taken place intermittently in SFA 19 and have relatively limited spatial coverage. In 2006, 24 sites were electrofished in 9 rivers in SFA 19, while in 2007, 8

sites were fished in 6 rivers. Of these 32 sites, half of them had been sampled since 1996, while the other half were either newly developed or had last been electrofished in the 1970's and 80s. Atlantic salmon were found in all but 3 of the sites visited: two upstream of a large barrier falls on the Clyburn River and one on the Sydney River. Where salmon were found, estimated densities of fry (age 0) ranged from 148 individuals per 100 m^2 in the Middle river to 4 individuals per 100 m^2 in Black Brook. The highest age 1 parr density (110 individuals per 100 m^2) was obtained at a site on North River, but parr densities were less than 10 individuals per 100 m^2 in River Denys, Grand River, Sydney River, Mira River and Black Brook. Age 2 parr were absent from the sites sampled on River Denys, the Ingonish and Grand Rivers in 2006, and in Sydney River in 2007. No individuals older than age 2 were found in any river. In general, fry and parr densities at most sites are low relative to reference levels of 29 individuals per 100 m^2 for fry and 38 individuals per 100 m^2 for parr (age 1 and age 2 combined). However, the densities estimated for rivers in eastern Cape Breton tended to be above those observed on mainland Nova Scotia.

Southern Upland of Nova Scotia (SFAs 20 and 21)

The Southern Upland (SU) region includes all rivers on the Eastern shore and Southwest Nova Scotia draining into the Atlantic Ocean. It has been divided into two Salmon Fishing Areas (SFAs) for management purposes: SFA 20 (Eastern shore) and SFA 21 (Southwest Nova Scotia) (Appendix 1). Within the previous century, 63 rivers in the Southern Upland are known to have supported anadromous Atlantic salmon populations. Based on pH samples collected in the early 1980's, at least 14 of these rivers were heavily acidified (pH < 4.7) and were no longer able to support salmon (DFO 2000). A further 20 rivers were partially acidified (pH ranges from 4.7 to 5.0) and were thought to support only remnant populations.

Atlantic salmon assessment activities in the SU region are focused primarily on two populations: the St. Mary's River (the index population for SFA 20), and the LaHave River (the index population for SFA 21). Estimates of adult abundance, smolt run size and juvenile densities are available for these two rivers. A regional electrofishing survey was undertaken in 2008 to determine salmon presence or absence in many of the other rivers in SFA 20 and 21 in a manner similar to a survey undertaken in 2000.

The **St. Mary's River** is one of the major river systems in SFA 20 and consists of two main branches: the West and East. With the exception of electrofishing surveys, assessment activities in the St. Mary's River are focused on the West Branch of the river, which contains 55% of the juvenile habitat available in the watershed. The conservation requirement for the entire river is 7.4 million eggs, which is equivalent to approximately 3,155 adult salmon.

Escapement estimates (Table 1) for the river are based either on the recreational catches (1996 and earlier), or on adult mark-recapture experiments (1997 to 2001 and 2006 to 2008) in the West Branch. From 2002 to 2005, mark-recapture experiments were attempted but were unsuccessful, and escapement estimates in these years were derived using the mean catch rate for seining during years when the mark-recapture experiments were successful. In 2008, a total of 30 salmon were marked, 63 were captured and 4 were recaptured, giving a corrected Petersen estimate of escapement of 397 salmon (95% C.I. = 194, 1048). This estimate represents the first notable increase in escapement in 5 years, but is still only 23% of the conservation requirement for the West Branch. Based on the scale samples taken from captured fish, 91% of the population were one-sea-winter salmon, 7% were two-sea-winter salmon and 2% were repeat spawners. This latter value is quite low.

Table 1. Estimated escapement of one-sea-winter (1SW) and multi-sea-winter (MSW; including both two-sea-winter and repeat spawning salmon) Atlantic salmon relative to the conservation requirement in the West Branch of the St. Mary's River for the years 1995 to 2008.

Year	1SW	MSW	% Egg Conservation
1995	1,121	240	78
1996	844	325	67
1997	390	61	26
1998	1,059	41	63
1999	307	83	22
2000	315	25	20
2001	319	106	24
2002	220	16	14
2003	600	122	42
2004	464	23	28
2005	192	8	12
2006	222	18	14
2007	182	23	12
2008	361	36	23

In 2008, the recreational salmon fishery on the St. Mary's River was not open on the West Branch above the highway bridge on Glenelg (Appendix 2). A preliminary estimate of the number of salmon caught and released in other parts of the river is 280 fish (Appendix 3). Assuming a 4% catch-and-release mortality rate, 11 to 12 salmon (size groups combined) are estimated to have died as a result of the recreational fishery in the St. Mary's River in 2008.

Smolt abundances (2005-2008) are estimated using a mark-recapture experiment and a corrected-Petersen estimate. In 2008, a total of 485 smolts were captured, and of these 15 fish were marked, indicating that they had been captured a second time. This gives a population estimate of 15,217 (95% C.I. = 9,451, 24,154) smolts and a capture efficiency of 3.1% for the smolt wheel. These values are slightly below the 2007 estimates of 16,110 (95% C.I. = 12,735, 20,835) smolts with a capture efficiency of 5.4%.

Based on an estimated 1,692,900 m^2 of juvenile habitat contained in the West Branch of the St. Mary's River, smolt production in 2008 was estimated to be 0.90 smolts per 100 m^2. This estimate is lower than that from the previous two years but is higher than in 2005 (Table 2). Return rates for the 2005 to 2007 smolt year classes have ranged from 0.73% to 3.02% for 1SW salmon and are less than 0.15% for 2SW salmon.

Table 2. The estimated annual wild smolt production (90% C.I.) and smolt wheel efficiency on the West Branch of the St. Mary's River from 2005 to 2008. Return rates are calculated using the estimated number of returning 1SW (1 year later) and 2SW (2 years later) salmon.

Year	Wheel efficiency (%)	Abundance estimate	Production per unit area (smolts/100m^2)	Return rate (%)	
				1SW	2SW
2005	10.3**	7,350 (6,000 – 9,100)	0.43	3.02	0.14
2006	2.8	25,100 (18,700 – 40,300)	1.48	0.73	0.11
2007	5.4	16,110 (12,735 – 20,835)	0.95	2.24	
2008	3.1	15,217 (9,451 – 24,154)	0.90		

**two wheels were deployed side-by-side

Abundance of juvenile salmon in the St. Mary's River is monitored by electrofishing. Between 9 and 37 sites throughout the St. Mary's River have been electrofished most years from 1985 to present. Mean age class densities (fish per 100 m^2) were calculated based on data from 12 sites in 2008. Estimated age 0, age 1 and age 2+ densities were 6.1, 2.5 and 0.3 respectively for the entire St. Mary's River, and were relatively consistent between the two branches (Figure 8). Both fry (age 0) density and age 1 parr density were lower in 2008 than in 2007.

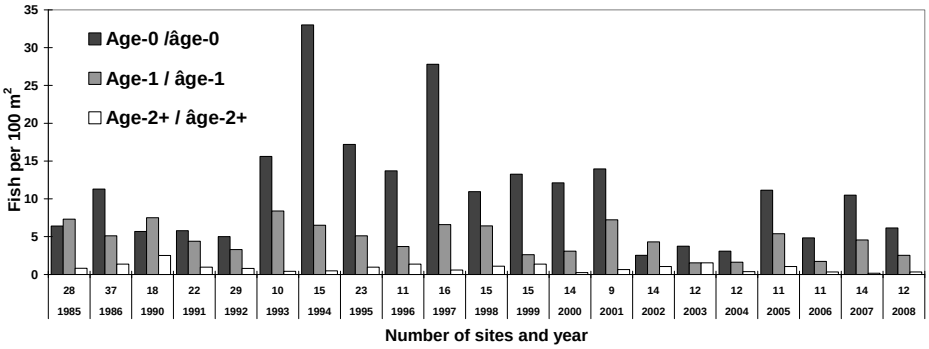

Figure 8. Mean density (fish per 100 m^2) for the three age classes of juvenile salmon (age 0, age 1, and age 2) in the St. Mary's River during 1985-1986 and 1990-2008. The number of sampling sites each year is listed immediately above the year label on the x-axis.

A life history model was used to evaluate the dynamics of salmon in the West Branch of the St. Mary's River. This model consists of two components: a freshwater production model that gives the number of smolts produced as a function of egg deposition, and an egg-per-smolt model, that gives the rate at which smolts produce eggs throughout their lives as a function of at-sea survival, fecundity and age-at-maturity. The model is used to evaluate how reproductive rates change (as a result of density dependence) as population sizes increase or decrease. The analysis indicates that the maximum lifetime reproductive rate (the number of spawners produced by a spawner throughout its life when abundance is very low such that density dependence is not reducing productivity) is 1.59 spawners, a value that is very low for any fish species. For comparison, previous research on three other salmon populations indicated a mean value of 5.1 spawners per spawner. These results indicate that the population is not able to easily recover from events that further decrease population size.

Assessment activities on the **LaHave River**, the index river for SFA 21, include counts of salmon ascending a fish ladder at Morgan Falls, estimates of smolt production upstream of Morgan Falls, and estimates of densities of juveniles for the watershed obtained by electrofishing. Presently, the conservation requirement for the LaHave River above Morgan

Falls is 1.96 million eggs, equivalent to 1,320 salmon of average characteristics. On a per unit area basis, this value is lower than that for other rivers in the Maritimes.

