Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

Gulf and Maritimes Regions **Stock Status Report 2003/026**

Atlantic Salmon Maritime Provinces Overview for 2002

Background

Harvest regulations for Atlantic salmon (Salmo salar) are derived and applied on a river-specific basis within nine management areas known as Salmon Fishing Areas (SFA) in the Maritime provinces of eastern Canada. Within these three provinces, there are more than 150 rivers with reported Atlantic salmon populations characterized by differences in life history traits including freshwater residence time, age at maturity, and the extent of ocean migrations.

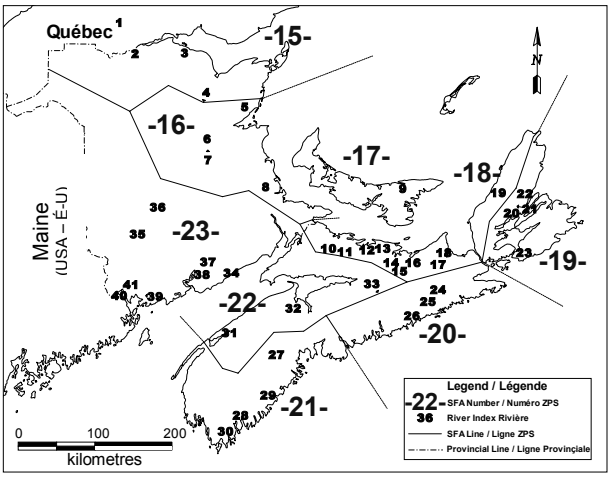
Spawning populations consist of varying proportions of small salmon (fork length <63 cm) and large salmon (fork length >= 63 cm). In the majority of rivers, small salmon (frequently referred to as grilse) are predominantly maiden fish (never spawned before) which have spent one year at sea before returning to spawn (one-sea-winter salmon, 1SW). The large salmon component (frequently referred to as salmon) contains a mixture of maiden fish which have spent two (2SW) or more years (MSW) before spawning and previous spawners which are returning for a second or subsequent spawning.

The conservation requirement for Atlantic salmon is a threshold reference point. The consequences of egg depositions below the reference point to the long-term sustainability of the stock are unknown but the likelihood of deleterious effects are greater when egg depositions are below the conservation requirement. The conservation requirement is established for individual rivers based on 2.4 eggs per m^2 of river habitat. In rivers impacted by airborne acid depositions, the conservation requirements are under review.

The status of the stocks is assessed on the basis of the proportion of the conservation egg deposition achieved in a given year and the trends in abundance of various life stages. In the absence of river-specific salmon escapement information and where quantitative electrofishing for juvenile salmon has been conducted, the status of stocks is assessed relative to a "normal index of abundance" (Elson norm) of 29 fry per 100 m^2 and 38 older parr per 100 m^2. Fry refers to juvenile salmon less than one year old whereas parr refers to juveniles of age 1 year and older.

Previous summaries of stock status described a geographically defined pattern of returns of small salmon and large salmon in the Maritimes:

- *Bay of Fundy and Atlantic coast of Nova Scotia stocks are characterized by a strong decline in abundance.*
- *Trends in the southern Gulf of St. Lawrence rivers range from declining through stable.*



Index of Rivers

1. Matapedia	14. West (Pictou)	28. Mersey
2. Restigouche (NB)	15. East (Pictou)	29. Jordan
3. Jacquet	16. Sutherlands	30. Clyde
4. Nepisiguit	17. West (Ant.)	31. Annapolis
5. Tabusintac	18. South	32. Gaspereau
6&7 Miramichi	19. Margaree	33. Stewiacke
6. NW Miramichi	20. Middle	34. Big Salmon
7. SW Miramichi	21. Baddeck	35. Mactaquac
8. Buctouche	22. North	36. Nashwaak
9. Morell	23. Grand	37. Kennebecasis
10. River Philip	24. St. Mary's	38. Hammond
11. Wallace	25. Liscomb	39. Magaguadavic
12. Waugh	26. East Sheet Hbr.	40. St. Croix
13. River John	27. LaHave	41. Dennis

Summary

- Large salmon returns in 2002 were lower than in 2001 in all assessed rivers of the Maritime Provinces. Small salmon returns generally increased in 2002.

- Despite restrictive fisheries management measures on salmon in distant and home-water areas over an extended period, returns have remained low. These low returns are largely associated with low marine survival.

- In Chaleur Bay **(SFA 15)**, the Restigouche River (in New Brunswick) appears to have fallen

Canada

short of the conservation requirement in 2002. Large salmon abundance was lower than in 2001, whereas small salmon abundance was much greater. Spawning escapements have varied about the conservation level since 1986. Returns in 2003 should be similar to the last five years, approximately at conservation. Nepisiguit River returns have been around conservation in the last five years and will likely be again in 2003. Small salmon in SFA 15 rivers are predominantly male and their current harvest generally is not limiting stock conservation.

- In **SFA 16**, the Miramichi River system and the Southwest Miramichi River did not meet the conservation requirement in 2002, the fourth time in five years. The Northwest Miramichi did not meet conservation in 2002, for the fifth consecutive year. The outlook for 2003 is for a return of large salmon greater than 2002 in both the Northwest and Southwest Miramichi rivers with a chance of meeting the conservation requirement equal to 64% for the Southwest Miramichi and 67% for the Northwest Miramichi River. The Buctouche River, used as an index for New Brunswick Northumberland Strait rivers achieved the conservation requirement in only one of eight previously assessed years (1993-2000) and is considered unlikely to do so in any given year.

- The majority (91%) of salmon returning to the Morell in 2002 and to other PEI rivers **(SFA 17)** are of hatchery origin. Salmon production in PEI rivers is negatively impacted by land use activities.

- Angling catches in the rivers of Northumberland Strait Nova Scotia **(SFA 18)** remained low in 2002. Juvenile densities were equal to or exceeded reference levels in three of seven rivers surveyed. Escapement to the Margaree River (western Cape Breton Island) was just above the conservation requirement. The juvenile densities in the Margaree River remained high.

- Adult salmon populations of eastern Cape Breton Island **(SFA 19)** were assessed on the Middle, Baddeck, North and Grand rivers. These populations were less than 25% of their conservation requirements in 2002, and are unlikely to meet conservation requirements in 2003.

- Except for the LaHave River above Morgans Falls the numbers of salmon that returned to rivers along the Atlantic Coast of mainland Nova Scotia **(SFAs 20 and 21)** in 2002 were insufficient to meet conservation requirements. These rivers are generally of low productivity and are negatively impacted by acid precipitation. Despite supplementation, salmon returns in 2003 are not expected to be sufficient to meet requirements for any of these rivers. Wild salmon populations are at critical low abundance and require actions to maintain their genetic integrity and ensure their persistence.

- **Inner Bay of Fundy (SFA 22 and part of SFA 23)** salmon populations are critically low, listed as endangered and are undergoing actions to prevent their extirpation.

- Salmon populations of the outer Bay of Fundy **(western part of SFA 23)** are unlikely to have met conservation requirements in 2002 and probabilities of most stocks achieving

requirements in 2003 are virtually zero. Where adult salmon were monitored, egg depositions were less than 10% of requirement. The monitored populations of outer Bay of Fundy rivers west of the Saint John River system have also declined precipitously and some are extirpated or nearly so. Efforts there have also been initiated to preserve the remaining genetic diversity for potential recovery.

Environmental Conditions

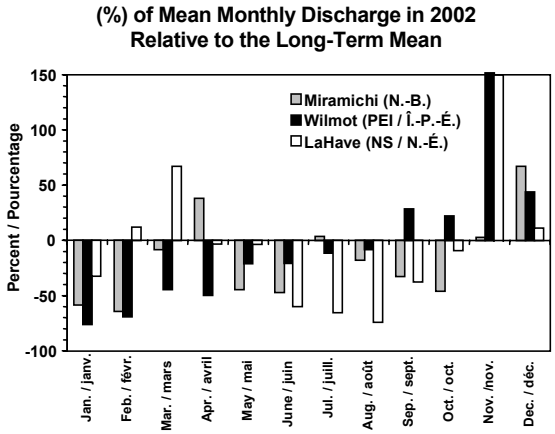
Streamflows

Freshwater conditions can affect Atlantic salmon at different life stages and also during different seasons of the year.

Conditions in the Maritime Provinces in 2002 were characterized by lower than normal winter precipitation and streamflow, especially in New Brunswick and Cape Breton. Record low monthly flows were observed in the Southwest Miramichi River in February. Spring peak flows occurred in mid-April, for most rivers, which was normal. Higher than normal flows were observed in March for Nova Scotia. The daily peak runoff in 2002 was characterized as mild in most rivers, with peak flows close to or less than the 2-year flood (a flood occurring on average every two years). LaHave River (NS) experienced the highest annual peak flows this year in December with a recurrence interval close to a 10-year flood.

The mild spring peak flows in 2002, resulted in lower than normal flows early in the season, in May and June throughout the Maritime Provinces. By July and throughout the summer, streamflow conditions were generally normal in NB and lower than normal in NS.

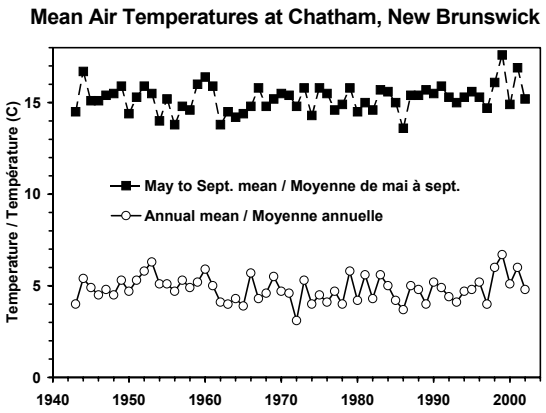
Higher than normal flow conditions persisted throughout the Maritime Provinces in autumn, with record high monthly flows in November (LaHave River (NS); Northeast Margaree River (NS) and Wilmot River (PEI)).



Daily low discharges were generally close to the 2-year low flow in 2002, although a few rivers showed more severe drought conditions. Southwest Miramichi (NB) experienced a 5-year low flow in winter, while both St. Mary's River (NS) and Northeast Margaree River (NS) approached a 10-year low flow.

Air and River Temperatures

Data on air temperature were analysed across the Maritime Provinces. Mean annual and mean summer air temperatures were average in 2002.