The total count of adult salmon at the Morgan Falls fishway on the LaHave River in 2008 was 691 fish (593 small and 98 large salmon), none of which were of hatchery origin (Figure 9). This is consistent with values for total returns observed since 1997, but represents an increase from returns in 2007. Estimated egg deposition above Morgan Falls increased to 1,078,475 eggs in 2008 or 55% of the conservation requirement (Figure 10).

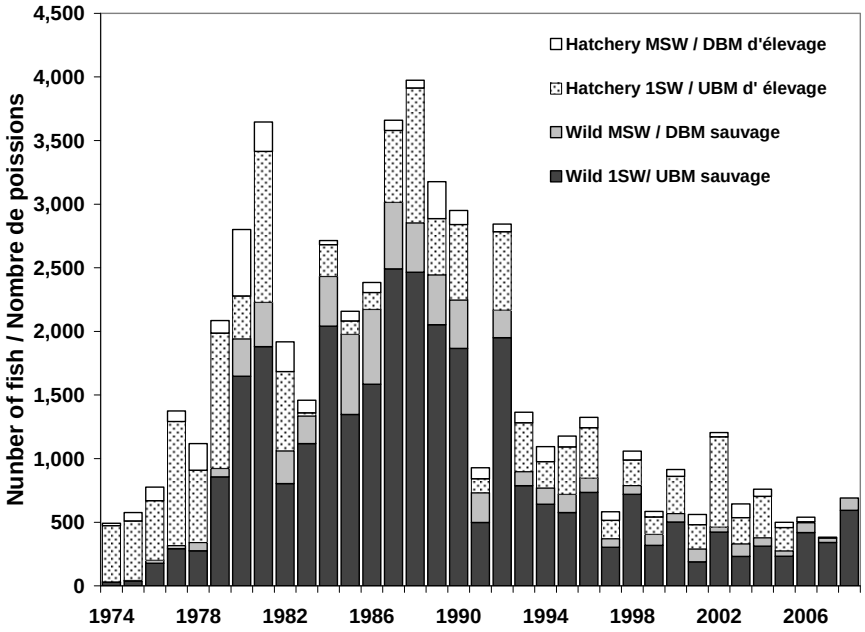

Figure 9. Counts of Atlantic salmon at Morgans Falls fishway on the LaHave River, NS, from 1974 to 2008 by wild-origin and hatchery-origin 1SW and MSW adults.

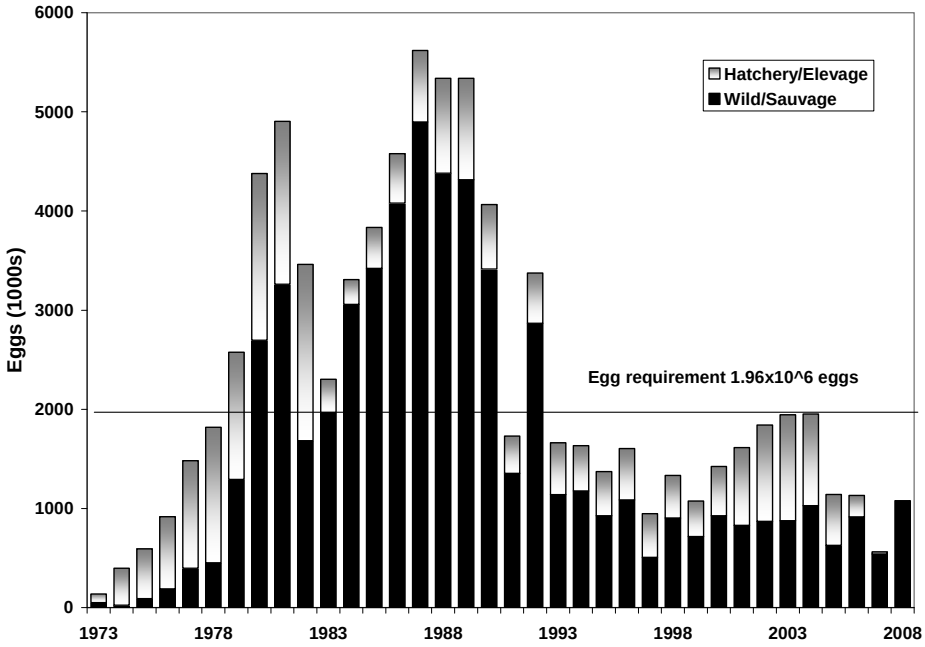

Figure 10. Estimated egg deposition (1000's) relative to the conservation requirement by wild and hatchery Atlantic salmon above Morgans Falls from 1973 to 2008. No adults of hatchery origin contributed to egg deposition in 2008.

In 2008, a preliminary (April 14/09 database query) estimate of the number of salmon caught and released in LaHave River was 36 fish (Appendix 3). Assuming a 4% catch-and-release mortality rate, 1 to 2 salmon are estimated to have died as a result of the recreational fishery in this river in 2008.

In 2008, a total of 14,450 wild smolts (90% C.I. = 13,500, 15,500) were estimated to have migrated from above Morgan Falls, a 43% decline from the 2007 value and less than the 1996-2007 mean of 16,589 (Table 3).

Table 4. The estimated production (90% C.I.) per unit area and return rates of wild smolts above Morgan Falls on the LaHave River from 1996 to 2008. Return rates are calculated using the estimated number of returning 1SW (1 year later) and 2SW (2 years later) salmon.

Year	Abundance Estimate	Production per Unit Area (smolts/100m^2)	Return Rate (%)	
			1SW	2SW
1996	20,511 (19,886 – 21,086)	0.79	1.47	0.23
1997	16,550 (16,000 – 17,100)	0.63	4.33	0.43
1998	15,600 (14,675 – 16,600)	0.60	2.04	0.34
1999	10,420 (9,760 – 11,060)	0.40	4.82	0.86
2000	16,300 (15,950 – 16,700)	0.63	1.16	0.11
2001	15,700 (15,230 – 16,070)	0.60	2.70	0.59
2002	11,860 (11,510 – 12,210)	0.46	1.95	0.45
2003	17,845 (8,821 – 26,870)	0.68	1.75	0.17
2004	21,613 (19,613 – 21,513)	0.79	1.13	0.33
2005	5,270 (4,670 – 5,920)	0.20	7.95	0.54
2006	22,971 (20,166 - 26,271)	0.88	1.48	0.40
2007	24,430 (23,000 – 28,460)	0.98	2.33	
2008	14,450 (13,500 – 15,500)	0.55		

Smolt production in 2008 was 0.55 smolts per 100 m^2, less than the long term mean (1996-2007) of 0.64 smolts per 100 m^2. This parameter indicates relatively low freshwater production of juvenile salmon in 2008. Egg-to-smolt survival was 1.3%, similar to the long term mean (1996-2007) of 1.2%.

The ratio between smolt production and subsequent adult returns provides an estimate of the return rate of smolts (indicative of at-sea survival). For the LaHave River above Morgan Falls, return rates have ranged from 1.1% to 7.9% for 1SW adults and 0.11% to 0.86% for 2SW (Table 4). The estimate of the return rate of wild smolts emigrating from above Morgan Falls in 2007 to 1SW returns in 2008 was 2.33%, less than the long-term mean of 2.8%. The estimate of the return rate of wild smolts emigrating in 2006 to 2SW returns in 2008 was 0.4%, a value identical to the long-term mean.

Population dynamics of LaHave River salmon were also analyzed using an equilibrium model. The parameter estimates obtained from the freshwater production model were sensitive as to whether data for the 2002 egg deposition year were included (this data point is an outlier). With this data point excluded, the maximum lifetime reproductive rate of salmon at the average return rates observed for this population (Table 4) is 0.94 spawners per spawner, while at the minimum and maximum observed return rates, the values are 0.39 and 2.48 spawners per spawner respectively. If the 2002 data point is included, these values increase to 2.50, 1.06 and 6.61 when calculated using the mean, minimum and maximum return rates respectively. As was the case for the St. Mary's population, these values are low for salmon populations.

Abundance trends in Southern Upland salmon populations were evaluated using data from four populations: the LaHave, St. Mary's, East River (Sheet Harbour) and Liscomb using both the log-linear model and ratio model described above (Figure 11). In all cases, the two models estimated similar decline rates and were statistically significant. During the last 10 years that

data were available, the salmon population in the Liscomb River was estimated to have declined by > 95% (Figure 11). This population originally increased in size as the result of the construction of a fish ladder providing access above a waterfall combined with a stocking program. At its peak, over 1600 wild salmon returned to this river (DFO 2000). The estimated population decline over the last 15 years for salmon in East River, Sheet Harbour is more extreme, at > 99% (Figure 11). Decline rates for the LaHave River river population above Morgan Falls are 56% for the hatchery and wild components combined (Figure 11), and 46% for the wild component alone, over the last 15 years. The St. Mary's population is estimated to have declined by > 56% (Figure 11) during the last 15 years.