Normal summer discharge and air temperatures in 2002 resulted in normal summer water temperatures for many rivers with a few high temperature events. During these extreme events, maximum recorded water temperatures were close to 30°C. The number of days on which temperatures exceeded 23°C is used as an indicator of water temperature stress on fish. In 2002, the number of days when water temperatures exceeded 23°C was in the mid-range of values recorded in previous years.

Number of days when maximum water temperature exceeded 23ºC

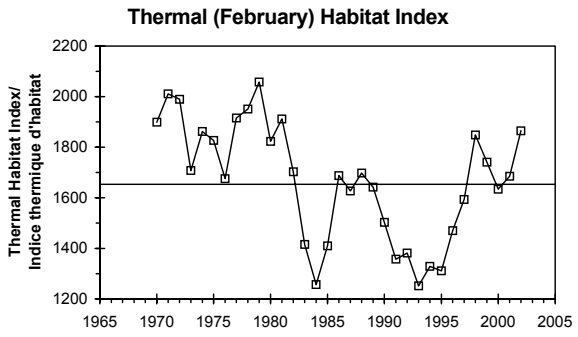
Year	Nashwaak River	Little Southwest Miramichi	Southwest Miramichi estuary
1995	55		
1996	6	10	
1997	24	14	
1998	30	15	21
1999	67	62	59
2000	25	19	11
2001	46	52	36
2002	30	30	26

Marine Environment

Atlantic salmon generally inhabit the near-surface water and thus, surface or near-surface temperatures are considered important in determining their survival rate.

Satellite-derived sea surface temperatures (SSTs) from the Labrador Sea to the Gulf of Maine, including the Gulf of St. Lawrence, were above normal during most of 2002. The SST change relative to 2001 varied spatially, however, being slightly warmer in the Labrador Sea, about the same temperature along the Labrador Shelf, cooler from northern Newfoundland to the eastern Scotian Shelf including the Gulf of St. Lawrence and the Grand Bank, and significantly warmer (by upwards of 1ºC) on the western Scotian Shelf, on Georges Bank and in the Bay of Fundy. In the latter region and in the Labrador Sea, the satellite-derived surface temperatures in 2002 were near the highest on record (over 20 years). Warm air and sea surface temperatures in the Northwest Atlantic historically have been associated with a low North Atlantic Oscillation (NAO) index. This index is a measure of the strength of the large-scale atmospheric circulation, in particular the intensity of the Icelandic Low and the Azores High, and is defined by the winter sea level air pressure at the Azores minus that at Iceland. A low NAO index means a weakening of the Low and the High. Consistent with the historical data, the warmer-than-normal SSTs in 2002 coincided with a below normal NAO index.

A marine thermal habitat index for salmon in winter has been developed and defined as the area at the southern extent of the Labrador Sea in February that contains surface waters within 4-8°C. This index was high through the 1960s and 1970s, declined during the early 1980s and remained below or near its long-term (1971-2000) mean from 1983 to 1997. After the minima in 1993, the index rose, reaching above normal values by 1998. In 2002 the index was at its highest level since the early 1980s. This thermal habitat index is negatively correlated with the NAO index .



The southern extent of winter ice off the Newfoundland and Labrador coasts is strongly related to winter air temperatures and winds, and influences the return timing of salmon for some stocks.

The aerial coverage of sea-ice off southern Labrador and northern Newfoundland was below normal in 2002 with a late advancement and early retreat contributing to the lighter than usual ice year. Ice-cover in the Gulf of St. Lawrence in 2002 was also less-than-usual. For the fifth year in succession, very little ice was transported onto the Scotian Shelf from the Gulf, and the ice coverage seaward of Cabot Strait was the second lowest in the 40-yr record. The small amount of ice on the Scotian Shelf in recent years is in contrast to the general trend of increasing sea-ice coverage from 1963 to 1990.

Coastal surface temperature anomalies for the Gulf of Maine (St. Andrews, N.B. and Booth Bay, Maine) and the Scotian Shelf (Halifax Harbour) may be indicative of conditions affecting smolts and post-smolts originating in rivers of the Gulf of Maine/Bay of Fundy and along the Atlantic Coast of Nova Scotia, respectively. Temperature records began in 1908 at Boothbay, 1921 at St. Andrews and 1925 at Halifax. The available data for 2002 indicate a continuation of the warmer-than-normal conditions observed during the last ten years at Boothbay and St. Andrews and the warmest temperatures since the 1950s. In contrast, temperatures were cooler-than-normal at Halifax for the second consecutive year.

Available subsurface temperature data from the western Gulf of Maine and the Scotian Shelf indicate no strong pattern but with higher than usual spatial variability.

In summary, conditions in 2002 indicate generally warm ocean temperatures in the near surface waters in the areas frequented by Atlantic salmon with no strong pattern in subsurface waters.

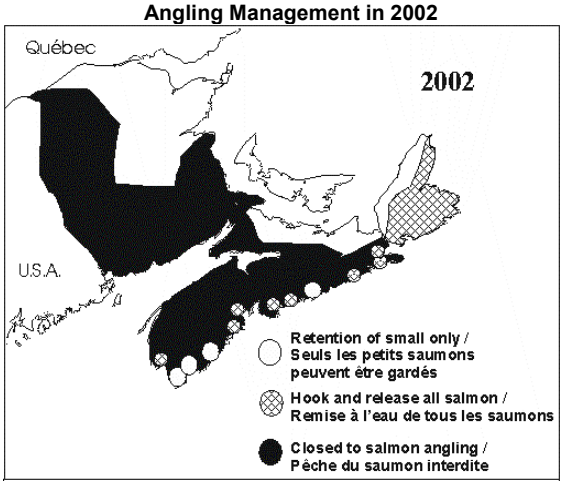
The Fishery

Atlantic salmon were harvested by two user groups in 2002: Aboriginal peoples and recreational fishers. Aboriginal peoples were given first access to salmon (after conservation requirements) based on communal needs for food, social and ceremonial purposes. Aboriginal fisheries in 2002 occurred in the southern Gulf of St. Lawrence rivers generally in accordance with agreements and communal fishing licenses. Under agreements reached in 2002, several Aboriginal communities in Nova Scotia were permitted to retain hatchery “adipose clipped” grilse from 5 Atlantic coast rivers (Musquodoboit, Sackville, Mushamush, LaHave and Tusket) in SFA’s 20 and 21, using methods that facilitate live release of wild fish.

The persistent failure of stocks in some areas of the Maritimes to achieve conservation requirements resulted in the progressive closures of Atlantic salmon in-river fisheries in the last 10 years. Salmon fishery closures began in 1990 in the inner Bay of Fundy rivers. By 1998, the most restrictive measures

to date were enacted. Retention angling fisheries for small salmon during 1998 to 2002 were allowed only in most of the southern Gulf of St. Lawrence, and in four acid-toxic rivers of the Atlantic coast. Eight Atlantic coast rivers were opened for a hook and release fishery from June 1 until July 15, in 2002.

Angling Management in 2002



In the Miramichi River (SFA 16) and the Nepisiguit River (SFA15), the daily small salmon retention limit was one fish. In all other areas of New Brunswick, daily retention limit of small salmon was two fish. The maximum daily catch-and-release limit was four fish of any size except for Cape Breton East (SFA 19), Eastern Shore (SFA 20) and Southwestern Nova Scotia (SFA 21) where the daily catch and release limit was two fish of any size. Season bag limits of 8 in New Brunswick and Nova Scotia and 7 in PEI, remained unchanged from previous years in those areas with angling fisheries.

All commercial fisheries for Atlantic salmon in eastern Canada remained closed in 2002. The commercial salmon fishery moratorium for insular Newfoundland was initiated in 1992, for Labrador in 1998, and for the fisheries in Québec in 2000.

A commercial and subsistence fishery (42.6 t) off west Greenland in August and September 2001 intercepted an estimated 9,800 salmon destined to return as large salmon to North America in 2002.

Harvests of large salmon in the aboriginal food fisheries declined in 2002 relative to recent years, whereas small salmon harvests increased in Gulf New Brunswick. Reports for many Gulf of St. Lawrence aboriginal harvests were incomplete to date (Table 1).

Removals (retained plus mortalities from hook and release angling) of large salmon in the recreational fisheries of SFA 15 were available from the Matapédia River (Restigouche System), where catches in 2002 were down 54% from 2001 whereas small salmon catches were up 114% from the previous year (Table 1). In southern SFA 15, Nepisiguit River catches of both large and small salmon were down 32-33% from 2001. In SFA 16, Miramichi River Crown Reserve Angling catches of large salmon were down 45% from 2001 and the lowest ever recorded whereas small salmon catches were up 51%. Complete angling catch estimates for Gulf New Brunswick have not been available since 1998. SFA 17 (PEI) recreational removals of small salmon, predominantly hatchery reared fish, were down 51% from 2001. Removals of small and large salmon in SFA 18 (Gulf of St. Lawrence Nova Scotia) rivers in 2002 were up from 2001 but below the average of the last five years.

Resource Description

Information in this document represents an update of 37 rivers for 2002 (Table 2). In an update, there are no important changes in methods. The previous

assessment or update for these stocks was conducted in 2001 (DFO 2002).

The status of the resource is determined from the annual returns and spawning escapements relative to the conservation requirements, the abundance of juveniles and smolts, corresponding trends in the juvenile stages, measures of sea survival, and the extent of habitat constraints on production (Table 2). The returns represent the size of the population returning to the river before any in-river removals. Spawning escapement is determined by subtracting all the known removals (including food fisheries, recreational harvests, broodstock collections, and scientific samples) from the total returns. Uncertainties in estimates are characterized by 90% confidence intervals and when available are shown in brackets as a range after the point estimate.

Estimates of returns are based on various techniques ranging from entire counts (such as fishways) to indices of abundance based on catch rates. In the absence of river-specific salmon escapement information and where quantitative electrofishing for juvenile salmon has been conducted, the status of stocks was assessed relative to P.F. Elson's "normal index of abundance" (Elson norm) for Maritime streams of 29 fry per 100 m^2 and 38 older parr per 100 m^2. Fry refers to juvenile salmon less than one year old (i.e. young-of-the-year, 0+parr) whereas parr refers to juveniles of age 1 year and older.

Chaleur Bay (SFA 15)

Updates are provided for three SFA 15 rivers in northern New Brunswick: Restigouche, Jacquet and Nepisiguit rivers. The Restigouche River has the second most abundant run of large salmon in eastern Canada.

The Restigouche River is assessed as two components. The Matapédia River (PQ) empties into the Restigouche River just above the head-of-tide and is managed by the province of Québec. Most of the remaining watershed, referred to as Restigouche (NB) is in New Brunswick or borders the two provinces. The conservation requirement for the Matapédia River was revised downward to 7.64 million eggs (equivalent to 1,139 large salmon) by the province of Québec in 1999. The revised value stems from a stock and recruitment analysis of six rivers in Québec and a revised measure of habitat. The previously used value, 11.44 million eggs, was based on standard habitat measurements and an egg requirement of 1.68 eggs per m^2. For the Restigouche (NB) portion, the conservation requirement is based on the default 2.4 eggs per m^2 and equates to a requirement of 55 million eggs.

Status

Angling catches of large salmon in the **Matapédia River** in 2002 were down 54% from 2001 whereas small salmon catches were up 114% from 2001. Following mid-season visual counts, the mandatory release of large salmon became effective August 17th until season's end.

Returns to the Matapédia River are determined from diver counts in October. The returns in 2002 were estimated at 2,292 large salmon and 2,540 small salmon, 41% below the estimate of large salmon in 2001 and 65% above the estimate of small salmon in 2001. The escapements to the Matapédia River were estimated at 1,803 large salmon and 1,223 small salmon. Spawning

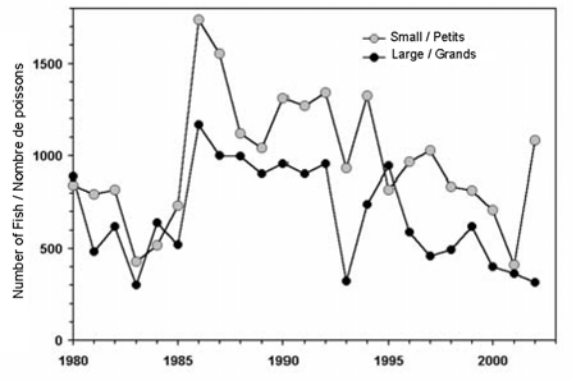
escapement in 2002 was 157% of requirement (based on fish) and exceeded the conservation requirement for the ninth consecutive year.

Matapédia				
	Small Salmon		Large Salmon	
	Returns	Spawners	Returns	Spawners
1994	1206	384	2293	1341
1995	1006	669	3319	2461
1996	2012	1291	3749	2807
1997	1201	751	2682	1993
1998	1473	823	2084	1643
1999	1600	890	2591	1983
2000	1586	733	2583	1893
2001	1541	926	3869	2802
2002	2540	1223	2292	1803

Indices of returns and escapement to the **Restigouche (NB)** include diver counts of adult salmon in early October, counts at protection barriers and catches in the angling fishery.

Diver counts of adult salmon in early October 2002 in Restigouche (NB) provided minimum escapement estimates of 5,500 large salmon and about 8,300 small salmon. Diver counts of large salmon in three tributaries were down 11% relative to 2001 whereas counts of small salmon were up 181% from the previous year. Counts from the Northwest Upsalquitch protection barrier were up 164% for small salmon and down 14% for large salmon. This was the lowest count of large salmon since 1982.

Northwest Upsalquitch

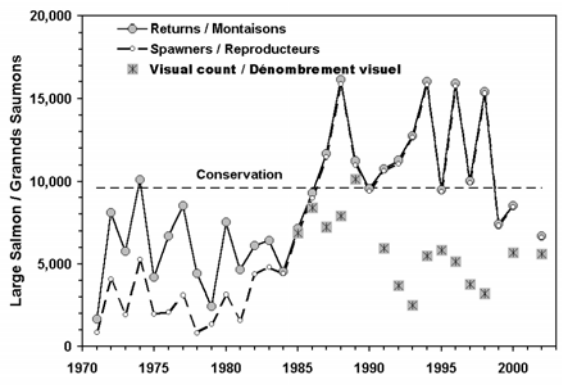


Counts at the counting fence on Little Main Restigouche were up 243% for small salmon and up 36% for large salmon relative to 2001. Reported angling catches from lodges in 2002 were up 45% for small salmon but unchanged for large salmon relative to 2000, the last year counts from lodges are considered complete.

The catch rates in the angling fishery during 1971 to 2000 were estimated from a model relating fry abundance as estimated from electrofishing surveys to escapement of large salmon which would have likely produced the observed fry levels. The average catch rate of the previous five years was applied to the 2002 provisional catches of large salmon to estimate returns. The estimation of spawners and catch rates from the model were constrained by assuming that at a minimum, 500 large salmon spawners were present annually in the Restigouche (NB) waters over the time series and additionally that the visual estimates of salmon between 1985 and 2001 were also a minimum. The annual estimates of catch rates and escapement can change with additional years of input data.

Estimated catch rates in the Restigouche (NB) portion of the river have declined to less than 0.20 for 1997 to 1999 but increased again to about 0.25 in 2000. Based on the average catch rate of the previous five years (0.19) and a provisional catch of large salmon in 2002 of 1,300 fish, the returns of large salmon were in the order of 7,000 fish. At an assumed catch and release mortality factor of 6%, losses were less than 100 fish and within the uncertainty of the returns estimate.

Restigouche (NB)

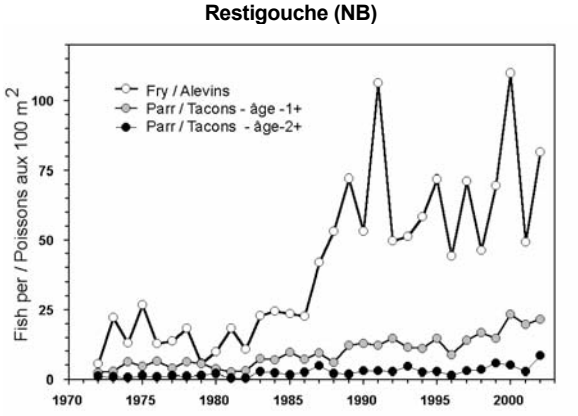


Conservation requirement for the Restigouche (NB) of 55 million eggs is based on 2.4 eggs per m^2 and would on average be obtained from 9,600 large salmon. The estimated escapement of about 7,000 spawners in 2002 represents 75% of the requirement. Point estimates of the escapements since 1984 indicate the conservation requirement was met or exceeded in 12 of the last 18 years assessed. Visual estimates of escapement are considered to be minimum, have been lower than those from other methods, and are not correlated with the observed juvenile densities in subsequent years.

Use of either the historic or the updated Matapédia egg deposition requirement for the Restigouche (NB) would indicate that the conservation requirement was met or exceeded every year since 1986.

Densities of fry and parr (age-1+ and older) from fifteen index sites in Restigouche (NB) sampled annually since 1972 remain at greatly increased levels relative to the 1970s and early 1980s. Densities of fry in 2002 were within the range of the average fry abundances observed between 1986 and 2001. Age-1+ parr abundance was second only to abundance in 2000. Annual variations in densities represent variations in egg depositions, survival rates, and water conditions at time of sampling.

Restigouche (NB)



Densities of juvenile salmon (all age groups) in the Matapédia and Patapédia rivers in 2002 were higher than in the other tributaries of Restigouche (NB) and remained as high as those in the tributaries of Restigouche (NB) during 1998 to 2001.

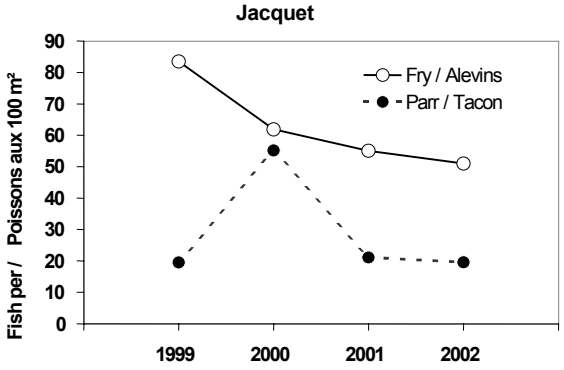
Counts of returning salmon to the **Jacquet River** barrier in 2002 are incomplete because of late installation of the barrier fence. The barrier operated from August 1st to October 30th, enumerating 340 small salmon and 136 large salmon, which represents about 26% of the conservation requirement. Estimates of returns for 1998 to 2002 are unavailable or incomplete due to washouts in October or late season installation. Conservation requirement of 3.8 million eggs would be obtained from 571 large salmon. Conservation requirement was achieved in 1994 and 1995 but not in the subsequent two years for which counts are considered complete.

Jacquet

Year	Salmon Returns Small	Salmon Returns Large	Egg Depositions % of Conservation	Egg Depositions % by large
1994	613	595	109	95
1995	344	589	106	98
1996	634	359	67	92
1997	372	384	70	96
1998[1]	402	298	55	95
1999[2]	-	-	-	-
2000[1]	209	252	45	97
2001[3]	245	184	34	95
2002[3]	340	136	26	90

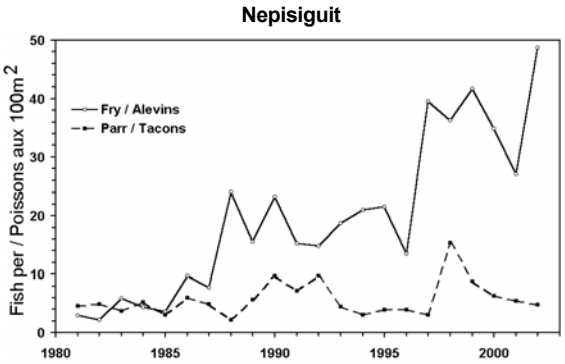
[1] Partial count due to washout
[2] Unavailable due to washout
[3] Late installation of barrier

Juvenile electrofishing at six sites, initiated in 1999, continue to show high fry and medium parr densities in 2002.



The escapement and returns of large salmon to the **Nepisiguit River** were estimated previously from redd counts conducted in late October or early November by the Nepisiguit Salmon Association. In 2002, weather and water conditions made it impossible to conduct redd counts. Returns to a counting fence are considered incomplete due to late installation. The fence operated from July 16th to October 24th, enumerating 151 large and 106 small salmon. The conservation requirement for the Nepisiguit River of 9.5 million eggs would be attained from 1,600 large salmon. The lack of sufficient data on returns precludes any statement as to whether or not the conservation requirement was met in 2002.