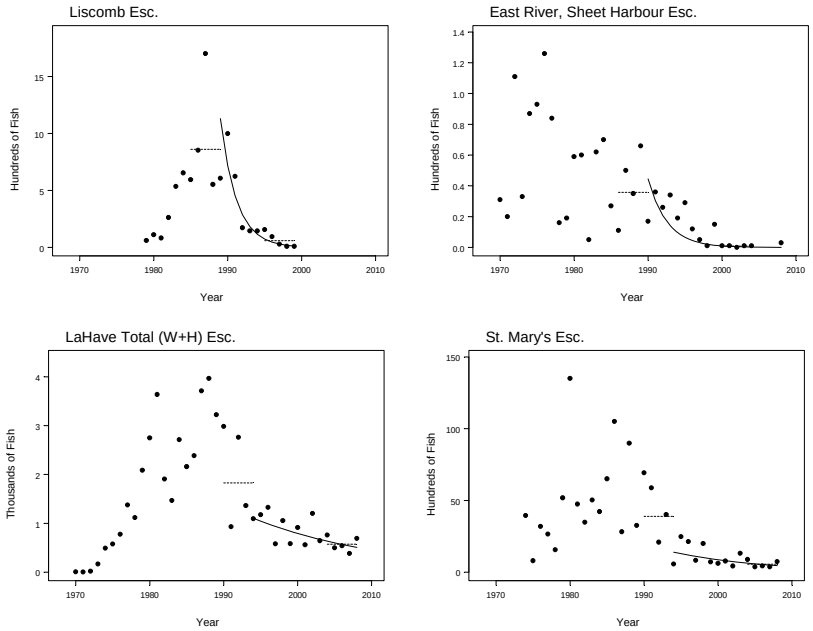

Figure 11. Trends in abundance of adult Atlantic salmon (size categories combined) in four Southern Upland rivers during the last 15 years. The solid line is the predicted abundance from a log-linear model fit by least squares. The dashed line shows the 5-year mean abundance for 2 time periods separated by 15 years. The points are the observed data.

Abundance of Atlantic salmon in **other Southern Upland rivers** is assessed using electrofishing surveys to determine the abundance of juveniles. Region-wide surveys took place in 2000 and 2008. These surveys were similar in terms of total effort and coverage, although marginally more sites were completed in 2008 (143 vs. 128), but one less river was visited (51 rather than 52). Total shocking time was slightly greater in 2008 (143,385 seconds vs. 104,331 seconds), but the total area surveyed was lower (98,019 m^2 vs. 128,841 m^2). In 2008, less than half as many fish were captured on the first pass (3,474 fish) than in 2000 (7,825 fish). Approximately one quarter as many juvenile salmon were captured in 2008 (977 salmon) than in 2000 (3,733 salmon). In 2000, juvenile Atlantic salmon were found in 54% of the rivers (28 of 52), but were only found in 39% (20 of 51) of the rivers in 2008 (Figure 12).

Overall, the mean density of age 0 juveniles declined from 5.0 to 1.9 fish per 100 m^2 between 2000 and 2008, while the mean density of age 1 and older parr decreased from 3.5 to 0.9 fish per 100 m^2. Of the sites surveyed in both years (n = 74), total juvenile density decreased in 43% (n = 32) and increased in 8% (n = 6) (Figure 13). The remainder of the sites (n = 36) had densities of zero in both years. However, any increase from the 2000 density was very small (as shown by the proximity of the points to the 1:1 line) while declines tended to be quite large. In

addition, juvenile salmon were not found at 7 sites and 2 rivers in 2008 where they had been found in 2000.

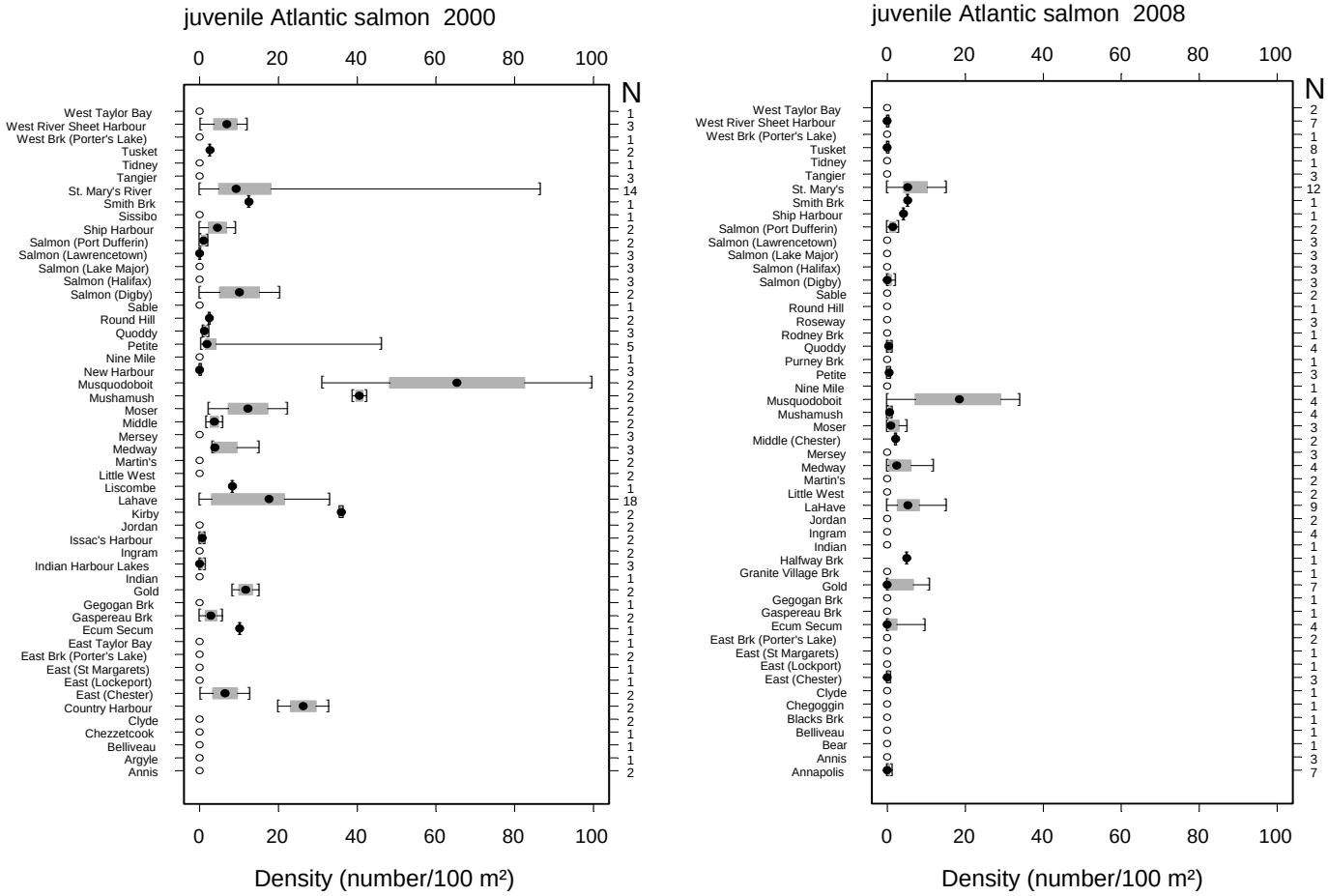

Figure 12. Box plots showing the density of Atlantic salmon in Southern Upland rivers based on electrofishing during 2000 and 2008. The dot shows the median density and the box shows the inter-quartile spread. Open dots indicate that no salmon were captured in the river. The whiskers are drawn to the minimum and maximum. "N" is the number of sites that were electrofished in each river.

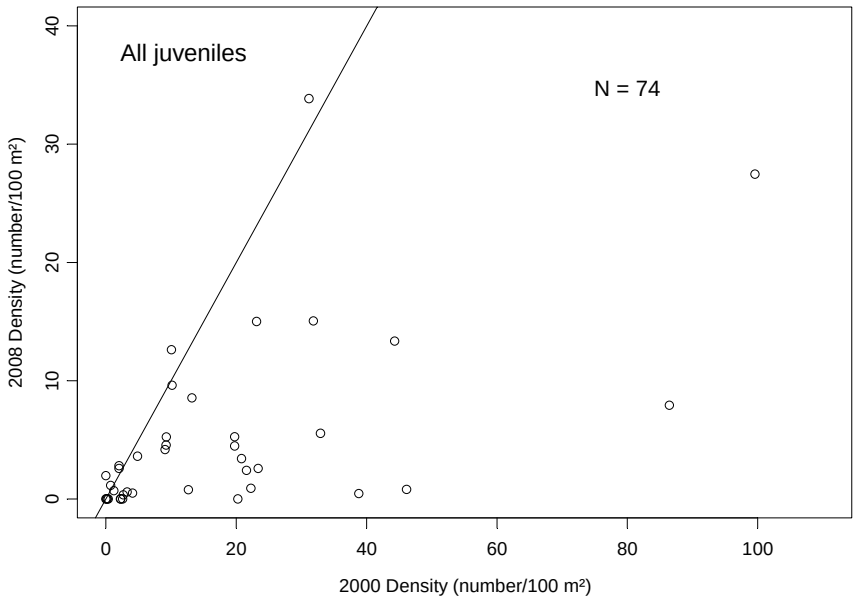

Figure 13. Comparison of densities of juvenile salmon (all age categories combined) at sites that were electrofished in 2000 and again in 2008. The line is the one-to-one line, above which densities have increased from 2000 to 2008 and below which they have decreased.

Outer Bay of Fundy (SFA 23)

The outer Bay of Fundy Rivers in SFA 23 include those between the Saint John River and its tributaries and the St. Croix River, and are bounded on the east by the "endangered" inner Bay of Fundy populations and on the west by some United States "endangered" populations. The entire SFA 23 has been closed to commercial fishing for Atlantic salmon since 1984. The continual failure of populations to achieve conservation requirements has resulted in the complete closures of the Aboriginal food and recreational fisheries since 1998. Assessment data in SFA 23 are collected for two index populations: the Saint John River upriver of Mactaquac Dam and the Nashwaak River.

Status

The conservation requirement for salmon populations **upriver of Mactaquac Dam** is based on an accessible rearing area of 13,472,200 m^2 of >0.12% and <5.0% gradient. This excludes the Aroostook River, headponds, as well as the 21 million m^2 of river with gradient <0.12% and represents about 37% of the total accessible salmon habitat (wetted area) within SFA 23. Based on an assumed requirement of 2.4 eggs/m^2, the conservation requirement is 32,330,000 eggs. The number of spawners necessary to obtain the conservation requirement are estimated to be 4,900 MSW and 4,900 1SW salmon.

Counts at Mactaquac Dam consist of fish captured at the fish collection facilities at the Mactaquac Dam and at the smolt migration channel at the Mactaquac Biodiversity Facility. During 2008, the fish collection facilities at the dam and the migration channel at the biodiversity facility were operated from May 28 to October 28.

Total 1SW (1,801) and MSW (281) returns destined for upriver of Mactaquac Dam on the Saint John River in 2008 were both well below returns observed in most years since 1970 (Figure 17). The MSW returns were the lowest on record since 1970. The 1SW returns were higher than in

2007 but were still the 7th lowest on record. Wild origin fish comprised 44% of 1SW and 51% of MSW fish.

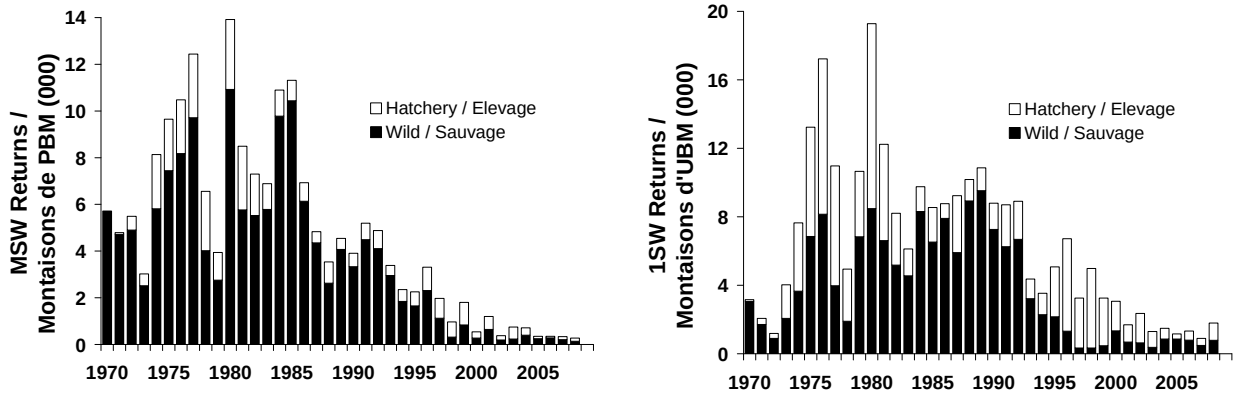

Figure 17. Estimated total returns of wild and hatchery 1SW and MSW salmon destined for upriver of Mactaquac Dam, Saint John River, 1970 - 2008.

Adjusted return rates for hatchery-reared smolts were 0.70% for 1SW salmon and 0.05% for two sea-winter (2SW) salmon, a 3-fold increase and a decrease of about 50%, respectively, from the values in 2007 (Figure 18). The return rate to 1SW from the 2007 smolts was the highest value observed in the past decade and was the second smolt class from the captive-reared adult program. The poor (3rd lowest on record) smolt-to-2SW salmon rate from the 2006 hatchery smolts was consistent with the poor smolt-to-1SW rate observed in 2007 from the same smolt class.

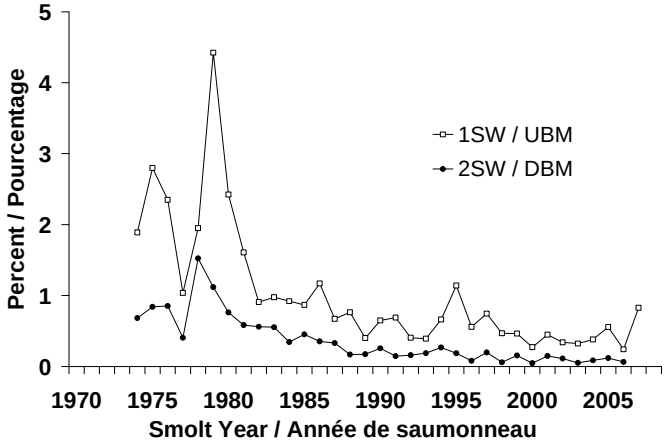

Figure 18. Return rates of hatchery-reared smolts to virgin 1SW and virgin 2SW salmon destined for upriver of Mactaquac Dam, Saint John River, by smolt year, 1974 – 2007.

Removals from the spawning escapement destined for production areas upriver of Mactaquac include: 1) the estimate of 1SW and MSW salmon ascribed to by-catch in the estuary, 2) salmon passed or trucked upriver of Tinker Dam on the Aroostook River, 3) salmon retained at Mactaquac as broodstock, and 4) salmon estimated to have been lost to poaching or handling operations at Mactaquac. Losses to poaching include salmon estimated to have been taken by illegal nets on the Tobique River, and known mortalities at fishways (Beechwood, Tobique and/or Tinker Dam) or the Tobique Half Mile Barrier (Table 5).

Table 5. Estimated removals of 1SW and MSW salmon destined for upriver of Mactaquac Dam on the Saint John River, N.B., 2008.

	Removals		Percent of Total Returns	
Component	1SW	MSW	1SW	MSW
Passed above Tinker Dam	20	5	1.1	1.8
Mortality at Beechwood	19	2	1.1	0.7
Hatchery Broodfish	21	38	1.2	13.5
Poaching Estimates	49	22	2.7	7.8
By-catch Estimates	18	7	1.0	2.5
Total	127	74	7.1	26.3

Spawners numbered 1,674 1SW and 208 MSW salmon, 34% and 4% of the respective conservation requirements. The egg deposition estimate (46% from wild fish) was 5% of the requirement, the lowest value on record (Figure 19).

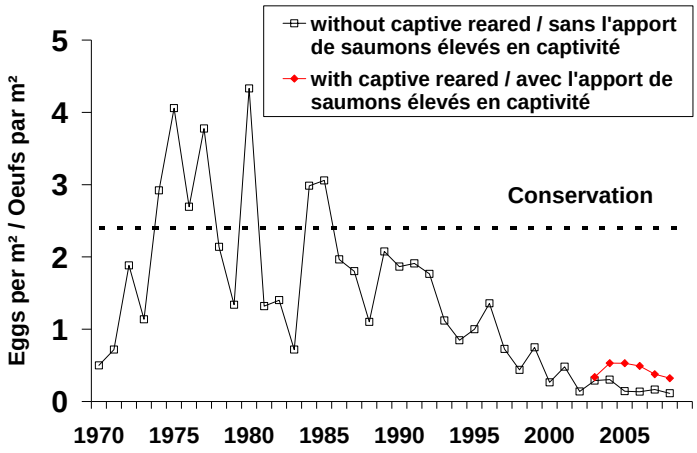

Figure 19. Estimated egg deposition upriver of Mactaquac Dam, Saint John River, 1970 - 2008.

The Mactaquac Biodiversity Facility (formerly Fish Culture Station) has been involved in the mitigation of salmon lost to hydroelectric projects on the Saint John River, primarily via smolt production. Each year, hatchery broodstock for the program has come from 200-300 wild sea-run adults. The program at the Mactaquac Biodiversity Facility has been re-focused to the singular objective of conserving and restoring a declining resource. Thus, discussion within DFO and the Saint John River Management Advisory Committee and the Saint John Basin Board resulted in a program change to replace a large portion of the traditional smolt production with production of age-0 fall parr and captive rearing to broodstock of mostly wild-origin juvenile salmon for release and natural spawning upriver of Mactaquac. This new salmon conservation program resembles the one utilized for the endangered inner Bay of Fundy salmon populations. An additional 2.8 million eggs (or 9% of the requirement) were potentially deposited from captive-reared spawners in 2008 (Figure 19).

The **Nashwaak River** is the largest single salmon-producing tributary of the Saint John River downriver of Mactaquac Dam, containing 28.5% of the total salmon production area downriver of Mactaquac Dam. A salmon counting fence 23 km upriver from the confluence with the Saint John River was operated by DFO in 1972, 1973 and 1975, and by DFO in cooperation with Aboriginal

peoples from 1993 - 2008. In 2008, the fence was jointly operated by Kingsclear and Oromocto First Nations. Salmon production area upriver of the fence is estimated to be 5.35 million m^2 (90% of the total river estimate) and the conservation requirement is 12.8 million eggs. The number of spawners necessary to obtain the conservation requirement is estimated at 2,040 MSW and 2,040 1SW salmon.

Counts of 523 1SW and 78 MSW salmon at the Nashwaak River fence, combined with seining of upriver holding pools, resulted in an estimated return of 1,237 1SW and 162 MSW salmon (Figure 20). Both 1SW and MSW returns in 2008 were higher than the previous year; the 1SW returns were 3rd highest while the MSW returns were the 5th lowest since monitoring resumed in 1993.