Juvenile abundance as measured annually at 11 sites increased during the 1990s and supports the interpretation of improved spawning escapements in recent years. Fry densities in 2002 were the highest of the time series.



Outlook

For the **Matapédia River**, returns of small and large salmon have approximated or exceeded 4,000 fish annually since 1995. There is no reason to expect the total returns and the egg depositions to be less than the conservation requirement for the river in 2003.

The relatively high juvenile abundance levels observed for **Restigouche (NB)** since 1990 suggest that returns will be similar to those of the last five years, at about conservation level.

Incomplete counts for the last five years on the **Jacquet River** preclude any outlook statement for this river.

No changes in returns from the previous five years are expected for the **Nepisiguit River**.

Management Considerations

Large salmon returns to **Restigouche (NB)** in 1999, 2000 and 2002 were below conservation requirement. The in-river fisheries losses of large salmon in

Restigouche (NB) are not significant, primarily associated with catch and release mortality and represent less than 5% of the eggs in the returns.

Management approaches on the **Matapédia River** have provided escapement levels at or above the conservation requirement.

The impact of the aboriginal fisheries prosecuted in the estuary remains unknown because the reported harvests are incomplete. The assessments of the Restigouche (NB) and Matapédia River stocks are after the estuary fisheries and since 1985, the spawning escapements have varied close to or above conservation.

Small salmon returning to SFA 15 rivers are predominantly male and contribute minimally to egg depositions. Harvests of small salmon in recent years have not jeopardised achievement of a 1:1 male to female sex ratio.

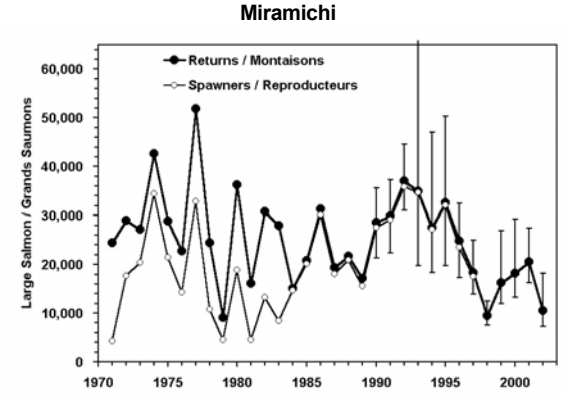
Miramichi and Southeast Gulf New Brunswick (SFA 16)

The information for the Buctouche and other Northumberland Strait New Brunswick rivers and the Tabusintac River was fully assessed in 1999 (DFO 2000a) and since updated for 2000, 2001 and now 2002. No assessment for the Tabusintac River is presented in 2002. The information for the Miramichi River is based on a full assessment for 2002.

SFA 16 includes the Miramichi River, the largest salmon producing river of eastern Canada, and numerous small coastal rivers along the Northumberland Strait shore of New Brunswick. The Northwest and Southwest branches of the Miramichi River are assessed separately. The Buctouche River is used as an index river for New Brunswick Northumberland Strait rivers. Juvenile abundance was monitored on the Buctouche River and five other rivers of Northumberland Strait New Brunswick.

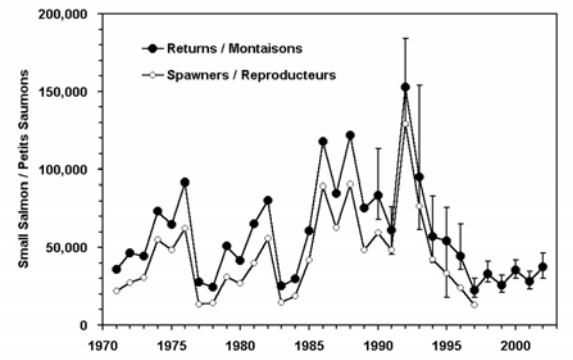
Status

The estimated return of 10,600 large salmon (7,200 – 18,200) to the **Miramichi River** in 2002 was 36% below the previous five-year average. About 8,800 large salmon (5,600 – 15,600) returned to the **Southwest Miramichi** and 1,700 large salmon (1,100 – 2,700) returned to the **Northwest Miramichi**, down 41% from 2001 for the Southwest Miramichi and down 70% from 2001 for the Northwest Miramichi. The continued low abundance of large salmon in 1998 to 2002, relative to the previous decade was consistent with the continued low returns of small salmon in 1997 to 2001.



Small salmon returns in 2002 were 37,600 fish (30,300 – 46,600) up 33% from 2001 and increased 30% from the previous five-year average. A total of 20,500 small salmon (11,900 – 29,700) returned to the Southwest Miramichi and 16,800 small salmon (12,700 – 23,300) returned to the Northwest Miramichi, similar to 2001 for the Southwest Miramichi and more than double from 2001 for the Northwest Miramichi.

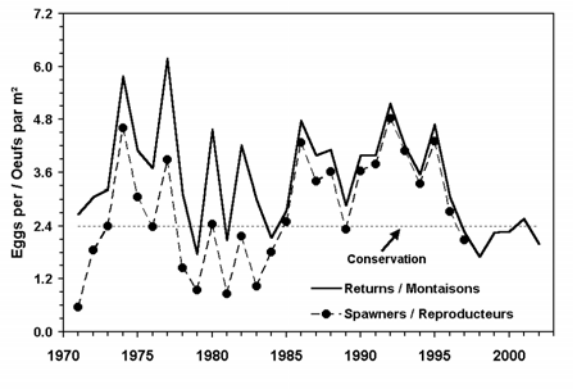
Miramichi



Other indicators of abundance (counting facilities and fisheries) throughout the Miramichi watershed show similar decreases in abundance for large salmon and increases in small salmon returns.

Conservation requirement for the Miramichi River of 132 million eggs (128 million for Northwest and Southwest branches) would be contributed on average by 23,600 large salmon. Removal data for 1998 to 2002 are incomplete. In 2002, egg depositions by all salmon returning to the Miramichi River (before any removals) would have equalled 83% of the conservation requirement (17% chance of having met requirement). Egg depositions by large salmon alone would have equalled 48% of requirement. Egg depositions after accounting for removals would be less than these values.

Miramichi



In the Southwest Miramichi, eggs in the returns were 84% (23% chance of having met requirement) of the conservation requirement of 88 million eggs. In the Northwest Miramichi, eggs in the returns were 79% (10% chance of having met requirement) of the 41 million egg conservation requirement. Egg depositions after accounting for removals would be less than these values.

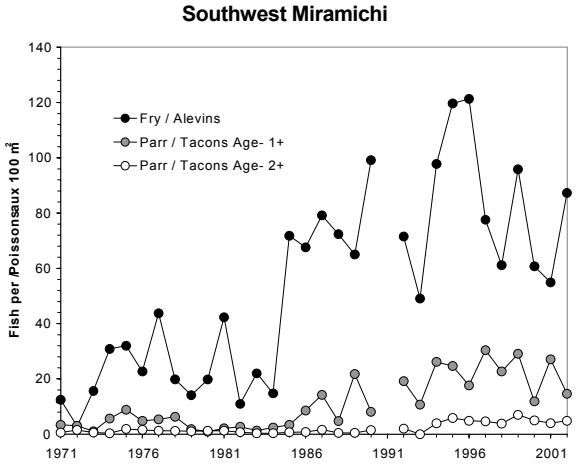
Percent of conservation requirement (eggs) achieved in Returns (Ret.) and Escapement (Esc.)

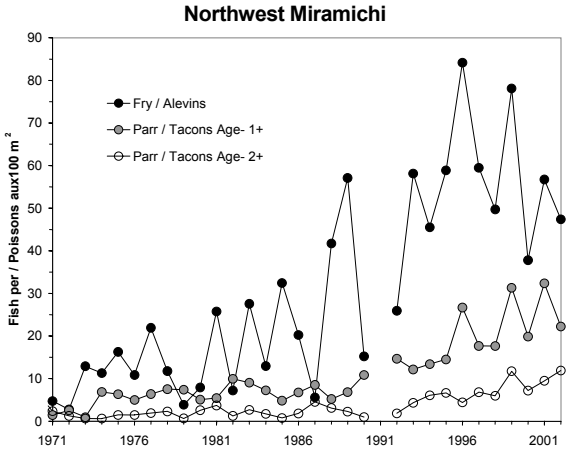
	Northwest		Southwest	
Year	Ret.	Esc.	Ret.	Esc.
1992	141	120	247	238
1993	184	177	154	149
1994	216	200	115	108
1995	288	269	152	139
1996	151	134	124	114
1997	121	105	82	78
1998	58	-	67	-
1999	98	-	88	-
2000	87	-	97	-
2001	91	-	111	-
2002	79	-	84	-

Small salmon could potentially have contributed 69% of the total eggs in the Northwest Miramichi and 30% of the total in the Southwest Miramichi. Eggs in the returns in 2002 were decreased from the previous three years in both the Southwest and Northwest Miramichi rivers, and both were below the levels estimated in the first half of the 1990s.

Juvenile densities are expressed as the median densities of 14 to 72 sites surveyed annually. Median rather than average values were chosen because of the non normal distribution of measured juvenile densities. Values for 1991 have been omitted as only three sites were surveyed that year. Juvenile densities of fry and parr (age-1+, age-2+ and older) in the Northwest and Southwest branches of the Miramichi River remain at higher levels than those of the 1970s and early 1980s. During the last 10

years, median fry densities have been consistently higher than Elson norms throughout the Miramichi. Median parr densities have exceeded Elson norms in each of the Northwest and Southwest Miramichi rivers twice during the last 10 years.





Annual variations in densities represent variations in egg depositions, survival rates, and water conditions at the time of sampling. However, since assessments of the Northwest and Southwest branches of the Miramichi River were initiated in 1992, relative survivals from egg to fry have been low when eggs depositions have been high (> 300 eggs per 100 m^2).

Smolt production from the Miramichi River in 2002 was estimated at about 900 thousand fish, compared to the 600 thousand smolts estimated to have migrated to sea in 2001. Smolt production from the Northwest Miramichi in 2002 increased 12% from 2001 whereas production in the Southwest Miramichi increased 68% from 2001. The return rate of smolts from 2001 to small salmon (all 1SW salmon) in 2002 was 7.7% for the Northwest Miramichi and 5.4% for the Southwest Miramichi (about the average smolt survival for the Northwest Miramichi from 1999-2001).

Northwest and Southwest Miramichi

	Smolt Production		Return Rate	
Smolt Year	Estimate (000's)	per 100 m^2	1SW	2SW
Northwest Miramichi				
1999	390	2.3	3.3%	0.9%[1]
2000	156	0.9	4.9%	n.a.[2]
2001	219	1.3	7.7%[1]	
2002	246[1]	1.5[1]		
Southwest Miramichi				
2001	380	1.1	5.4%[1]	
2002	640[1]	1.8[1]		

[1] Value is preliminary
[2] Unavailable pending age determinations of large salmon

For the **Buctouche River**, adult returns have not been assessed since 2000. Between 1993 and 2000, returns of large salmon ranged from 95 to 244 fish and small salmon returns ranged from 38 to 127 annually.

Buctouche

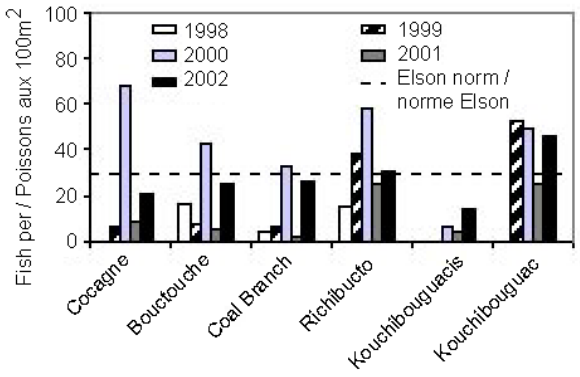
	Returns		Escapement	
Year	Large	Small	Large	Small
1993	95	78	94	21
1994	225	77	212	59
1995	154	98	147	67
1996	134	127	124	78
1997	200	97	191	67
1998	102	92	101	91
1999	244	115	244	111
2000	100	38	100	28

Egg depositions from large and small salmon in the Buctouche River failed to achieve the conservation requirement in seven of the eight assessed years.

Egg Deposition (%) Relative to Conservation Requirement		
Year	Returns	Escapement
1993	38	35
1994	77	72
1995	61	58
1996	49	46
1997	74	70
1998	33	33
1999	103	102
2000	37	36

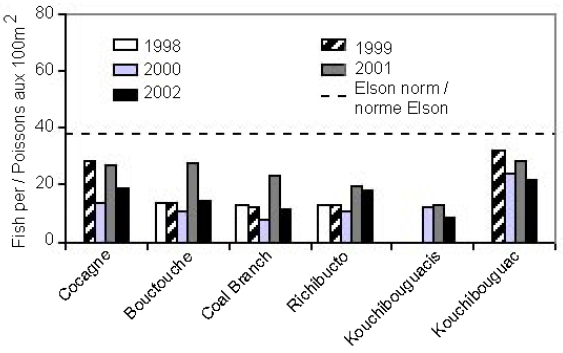
In 2002, mean fry densities (14-46 per 100 m^2) in the Buctouche and five other southeastern New Brunswick rivers (Cocagne, Coal Branch, Richibucto, Kouchibouguacis and Kouchibouguac) were considerably higher than observed in 2001, and higher than the previous five year means. Except for Kouchibouguacis (14 per 100 m^2), densities were near or in excess of the Elson norm.

Fry



Mean parr densities in 2002 (9-22 per 100 m^2) were well below the Elson norm in all rivers sampled, below levels observed in 2001, and below the previous five year means.

Parr



The rivers in southeastern New Brunswick are small, shallow, low gradient streams with a high proportion of bedrock and coarse substrate which is unsuitable as spawning habitat. For the Buctouche at least, egg-to-fry survival is generally low, suggesting there may be a habitat constraint between those life stages. However, a high egg deposition in 1999 resulted in much higher fry densities in 2000, an even that appears consistent across rivers. Generally, survival from age 0+ through age 2+ appears to be good, and juveniles are generally distributed throughout the habitat.

Outlook

For the **Miramichi River**, based on the range of ratios of small salmon to large salmon the next year, the large salmon return in 2003 is expected to be between 14,000 and 27,000 fish. Small salmon return in 2003 may number 38,000 fish based on the previous five-year average. Based on the smolt production estimate for the Miramichi River in 2002 of 900 thousand smolts and assuming an average return rate of 5%, (mid-range of values observed for the Northwest Miramichi in last three years) the small salmon return in 2003 may number 44,000 fish. Eggs in the returns of small and large salmon have a 77% probability of meeting or exceeding conservation requirement, with small salmon

potentially accounting for 27% (13% - 43%) of the total eggs in the returns.

For the **Southwest Miramichi**, the return of large salmon in 2003 is expected to be between 8,900 and 18,600 fish. The average small salmon return in the previous five years has been 20,400 fish (range of 14,400 – 24,000). Based on the estimated smolt production from the Southwest Miramichi in 2002 and a possible return rate of 5%, small salmon returns in 2003 could number 32,000 fish. Eggs in the returns of small and large salmon have a 64% probability of meeting or exceeding conservation requirement. Small salmon may account for 27% (13% to 45%) of the eggs in the total returns.

For the **Northwest Miramichi**, the return of large salmon in 2003 is expected to be between 3,700 and 10,000 fish. The average small salmon return in the previous five years has been 11,300 fish (range of 7,700 - 16,800 fish). Based on the estimated smolt production from the Northwest Miramichi in 2002 and a mid-range return rate of 5% over the last three years, small salmon return in 2003 may total 12,000 fish. There is a 67% chance that eggs in the returns of small and large salmon will meet or exceed the conservation requirement. Small salmon may account for 29% (13% to 47%) of the eggs in the total returns.

Adult returns were not assessed for the **Buctouche River** in 2002. The conservation requirement was not met in seven of eight previously assessed years and is unlikely to do so in 2003. Juvenile abundance in southeastern rivers in recent years suggests some potential for long term improvement in adult returns.

Management Considerations

In the absence of fisheries-related mortality on salmon in the **Miramichi River** in 2003, there is a 77% chance that the eggs in the returns of small and large salmon will meet the requirement. Probabilities of meeting the conservation requirement in 2003 in the absence of fisheries removals are less than 70% in both the Northwest and Southwest Miramichi branches. Considering the continued uncertainties in the expected small and large salmon returns in 2003, a cautious approach to fisheries management is recommended.

The **Buctouche River** is used as an index for New Brunswick Northumberland Strait rivers. Although not assessed for adult returns in 2002, past results indicate that attaining the conservation requirement in any given year is unlikely. Small salmon have contributed an average of 2% (0-6%) of total egg deposition from all salmon. Based on parallel changes in juvenile abundance in the Buctouche and most other Northumberland Strait NB rivers surveyed in recent years, the Buctouche River appears to be a valid index and provides a basis for the management of this group of rivers.

Prince Edward Island (SFA 17)

This section updates salmon status in SFA 17 for 2002. Most original runs of Atlantic salmon in Prince Edward Island were eliminated due to over-exploitation, barriers to migration, and habitat degradation. Salmon are stocked in up to six of PEI's larger rivers by release of smolts that have been raised semi-naturally in open impoundments. This program has been most successful in the Morell River, which has accounted for more than half of the province's salmon

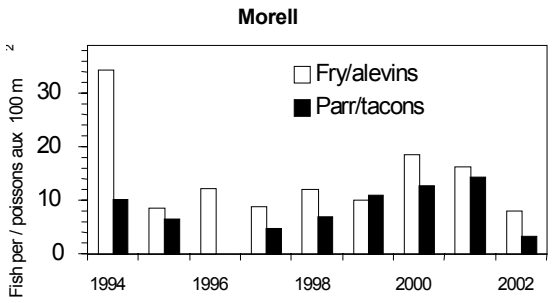
angling catch in recent years. Angling catches of PEI salmon have trended downward since 1996, and estimated catches in 2002 were 70% of the 1997-2001 mean. A small amount of natural production occurs in the Morell and other stocked rivers. Juvenile salmon of wild origin occur in a number of unstocked rivers.

Status

The counting facility at Leards Pond on the **Morell River** operated in 2002, for the first time since 1999. Sixty-one small and nine large salmon were counted at the facility. Total fish counted (70) were 17% of the mean count for the years 1990-1999. The Leards Pond counting facility captures an unknown and probably variable proportion of the salmon that ascend the West Branch of the Morell River. Hence counts there do not provide a reliable basis for estimating egg deposition in waters upstream from the pond. However, given the low numbers of fish counted in comparison with previous years, it is very unlikely that egg deposition in the waters above Leards Pond met the conservation requirement.

Most (91%) adult salmon counted at Leards 2002 were of hatchery origin.

Mean total densities of juvenile salmon (fry plus age-1+ and older parr) on the Morell were estimated as 19.8 fish per 100 m^2 in 1996-2001 and 11.3 fish per 100 m^2 in 2002. In 2002, the survey was conducted in high water conditions and the survey method changed from multiple-sweep with barrier nets to single-sweep with no barrier nets.



Salmon returns to hatchery-stocked PEI rivers other than the Morell are far below conservation requirements.

Outlook

Based on recent years' experience, returns in 2003 to the **Morell River** will probably not meet conservation requirement, but broodstock needs for the stocking program (minimum 50 fish) will be met. Egg depositions have little influence on future returns because most returns are of hatchery origin. Returns in 2003 will probably be similar to those of recent years because the intensity of stocking has not changed.

In other PEI rivers, conservation requirements will not be met, but returns will continue because of ongoing stocking programs.

Management Considerations

Stream sedimentation caused by agriculture and other land use activities negatively impacts Atlantic salmon populations on PEI (DFO 2000b). Cultivation techniques which reduce erosion and pesticide run-off have become more widespread in recent years, but potato acreage has also increased. Reducing these impacts would increase the opportunity for sustaining populations of Atlantic salmon.

No change is recommended to current management for hatchery-reared fish,

which comprise most of PEI's salmon runs.