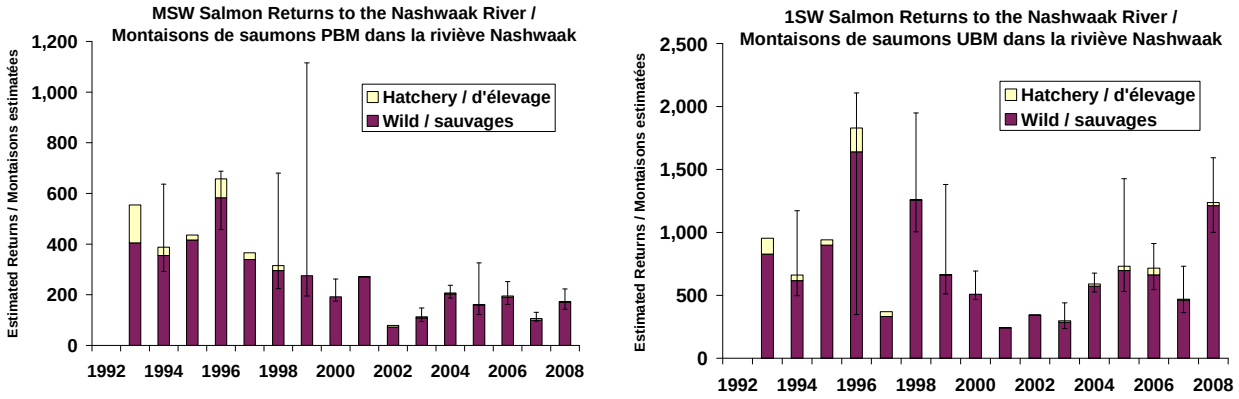

Figure 20. Estimated wild and hatchery 1SW and MSW salmon returns (and 2.5 and 97.5 percentiles) to the Nashwaak River, 1993-2008.

In 2008, 20 1SW salmon and five MSW salmon were removed from the fence trap and transported to Mactaquac Biodiversity Facility for restoration initiatives by the Nashwaak Watershed Association Inc. No salmon mortalities were observed while the counting fence was in operation in 2008. DFO fishery officers reported no illegal activities targeting salmon destined for or within the Nashwaak watershed. Therefore, no corrections were made for illegal removals. Spawners represented 60% and 8% of the respective 1SW and MSW conservation requirements. In 2008, the egg deposition estimate of 23% of the requirement was more than a two-fold increase from 2007 and the highest value observed in the past decade (Figure 21). One-sea-winter females contributed 71% of the total egg deposition. Hatchery fish contributed 2% of the total egg deposition.

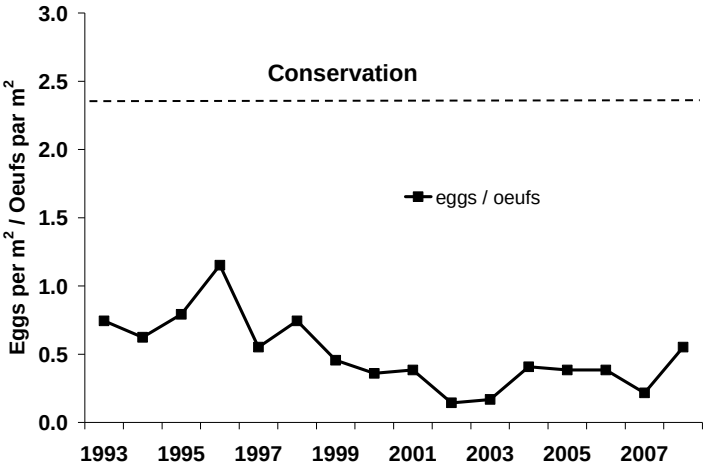

Figure 21. Estimated egg deposition upriver of the counting fence operated just below Durham Bridge, Nashwaak River, 1993 - 2008.

Wild smolt production has been monitored since 1998. The number of wild smolts emigrating from upriver of the adult counting fence in 2008 was estimated to be 7,310 (5,500 – 11,180). The total number of wild smolts decreased 67% from 2007, was only 50% of the five-year mean, and was the second lowest estimate since smolt assessment commenced in 1998 (Table 5). Smolt production in 2008 was 0.14 smolts per 100 m^2, less than the long term mean (1998-2007) of 0.31 smolts per 100 m^2. Similar to the LaHave River, these values indicate relatively low freshwater production of juvenile salmon in 2008.

The return rate of the 2007 wild smolt class as 1SW salmon in 2008 was 5.63% - the third highest return rate since wild smolt assessments were initiated in 1998 (Table 5). The return rate of the wild smolt class of 2006 as 2SW salmon in 2008 was 0.62% - the second lowest return rate observed since the 2SW returns in 2000 and only 41% of the rate from the previous year.

Table 5*. Estimates of the wild smolt production upriver of Durham Bridge, (and 2.5 and 97.5 percentiles) and smolt-to-adult return rates for the Nashwaak River, 1998 – 2008.*

Smolt	Wild Smolt Estimate				Return Rate (%)	
Year	Mode	2.5 perc	97.5 perc.	Smolts / 100 m^2	1SW	2SW
1998	22,750	17,900	32,850	0.43	2.91	0.67
1999	28,500	25,300	33,200	0.53	1.79	0.84
2000	15,800	13,400	19,700	0.30	1.53	0.28
2001	11,000	8,100	17,400	0.21	3.11	0.90
2002	15,000	12,300	19,000	0.28	1.91	1.26
2003	9,000	6,800	13,200	0.17	6.38	1.58
2004	13,600	10,060	20,800	0.25	5.13	1.28
2005	5,200	3,200	12,600	0.10	12.73	1.52
2006	25,400	21,950	30,100	0.47	1.81	0.62
2007	21,550	16,675	30,175	0.40	5.63	
2008	7,310	5,500	11,180	0.14		

Abundance trends in SFA 23 salmon populations were evaluated using data from four rivers: Saint John upriver of Mactaquac Dam, Nashwaak, Magaguadavic and St. Croix rivers using both the log-linear model and ratio model described above. Predictions from the log-linear model for all four populations indicate considerable declines in population abundance over the past 15 years (Figure 22). The estimates were 86.2% (77.6% for the wild only) for salmon upriver of Mactaquac, 97.1% for the Magaguadavic population and 95.3% for the St. Croix population for wild

and hatchery returns combined. The estimated percent decline for the Nashwaak population was lower (46.3% for the hatchery and wild components combined; 43.8% for the wild component only). Similar percent declines were estimated using the ratio model for these four populations.

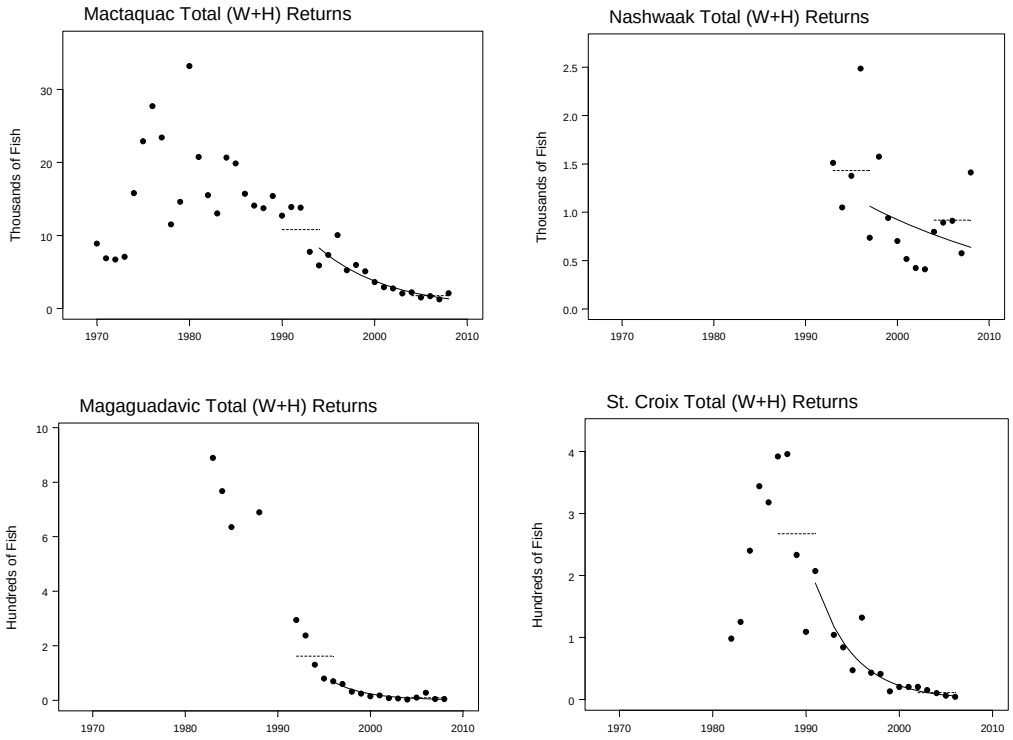

Figure 22. Trends in abundance of adult Atlantic salmon (size categories combined) in four rivers in SFA 23 during the last 15 years. The solid line is the predicted abundance from a log-linear model fit by least squares. The dashed line shows the 5-year mean abundance for 2 time periods separated by 15 years. The points are the observed data.

Sources of Uncertainty

Atlantic salmon have been stocked intermittently into many rivers throughout the region, albeit to a lesser extent in recent years. Abundance trends on rivers such as the LaHave, East (Sheet Harbour) and Liscomb are undoubtedly influenced by changes in stocking practices although its overall effect is not known.

The effect of stocking on the comparison of the 2000 and 2008 juvenile abundance (electrofishing) surveys has not been fully evaluated, although it is known that the majority of rivers included in the survey had not been recently stocked.