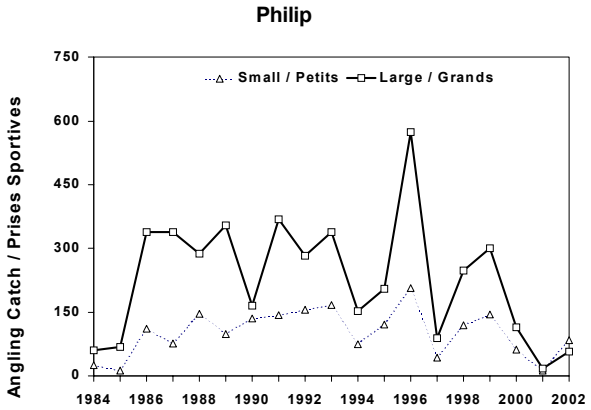
Some PEI rivers produce small numbers of wild fish. Egg deposition from wild spawners is far below conservation requirements in all systems. It is recommended that protection be provided for wild salmon (as indicated by an intact adipose fin). Increased spawning escapement of wild fish can be expected to benefit wild production and also provide more fish of wild origin for broodstock use. Measures to restrict harvest of wild fish would affect the Morell and other large streams. They would not affect unstocked systems with late-running salmon that enter rivers after the angling season has closed.

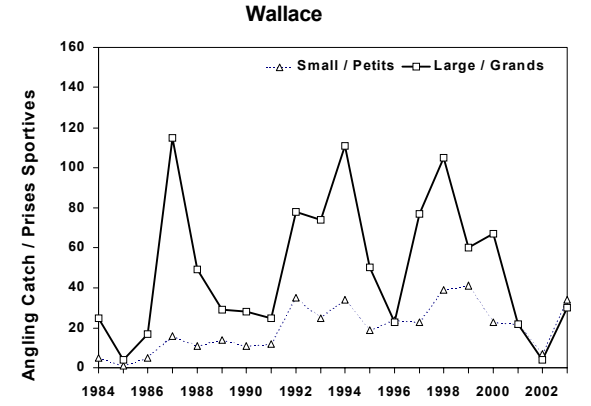
Northumberland Strait Nova Scotia and Western Cape Breton (SFA 18)

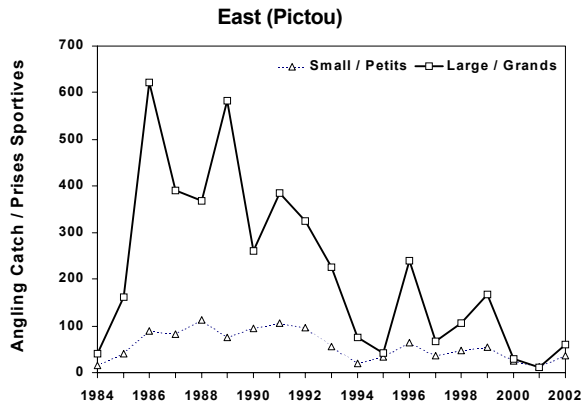
Salmon Fishing Area 18 includes the rivers from Northumberland Strait Nova Scotia and western Cape Breton Island. Sixteen rivers from Northumberland Strait Nova Scotia are known to support Atlantic salmon stocks. The last stock assessment was conducted in 1999 for eight of these rivers and stock status information was updated in 2000 (DFO 2001) and in 2001 (DFO 2002). Two principal rivers (Cheticamp River and Margaree River) from western Cape Breton Island support salmon stocks but only the Margaree River was assessed. The last salmon stock assessment in Cape Breton Island was conducted in 1999 (DFO 2000) and stock status information was since updated (DFO 2001 and 2002).

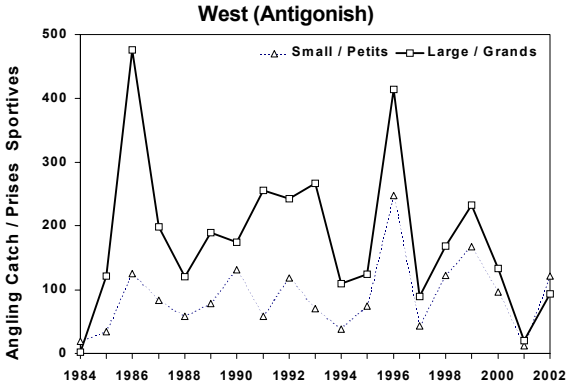
Status

Adults enter the rivers of Northumberland Strait Nova Scotia in late autumn, typically after September 15. Historic angling catches are presented for the rivers that are also monitored for juvenile abundance. In general, angling catch has been declining over the last few years. Catch rates in the recreational fishery are influenced by factors such as discharge, run timing, and angling season. The low angling catches in 2001 were attributed to the exceptionally low water level and presumed late entry of salmon that year. Preliminary total angling catch from all rivers in this area in 2002 was 371 small salmon and 305 large salmon. Most of these catches (87% of small and 93% of large salmon) occurred in five rivers: **River Philip, Wallace River, West River (Antigonish), West River (Pictou) and East River (Pictou)**.









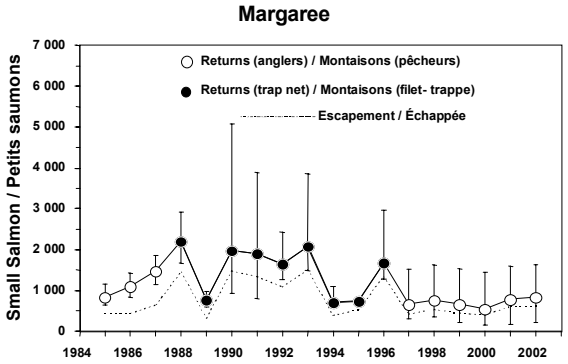
During a diver survey conducted in the **Sutherlands River** in 2002, 15 large and 24 small salmon were observed. The spawning requirement for the river is 25 large and 4 small salmon. Diver counts are partial and it is possible that the spawning requirement in this river was met in 2002.

Diver counts in the Sutherlands River

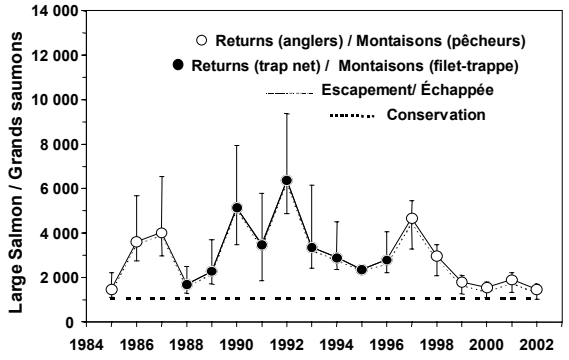
		Number of Salmon	
Year	Date surveyed	Large	Small
1995	6-Nov	24	17
1996	7-Nov	48	15
1997	17-Nov	46	25
1998	9-Nov	26	20
1999	3-Nov	28	25
2000	15-Nov	14	10
2001	-		
2002	6-Nov	15	24

Different techniques have been used to estimate the salmon returns to the **Margaree River** since 1985. From 1985 to 1987, returns were estimated from angling catches and assumed catch rates. From 1988 to 1996, returns were estimated from catches at an estuarine trapnet with trapnet efficiencies estimated from mark-recapture experiments. Salmon returns in 1997 to 2002 were estimated from recreational catches and an average capture rate derived from the mark-recapture experiment conducted from 1991 to 1996. In 2002, small and large salmon returns were estimated at 840 (216 – 1,632) and 1,460 (1,025 - 1,705) fish, respectively. Estimated small salmon returns increased by 5% but large salmon decreased by 30% compared with 2001.

The estimated escapements were 620 (216 – 1,416) small and 1285 (848 – 1,528) large salmon. The lower confidence limit of the large salmon estimate in 2002 is below the conservation requirement for the first time since 1985. Ninety-three percent of the fish sampled during broodstock collection were of wild origin.

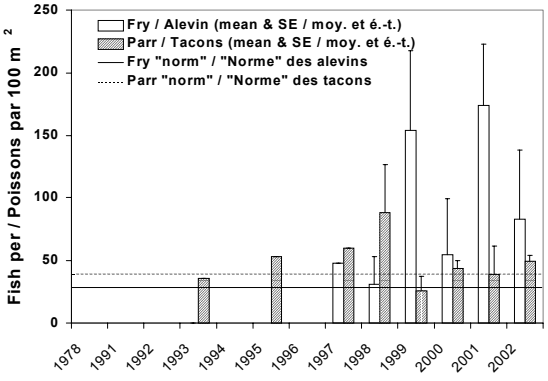


Margaree

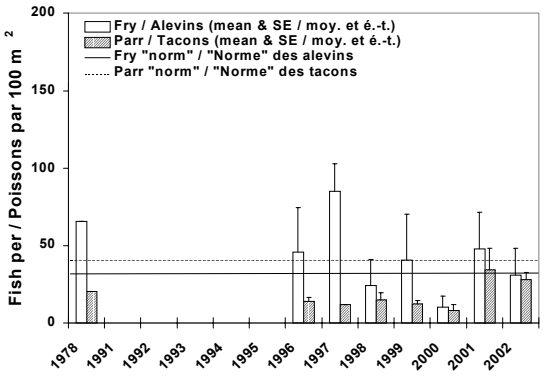


Juvenile surveys were conducted at historic sites in four rivers of the Northumberland Strait Nova Scotia (River Philip, Wallace River, East River (Pictou), and West River (Antigonish)). Except for the Wallace River, fry and parr densities exceeded the Elson norm in 2002. These results suggest that the number of salmon returning to these rivers in 2001 was likely sufficient to meet the spawning requirement. Electrofishing was also conducted in 2 to 3 sites in the Waugh, John and Barney's rivers. There were high fry densities in the Waugh and Barney's rivers, but fry densities were below the Elson norm in the River John. The average parr densities in the three rivers were below the Elson norm.