The number of rivers that have lost salmon populations is not known. The number of sites electrofished in some rivers during the 2000 and 2008 surveys are relatively low and failure to detect salmon in electrofishing survey does not necessarily mean that the population is lost.

The number of salmon caught and released within the region is estimated based on salmon license stub returns. There are anecdotal (but reliable) reports of salmon being caught and released by anglers fishing with a general recreational fishing license. Although the extent to which this is occurring is not known, the number of salmon caught and released each year in recreational fisheries is likely underestimated.

Conclusions

Overall, the information presented in this report does not outline a positive view of status of Atlantic salmon in the eastern Cape Breton, Southern Upland or outer Bay of Fundy regions.

In eastern Cape Breton, of the five populations for which adult abundance estimates are available, two (Grand and Clyburn) have shown marked declines over the last 15 years and a third (North) has declined significantly over the last 20 years. The other two populations (Middle and Baddeck) appear to be stable but at abundance levels well below their conservation requirements. Only one population (North) is estimated to be above its conservation requirement. Although recreational fishing effort was distributed over many rivers in the past, it has recently contracted to primarily the North, Baddeck and Middle Rivers. Given that fishing is still being reported on these rivers (with relatively unchanged effort for Middle River) and not on others is suggestive of low abundance on other rivers. However, on a more positive note, electrofishing surveys reveal a low abundance of juvenile salmon in most rivers that were sampled, adult abundance in two of the index rivers appears to be stable, and the North River population may be increasing (although this increase is not statistically significant).

The available data and analyses for Southern Upland populations indicate that some populations are presently extirpated and, despite the increase in abundance in 2008, that the healthiest populations are at low abundance levels. Total catches of Atlantic salmon in the 2008 electrofishing survey were roughly one quarter of those in 2000, and of the 38 sites that contained salmon in 2000 that were electrofished again in 2008, salmon decreased in abundance at 32 sites. The estimated abundances of juveniles in both surveys were well below reference values. On the St. Mary's and LaHave rivers, the predicted decline rates for adults during the last three generations are greater than 50% and are much higher if a longer time period is used. On other rivers, declines in adult returns (during an earlier time period) exceed 95%. Estimated maximum lifetime reproductive rates are very low in the St. Mary's and to a lesser degree in the LaHave river, and the majority of spawners are in one age class. As such, populations are thought to be at risk of extirpation.

In the outer Bay of Fundy region, populations upriver of Mactaquac Dam in the Saint John River have egg depositions that have been less than 50% of the conservation requirement for 14 of the last 15 years and less than 10% in five of the past seven years. Sixty-seven 1SW and 29 MSW salmon were estimated as losses to poaching and by-catch. These losses represented 3.7 and 10.3% of the total 1SW and MSW returns in 2008. Supportive rearing is necessary to maintain these populations given current low marine survival, fish passage mortality and (potential) issues with habitat productivity. Downstream of the Mactaquac Dam, the Nashwaak River population attained 23% of the conservation requirement in 2008 which was the highest escapement in the past decade, but total egg depositions have been less than 25% of the conservation requirement for the past 10 years. Although the recent increase is a positive sign, the prospects for attaining the conservation requirement in 2009 and for several subsequent years are low, based on the expected low MSW returns and low smolt production in 2008. Unlike 1SW fish returning to Mactaquac Dam which have a low component of female 1SW salmon, the Nashwaak River 1SW salmon average about 40% female. These females contributed almost three-quarters of the total egg deposition to the Nashwaak River in 2008. As in the past decade, this component of the population will be extremely valuable in future years with the anticipated low number of MSW returns. Their ongoing protection is important for population recovery in this watershed. Populations southwest of the Saint John River, i.e. Magaguadavic and St. Croix, are expected to remain at low abundance.

Other Considerations

Despite substantial reductions in fisheries from the 1980s to present, salmon populations in the Maritimes Region continue to decline or remain low. Low survival in the marine environment is known to be impacting salmon populations throughout the region, although its influence differs among SFAs. Population stressors have cumulative impacts and factors operating in the marine environment do not act in isolation from those acting in fresh water.

In contrast with the inner Bay of Fundy, marine survival rates in the rest of the region (SFAs 19 - 21 and part of 23) appear high enough that actions focused on improving habitat quality in fresh water are expected to enhance population viability, albeit without increasing population size to levels above conservation requirements. Examples of activities expected to improve freshwater productivity include: improved fish passage at dams and culverts; landscape-level approaches to reducing the impact of forestry, farming, urbanization, and industrial activities; restoration of natural flow regimes and channels; instream and riparian restoration; and improved land-use practices. Although these kinds of activities are expected to enhance population viability, an increase in at-sea survival is necessary to increase abundances to levels above the conservation requirements. However, for populations in which freshwater productivity is low, due to either acidification, hydro development or other factors, the low freshwater productivity has the potential to limit population recovery even if marine survival improves.

Within eastern Cape Breton (SFA 19), available data are not sufficient to identify the life stages that are limiting population growth or where mortality is occurring, and for this reason the relative tradeoffs between freshwater productivity and marine survival are unknown. As such, the extent to which actions focused on freshwater habitat can aid in the rebuilding of populations cannot presently be evaluated for this SFA. However, within this area, some populations appear stable, while others are in decline. In addition to their status relative to the conservation requirement, the importance of river-specific populations to the overall rebuilding of salmon populations in the area is a key consideration when making decisions about recreational and aboriginal fisheries, as well as other activities that will increase mortality of salmon.

Within the Southern Upland area (SFAs 20 and 21), acidification (DFO 2000) and limited fish passage in some rivers are impacting salmon in this area. The effect of acidification in many rivers is considered great enough that there is little expectation that salmon populations can rebuild even if marine survival improves. Addressing these threats is expected to enhance population viability (at low population size) at current marine survival rates and to reduce recovery times if marine survival improves. Given the depressed status of salmon populations in this area, the remaining larger populations (e.g., St. Mary's, LaHave, and Musquodoboit) are expected to have an important role in the recovery of populations in other rivers in the area.

Within the outer Bay of Fundy (SFA 23), populations in the Saint John River upriver of Mactaquac Dam require supportive rearing to prevent extirpation. Actions that increase survival from smolt to spawning are expected to increase viability and reduce recovery times once conditions are favourable for recovery. These include: reducing the poaching that is occurring throughout the system, in particular near the Tobique Narrows Dam, and increasing smolt survival by reducing turbine mortalities at each of the hydroelectric facilities affecting the upriver populations (Carr 2001, Jones and Flanagan 2007). These actions are expected to help maintain the genetic integrity of the populations by reducing the number of captive-reared salmon necessary to contribute to egg deposition.