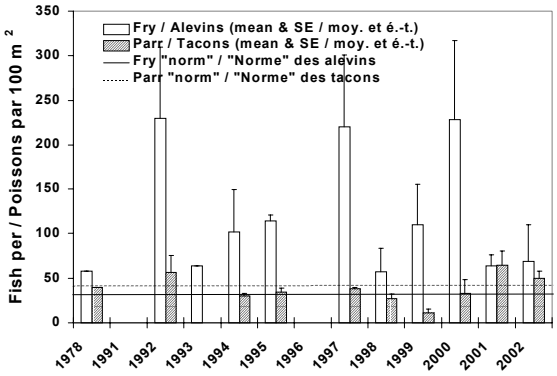
Philip



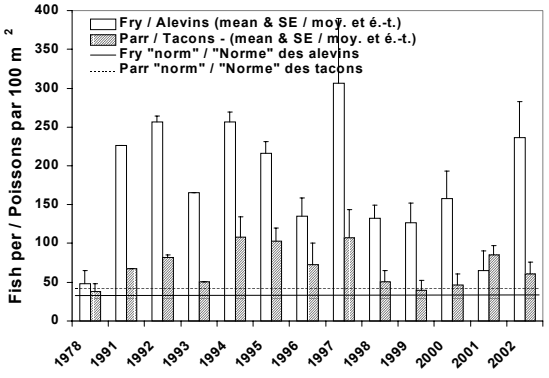
Wallace



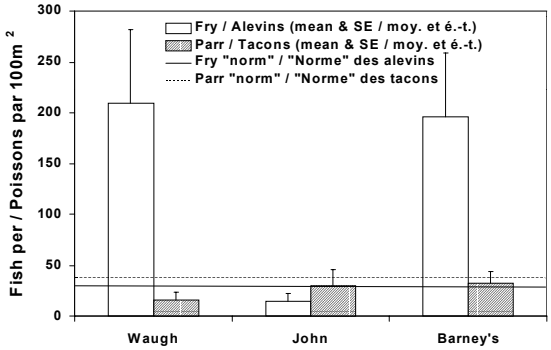
East (Pictou)



West (Antigonish)

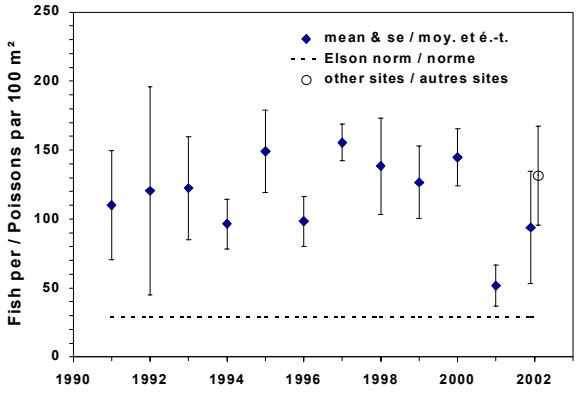


Other rivers – 2002

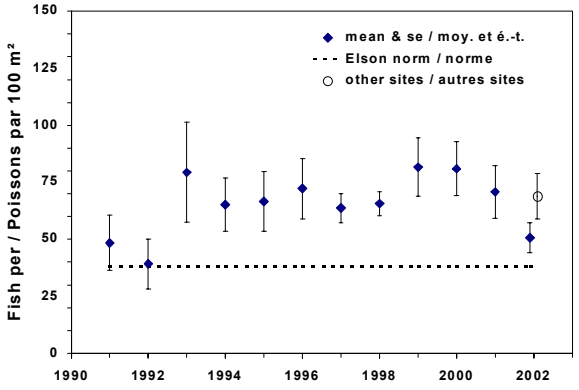


The juvenile densities at five historic sites in the Margaree River averaged 94 fry and 51 parr per 100 m^2, above the Elson norms. The average fry density was higher in 2002 compared with 2001, but remained low relative to previous years. The average parr density decreased in 2002, consistent with a lower fry density observed in 2001. Thirty-nine sites were additionally surveyed in 2002. Sites were sampled using a catch per unit effort technique calibrated to density using the traditional closed site method. The average fry and parr densities were higher in these sites compared with the historic sites and substantiate the high juvenile abundance in the Margaree River.

Margaree – Fry Densities



Margaree – Parr Densities



Outlook

The number of salmon returning to the rivers of the Northumberland Strait Nova Scotia is largely unknown. Based on the sustained juvenile abundance observed at the historic sites, no change in status from previous years is expected. Based on the estimated lower abundance of large salmon in the **Margaree River** in recent years, returns in 2003 are not expected to greatly exceed conservation requirement.

Management Considerations

The rivers in Northumberland Strait Nova Scotia are relatively small and salmon returns typically range from a few dozen to a few hundred. Generally, the level of directed fisheries exploitation in past years has not been of concern to conservation. Nevertheless, small rivers are more vulnerable to over-exploitation.

Escapement to the **Margaree River** has not greatly exceeded the conservation requirement in recent years. Considering the uncertainties in stock status, a cautious approach to fisheries management is recommended.

Little or no data were available for First Nation catches on many of the area rivers. Closer monitoring of returns and harvests in 2003 and beyond would be necessary to improve the accuracy of the assessment and reduce the risk of seriously impacting a year class through removals.

Eastern Cape Breton (SFA 19)

Salmon stocks of eastern Cape Breton Island include those of the Middle, Baddeck and North rivers with headwaters in the Cape Breton Highlands. These rivers have relatively pristine water quality and no significant impediments to fish migration. Grand River is of lower gradient than rivers flowing from the Highlands and has flows

and temperatures influenced by headwater lakes. A fishway by-passes Grand River falls.

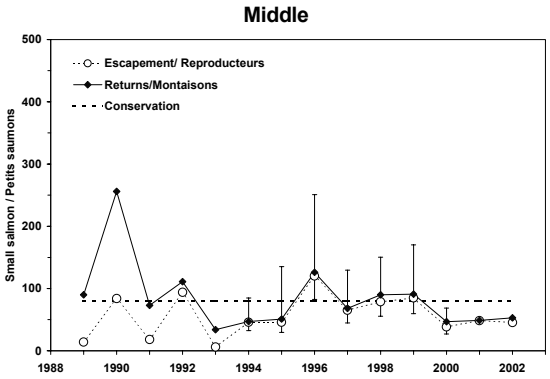
The last formal assessment for these rivers was in 1999. Updates have been provided in 2000 (DFO 2001), 2001 (DFO 2002) and are provided here for 2002. Adult assessments in this area are based on fall-season diver counts of salmon. Low, then high water levels prohibited the catch and marking of salmon necessary to calibrate the diver count of salmon in 2002. However, water levels declined and provided good conditions for diver observations of salmon. Counts of salmon were conducted from October 23-25, 2002 in the Middle, Baddeck and North rivers. The mean observation rate from previous mark and recapture estimates was used to derive the 2002 estimates.

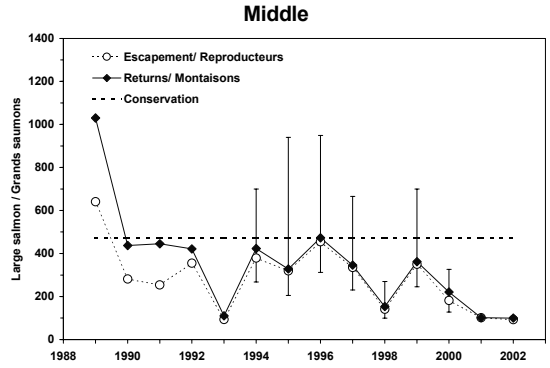
Returns were estimated by two methods: angling catch with an assumed catch rate of 0.5 and escapement estimates derived from diver counts plus removals prior to the counts. A method to estimate uncertainty in escapement estimates associated with historic diver observation rates has not been established and therefore is not estimated for 2001 and 2002.

Densities of juvenile salmon were determined by electrofishing only in the Sydney and Skye rivers and Grantmire and Indian brooks during 2002.

Status

Returns and escapement to **Middle River** in 2002 were estimated from removals, diver counts and the mean observation rate for dives made in the years 1994 to 2000 of 0.66 (0.54-0.80). Recreational and aboriginal removals of salmon in Middle River in 2002 were estimated to be 8 small and 7 large salmon. During a swim-through on Oct. 23, 91 salmon were observed. Estimated returns were 152 fish and estimated escapement was 137 fish, comprised of 45 small and 92 large salmon. The estimated escapement of large salmon was down 9% from 2001.





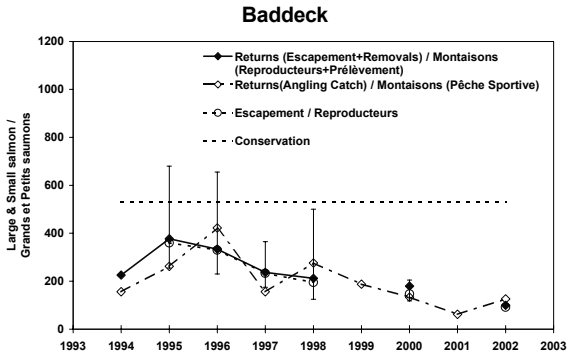
The conservation requirement for the Middle River of 2.07 million eggs is expected from 470 large and 80 small salmon. Small salmon escapement was about 56% of requirement, large salmon were about 20% of requirement.

No sampling for juvenile salmon was conducted in 2002 in the Middle River.

Escapement to the **Baddeck River** in 2002 was estimated from diver counts and the mean observation rate for the years 1994 to 1998 and 2000 of 0.61 (0.45-0.76). During a swim-through on Oct. 24, 56 salmon were observed

resulting in an estimate of 91 fish comprised of 11 small and 80 large salmon.

Losses of salmon from angling retention, mortality and illegal catches of salmon in Baddeck River in 2002 were estimated to be 2 small and 6 large salmon.

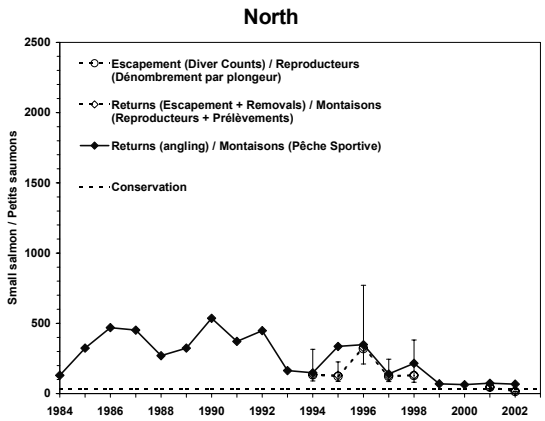


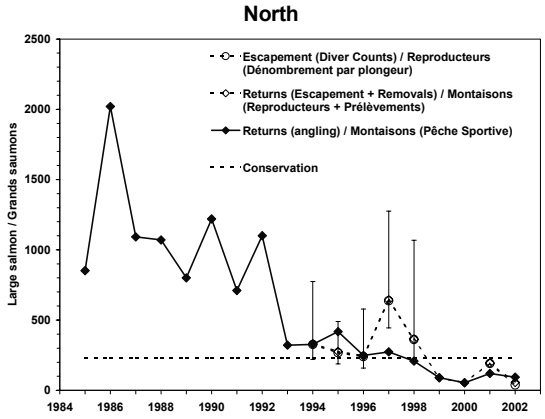
The conservation requirement for the Baddeck River is 2.0 million eggs, expected from 450 large and 80 small salmon. Small salmon escapement was 14% of requirement, large salmon were about 18% of requirement. Thus egg conservation requirements are unlikely to have been met in 2002.