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Approved by

Mike Sinclair Regional Director, Science
Date Approved: 26 May 2009

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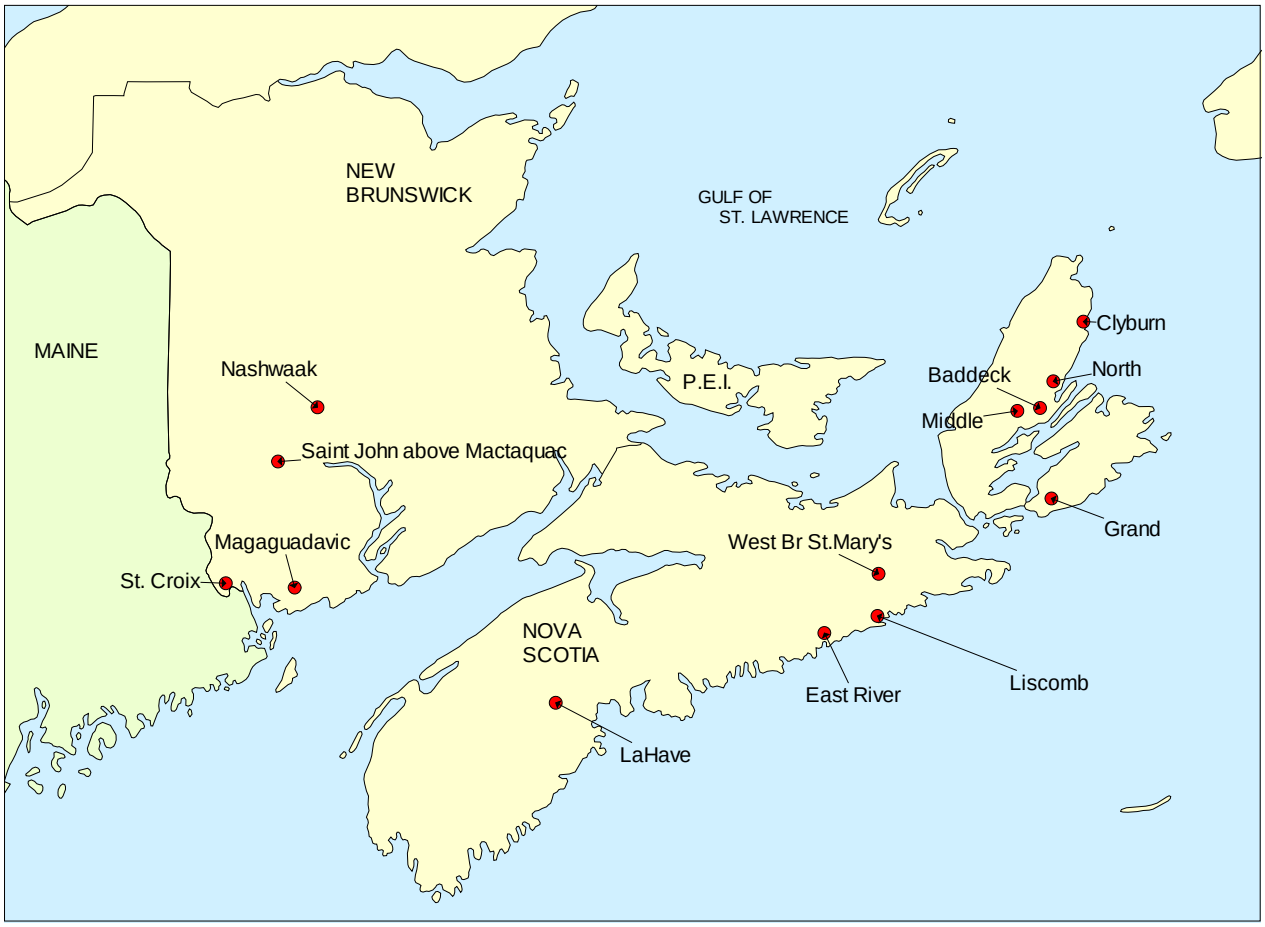
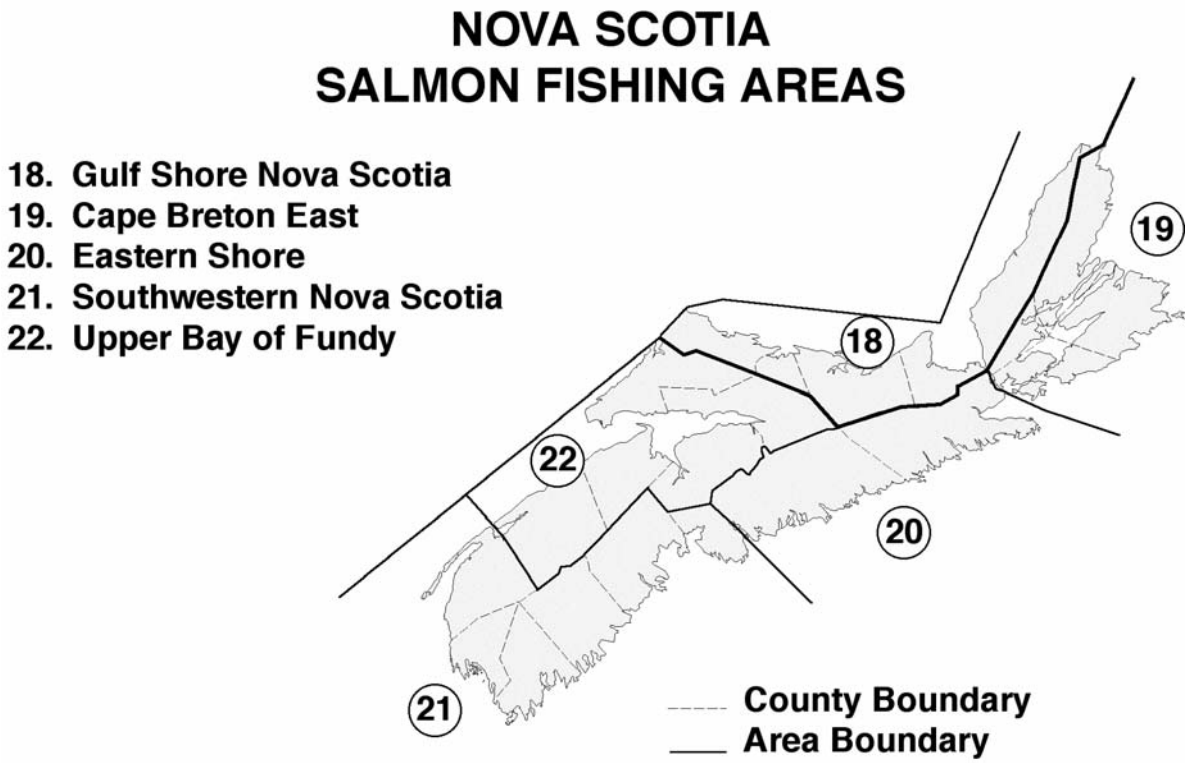
Appendices

Appendix 1. Map showing the locations of Atlantic salmon rivers for which abundance time series are presented in this response.



Appendix 2: Fisheries and Oceans Canada Notice 2008 Salmon Angling Seasons for Nova Scotia.

The Regional Director-General, Maritimes Region, Department of Fisheries and Oceans wishes to advise the public of the following changes to seasons and bag limits for Atlantic salmon in Nova Scotia.



1 (a) **SALMON FISHING AREA 18 (Gulf Shore of Nova Scotia)** and all waters of the Province flowing into that Area, except the waters referred to in paragraphs (b) to (j) ..... Sept. 1 to Oct. 31
(b) East River, Pictou County ..... Sept. 1 to Oct. 31
(c) West River, Pictou County ..... Sept. 1 to Oct. 31
(d) River Phillip ..... Sept. 1 to Oct. 31
(e) Wallace River ..... Sept. 1 to Oct. 31
(f) West River, Antigonish County ..... Sept. 1 to Oct. 31
(g) South River, Antigonish County ..... Sept. 1 to Oct. 31
(h) Margaree River, Northeast Margaree River, Southwest Margaree River and tributaries, except the waters referred to in paragraphs (i) and (j) ..... June 1 to Oct. 15
(i) Margaree River upstream from the highway bridges at East Margaree to the Big Intervale bridges on the Northeast Margaree River and upstream to the Scotsville highway bridge on the Southwest Margaree River, not including tributaries ..... June 1 to Oct. 31
(j) Northeast Margaree River and tributaries upstream from the Big Intervale bridges ..... Closed all year

NOTES FOR SALMON FISHING AREA 18

- THE DAILY CATCH AND RETAIN LIMIT IS TWO GRILSE (SALMON LESS THAN 63 CM IN LENGTH).
- THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING FOUR.
- THE YEARLY CATCH AND RETAIN LIMIT IS FOUR GRILSE (SALMON LESS THAN 63 CM IN LENGTH).

- WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED FROM OCTOBER 1 TO OCTOBER 31, INCLUSIVE.

2 (a) **SALMON FISHING AREA 19 (Cape Breton East)** and all waters of the Province flowing into that Area, except the waters referred to in paragraphs (b) to (q) ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(b) Baddeck River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(c) Catalone River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(d) Framboise River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(e) Gaspereau River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(f) Gerratt Brook ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(g) Indian Brook, Eskasoni ..... Closed all year

(h) Lorraine Brook ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(i) Marie Joseph River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(j) Mira River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(k) Salmon River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(l) Grand River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(m) Middle River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(n) North River downstream from the area known as “The Benches” as marked by a Fishery Officer ..... (catch and release only) June 1 to Oct. 31

(o) North River upstream from the area known as “The Benches” ..... Closed all year

(p) River Tillard ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

(q) Inhabitants River ..... (catch and release only) June 1 to July 15 and Sept. 1 to Oct. 31

NOTES FOR SALMON FISHING AREA 19

- THE ANGLING SEASONS ARE OPEN TO CATCH AND RELEASE FISHING ONLY ON THE ABOVE SPECIFIED DATES AND ARE SUBJECT TO IN-SEASON ADJUSTMENTS.
- THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING TWO.
- WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.

3 (a) **SALMON FISHING AREA 20 (Eastern Shore)** and all waters of the Province flowing into that Area, except the waters referred to in paragraph (b) to (g) ..... Closed all year

(b) East River, Sheet Harbour ..... June 1 to Sept. 30

(c) Musquodoboit River ..... (catch and release only) June 1 to July 15

(d) Salmon River (Guysborough), downstream from the highway bridge at West Cooks Cove ..... (catch and release only) July 1 to Sept. 30

(e) Salmon River (Guysborough), upstream from the highway bridge at West Cooks Cove ..... Closed all year

(f) St. Mary’s River, except the waters referred to in paragraph (g) ..... (catch and release only) June 1 to July 15

(g) West River, St. Mary's, upstream from the highway bridge at Gleneig ..... Closed all year

NOTES FOR SALMON FISHING AREA 20

- THE ANGLING SEASONS ARE OPEN TO CATCH AND RELEASE FISHING ONLY ON THE ABOVE SPECIFIED DATES AND ARE SUBJECT TO IN-SEASON ADJUSTMENTS.
- THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING TWO.
- WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.
- SEE EXCEPTIONS FOR THE EAST RIVER, SHEET HARBOUR AT THE END OF THIS NOTICE.

4 (a) **SALMON FISHING AREA 21 (Southwestern Nova Scotia)** and all waters of the Province flowing into that Area, except the waters referred to in paragraphs (b) to (k) ..... Closed all year
(b) Clyde River ..... May 10 to Sept. 30
(c) Jordan River ..... May 10 to Sept. 30
(d) Mersey River ..... May 10 to Aug. 15 ..... and Sept. 1 to Sept. 30
(e) Sackville River ..... (catch and release only) June 1 to July 15
(f) Mushamush River ..... (catch and release only) June 1 to July 15
(g) LaHave River downstream from Morgan Falls ..... (catch and release only) June 1 to July 15
(h) LaHave River upstream from Morgan Falls except the waters referred to in paragraph (i) ..... Closed all year
(i) LaHave River between the bridge on the Lower Branch Road (Varner's Bridge #2) in New Germany and the Cherryfield Bridge at Cherryfield, not including tributaries ..... (catch and release only) June 1 to July 15
(j) Petite Rivière, downstream from Fancy Lake ..... (catch and release only) June 1 to July 15
(k) Tusket River ..... (catch and release only) June 1 to July 15

NOTES FOR SALMON FISHING AREA 21

- THE ANGLING SEASONS ARE OPEN TO CATCH AND RELEASE FISHING ONLY ON THE ABOVE SPECIFIED DATES AND ARE SUBJECT TO IN-SEASON ADJUSTMENTS.
- THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING TWO.
- WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.
- SEE EXCEPTIONS FOR THE CLYDE, JORDAN AND MERSEY RIVER AT THE END OF THIS NOTICE.

5 (a) **SALMON FISHING AREA 22 (Upper Bay of Fundy)** and all waters of the Province flowing into that Area ..... Closed all year

EXCEPTIONS

- THE FOLLOWING FOUR RIVERS ARE HIGHLY ACIDIC AND NATURAL SALMON PRODUCTION IS UNLIKELY. ALTHOUGH PREVIOUSLY MANAGED AS PUT AND TAKE FISHERIES, THERE HAS BEEN NO STOCKING OF SALMON IN THESE RIVERS FOR SOME TIME. THEY REMAIN OPEN TO RETENTION, BUT THE LIKELYHOOD OF CATCHING SALMON THERE IS REMOTE.
    - THE EAST RIVER, SHEET HARBOUR IN SALMON FISHING AREA 20
    - CLYDE, JORDAN AND MERSEY RIVERS IN SALMON FISHING AREA 21.
- THE DAILY CATCH AND RETAIN LIMIT IS TWO GRILSE (SALMON LESS THAN 63 CM IN LENGTH)
- THE DAILY CATCH AND RELEASE LIMIT IS ANY COMBINATION OF GRILSE OR SALMON TOTALING FOUR.
- THE YEARLY CATCH AND RETAIN LIMIT IS FOUR GRILSE (SALMON LESS THAN 63 CM IN LENGTH).

- WHEN FISHING FOR SALMON, ONLY BARBLESS OR PINCHED BARB ARTIFICIAL FLIES ARE PERMITTED.

REMINDERS

FOR 2008 ANGLERS ARE REMINDED THAT

- FOR THOSE RIVERS ON WHICH RETENTION IS PERMITTED, THE YEARLY BAG LIMIT FOR ATLANTIC SALMON HAS BEEN REDUCED FROM EIGHT (8) TO FOUR (4) GRILSE THAT MEASURE LESS THAN 63 CM FROM THE TIP OF THE NOSE TO THE FORK OF THE TAIL.
- SALMON FISHING IS ONLY PERMITTED USING ARTIFICIAL FLIES WITH BARBLESS OR PINCHED BARB HOOKS IN CERTAIN LOCATIONS AT CERTAIN TIMES.
- ALL SALMON 63 CM OR LONGER MUST BE RETURNED TO THE WATER IN A MANNER THAT CAUSES THE LEAST POSSIBLE HARM TO THAT FISH.

SEASONS AND BAG LIMITS MAY CHANGE AT ANY TIME FOR CONSERVATION REASONS AND SUBJECT TO ABORIGINAL HARVEST AGREEMENTS.

FOR FURTHER INFORMATION CONTACT THE LOCAL FISHERY OFFICER AND REFER TO MARITIMES REGION VARIATION ORDERS 2008-081, 2008-082 AND 2008-083.

FAITH SCATTOLON
REGIONAL DIRECTOR-GENERAL
MARITIMES REGION

Appendix 3. Reported recreational catches in SFAs 19 to 21 for 2008 (preliminary: April 14/09 database query), 2007, and the average catches for 2003-2007 time period. All salmon fisheries in SFA 22 and 23 were closed during this time period.

	2008 (preliminary)				2007				5 -Year Mean (2003-2007)							
	Grilse		Salmon	Effort	Grilse		Salmon	Effort	Grilse				Salmon		Mean Effort	
	Retained	Released	Released	Rod-days	Retained	Released	Released	Rod-days	Retained	95% CI	Released	95% CI	Released	95% CI	Rod-days	95% CI
SFA 19: EASTERN CAPE BRETON ISLAND																
ACONI BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BADDECK	0	20	36	248	2	15	66	254	0.7	1.1	22.3	13	79.4	26.7	275	103.8
BARACHOIS	0	0	0	9	0	0	1	9	0	0	1	1.2	0.9	1.2	12.8	7.7
CATALONE	0	0	0	0	0	0	0	0	0	0	1.2	3.2	0.8	2.1	2.9	8.1
CLYBURNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.8	11.1
FRAMBOISE (GIANT LAKE	0	0	0	2	0	3	1	16	0	0	0.6	1.7	0.2	0.6	5.4	8.2
FRENCHVALE BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GASPEREAUX: C. BRETON CO.	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.8	1.2	2.6
GERRATT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND	0	4	0	7	0	6	2	34	0	0	12.8	7.6	1.3	1.6	34.7	22.4
GRANTMIRE BROOK	0	0	2	16	0	0	3	4	0	0	4.8	7	3.4	2.9	10.6	5.9
INDIAN BROOK	0	4	0	4	0	0	0	3	0	0	1.1	2.9	1	1.9	8.9	4.5
INGONISH	0	0	0	0	0	0	0	0	0	0	0.6	1	1.6	3.7	3	2.3
INHABITANTS	0	2	2	9	0	6	18	25	0	0	4.4	2.9	7.8	9.6	19.7	21.5
LITTLE LORRAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LORRAINE BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MACASKILL'S BROOK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARIE JOSEPH	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0.9	1
MIDDLE: VICTORIA CO.	0	40	54	398	0	42	95	506	0	0	33.9	13.1	99.2	47	380.1	155.8
MIRA	0	0	0	0	0	0	0	0	0	0	0.3	0.7	0	0	12	22.3
NORTH ASPY	0	0	11	9	0	17	12	81	0	0	4.9	8.7	13.8	9.8	49.6	28.4
NORTH: VICTORIA CO.	0	110	161	481	0	92	134	491	0.3	0.7	70.8	20.2	143.5	32.1	481.2	46.4
NORTHWEST BROOK (RIVER RYAN)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RIVER BENNETT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RIVER DENY'S	0	0	0	0	0	1	0	4	0	0	0.3	0.8	0	0	0.9	2.5
RIVER TILLARD	0	0	0	0	0	0	0	0	0	0	0.6	1.8	0.6	1	3.4	4.9
SAINT ESPRIT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SALMON: CAPE BRETON CO.	0	0	0	11	0	1	1	10	0	0	0.9	1.1	1	1.2	15.6	16.1
SKYE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SYDNEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SFA TOTALS :	0	181	266	1197	2	184	333	1441	0.9	1.1	160.3	26.1	355	84.3	1322.9	241.4
SFA 20: EASTERN SHORE																
COUNTRY HARBOUR				River Closed					0	N/A	0	N/A	0	N/A	1.6	N/A
EAST: SHEET HARBOUR	0	0	0	0	0	0	1	7	0	0	0	0	0.6	1	4.8	4.1
ECUM SECUM				River Closed					0	N/A	1.4	N/A	0	N/A	8.8	N/A
GUYSBOROUGH				River Closed					0	N/A	1.3	N/A	0	N/A	1.3	N/A
MOSER				River Closed					0	0	0.6	2.5	0	0	2.7	4.5
MUSQUODOBOIT	0	9	9	31	0	27	8	126	0	0	19.1	13.7	3.3	3.6	73.2	56.3
NEW HARBOUR				River Closed					0	N/A	4.4	N/A	0	N/A	2.9	N/A
SAINT FRANCIS					0	6	1	3	0	N/A	6	N/A	1.5	N/A	3	N/A
SAINT MARY'S	0	213	67	380	3	205	89	597	1.2	2.3	118.8	171	44.5	65.6	324.5	397.7
SALMON: GUYSBOROUGH CO.	0	2	0	36	2	10	3	55	0.3	0.9	16.7	20.1	7.5	7.5	42.6	39.1
SFA TOTALS :	0	224	76	447	5	247	103	789	1.2	2.5	133.7	134.5	47.3	52.8	385.3	388.7
SFA 21: SOUTHERN UPLANDS																
CLYDE	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.8	1.5
GOLD				River Closed					0	N/A	6.6	N/A	0.7	N/A	12.4	N/A
JORDAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LAHAVE	0	25	11	186	0	94	23	497	0	0	149.1	55.1	59.2	43.1	494.2	133.2
MEDWAY				River Closed					0	N/A	0.7	N/A	0	N/A	2.2	N/A
MERSEY	0	0	0	0	0	0	0	0	4.5	9	0.5	1.5	1.8	3.1	116	231.3
MIDDLE: LUNENBURG CO.					0	3	0	3	0	N/A	1.5	N/A	0	N/A	3.1	N/A
MUSHAMUSH	0	0	0	0	0	0	0	0	0	0	1.2	1.6	0	0	2.6	3.7
PETITE RIVIERE	0	2	4	7	0	10	3	33	0	N/A	10.1	N/A	2.9	N/A	32.9	N/A
SACKVILLE	0	0	0	0	0	1	0	49	0	0	3.4	3.9	0.3	0.7	38.6	15.1
TUSKET	0	0	0	0	0	0	0	0	0	0	3.2	5.9	1.2	2	29.7	44.5
SFA TOTALS :	0	27	16	192	0	108	26	584	4.5	9	162.9	56.5	63.3	42.9	695.6	179.4

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