No sampling for juveniles salmon was conducted in 2002 in the Baddeck River

Escapements to **North River** in 2002 were estimated from diver counts and the mean observation rate for the years 1994-1998 of 0.49 (0.39-0.60). During a swim-through on Oct. 25, 26 salmon were observed and resulted in an estimate of 14 small and 39 large salmon.

Losses of salmon from angling retention, mortality and illegal catches of salmon in North River in 2002 were estimated to be 5 small and 17 large salmon.





The conservation requirement for the North River is 0.85 million eggs expected from 200 large and 30 small salmon. Small salmon escapement was about 47% of requirement, large salmon were about 20% of requirement. Therefore, egg conservation requirements were unlikely to have been met in 2002.

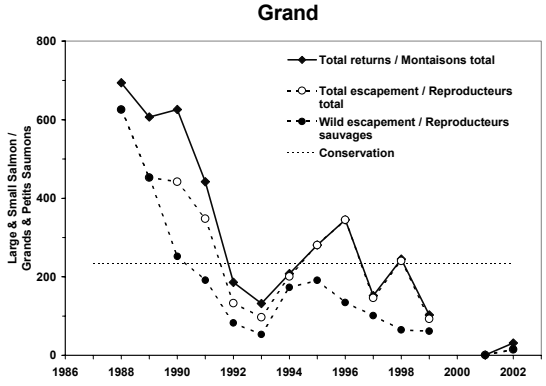
No sampling for juvenile salmon was conducted in the North River during 2002.

Grand River is obstructed to salmon passage at low discharge by a falls located 10.2 km upstream of head-of-tide. A fishway at the falls passes about 60% of small and 43% of large salmon. Most salmon are small, the few large fish are usually repeat-spawning 1SW fish. About 45% of the total juvenile production potential is upstream of the falls. There are now no stocked fish contributing to returns.

The salmon movements at the Grand River fishway have not been monitored since 2000. Returns to the fishway in 2001 and 2002, estimated from recreational catches and an assumed catch rate of 0.5, were 32 fish in 2002, up from 1 fish in 2001.

Losses of salmon from angling mortality and illegal catches of salmon in the Grand River in 2002 were estimated to be 13 small and 3 large salmon.

Low returns in recent years of wild fish to Grand River, suggest a low probability that egg conservation requirements were met. The conservation requirements upstream of the fishway are 475,000 eggs which is the production expected from about 234 salmon.

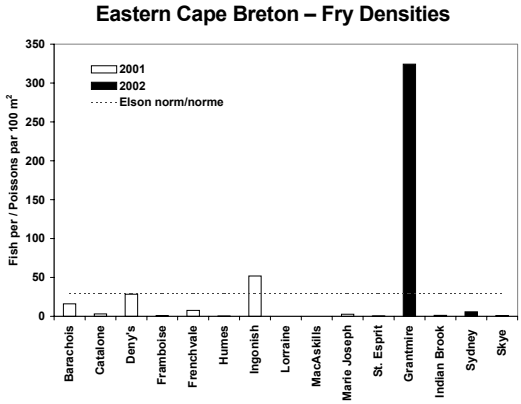


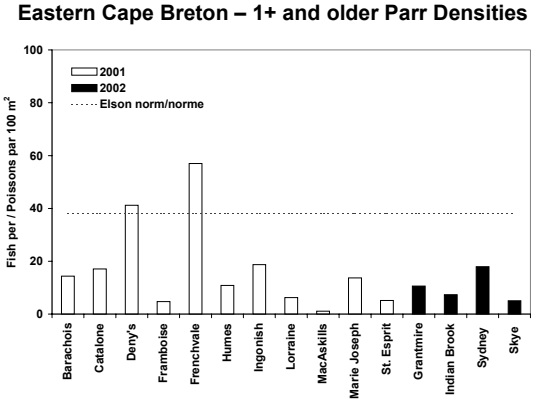
No juvenile density estimates are available for this river in 2002, however a few juveniles were captured and tissue sampled.

In 2002, juvenile salmon density estimates were conducted at one location in each of the Skye and Sydne**y** rivers, and Grantmire and Indian brooks, Cape Breton County.

Fry density was above the Elson norm in only the Grantmire Brook in 2002. However, because this density is based on a single site it may not be indicative of high spawner escapement in 2001.

Age-1+ and older parr densities, stages that have had more time to distribute within a river, are less susceptible to low sample size uncertainty. In 2002, all four rivers sampled were below the Elson norm for age-1+ and older parr. These data support the conclusion that recent escapements have generally been below conservation requirements in SFA 19 rivers.





Outlook

The outlook is based on the average returns in recent years.

For the **Middle River**, the forecast (based on 5 year average) of small and large salmon returns in 2003 is about 250 fish (70-457). The probability of returns exceeding the conservation requirement (550 fish) is about 1%.

For the **Baddeck River**, the forecast (based on 3 year average) of returns in 2003 is about 160 fish (69-259) and the probability of exceeding the conservation requirement of 530 salmon is near zero.

The projected return (based on 3 year average) of small and large salmon to **North River** in 2003 is about 270 fish (46-629). The probability of exceeding the conservation requirement of 230 fish is 64%.

For **Grand River,** the forecast (based on 4 year average) of wild salmon returns to the fishway in 2003 is about 40 fish (7-95). The probability of exceeding the conservation requirement of 234 fish is near zero.

Management Considerations

On the basis of adult escapements, conservation requirements were unlikely achieved in recent years on the **Middle, North** and **Baddeck** rivers. Expectations are that returns to most rivers in SFA 19 in 2003 will not meet conservation requirements.

The **Grand River** salmon did not meet the conservation requirement upriver of the fishway in 1999 and 2000. As in 2001 and 2002, returns in 2003 are now totally dependent on wild production, a component that has not met requirements since 1990. Therefore, it is unlikely that conservation requirements will be met in 2003.

Based on observations of juvenile salmon in 2001 and 2002, recent management plans have been successful in maintaining densities in some rivers despite low returns of salmon. These results are in part attributed to low harvests due to conservative management. Declining trends in adult returns to the monitored rivers in Eastern Cape Breton, together with declines noted in most other rivers of Maritimes Region indicate the need for continued conservative management.

Eastern and Southern Shores of Nova Scotia (SFAs 20 and 21)

Assessment of the status of salmon in rivers of the eastern and southern shores of Nova Scotia was last done in 1999 (DFO 2000a). Updates were provided in 2000 and in 2001 (DFO 2001, 2002) and are again provided here for 2002.

Rivers of SFAs 20 and 21 are generally organic-acid stained, of lower productivity, and, when combined with acid precipitation can result in acidic conditions toxic to salmon. At pH below 5.1, salmon production is considered unstable and only remnant populations may persist. Interspersed within drainages are areas of limestone rich soils (drumlins) that provide local areas of less acidified water. At least 65 rivers within the geological area known as the Southern Upland of Nova Scotia (most of SFAs 20 and 21) were known to maintain salmon populations.

As of 1986 fourteen rivers in SFA 20 and eight rivers in SFA 21 were **low- or non-acidified (**pH greater than 5.1) and had a history of Atlantic salmon angling catch. Two of these rivers, St. Mary's River (SFA 20) and LaHave River above Morgans Falls (SFA 21) have been used as index rivers.

As of 1986 there were twenty rivers that were **partially acidified** where main-river annual mean pH is between 4.7 and 5.0. At least fourteen rivers were **heavily acidified** (<pH 4.7) and had lost their population of Atlantic salmon.

Population simulation analysis indicated that at those acidity levels and 5% marine survival only seven of 47 rivers on the Southern Upland were expected to be self sustaining (DFO 2000c). Since that analysis, pH has not improved and marine survival of wild salmon has averaged only 3%.

There is evidence that despite reduction in sulphate depositions, pH in Southern Upland rivers has not recovered at rates observed in other geographic areas. Recoveries of elements like calcium, necessary for growth and development of fish are now expected to take as long as fifty to one hundred years in waters of the Southern Upland. Some of these rivers are additionally impacted by impoundment for hydroelectric or domestic water use.

Status

Low- or non-acidified rivers

Conservation requirements have been assigned for two low acidified rivers: 1.9 million eggs equivalent to 1,320 fish for the LaHave River above Morgans Falls, and 7.4 million eggs equivalent to 3,155 fish for the entire St. Mary's River.

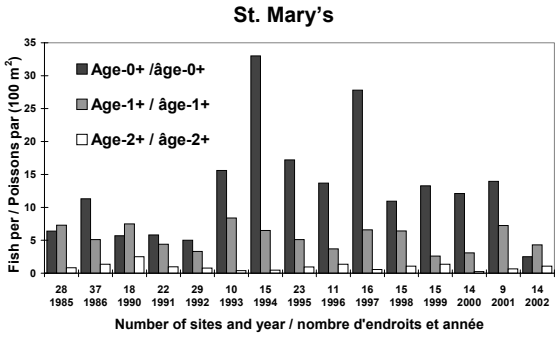
In the **St. Mary's River** escapement estimates were obtained from recreational catches (1996 and earlier) and from mark and recapture experiments (1997 to 2001). In 2002 a mark recapture experiment was attempted but water levels increased before fish could be recaptured. A total of 29 small and 3 large salmon were captured and marked. The October 2 and 3, catch was used to derive the 2002 estimate for the West River St. Mary's. The estimate was derived from the mean catch rate of 0.13 (0.06–0.20) for seining operations conducted at the same locations as sampled in 2002.

The estimated escapement to the West River St. Mary's, in 2002, was 236 fish (153 – 518) of which 94% were small salmon. Based on the proportion of habitat sampled, total escapement to St. Mary's River in 2002 was estimated to be about 430 fish that yielded 14% of the egg requirement for the entire river.

Escapement Estimates
St. Mary's River

Year	Small	Large	% Egg Conservation
1995	2038	437	92
1996	1535	590	93
1997	709	110	28
1998	1926	74	55
1999	559	150	30
2000	572	46	16
2001	580	195	30
2002	400	30	14

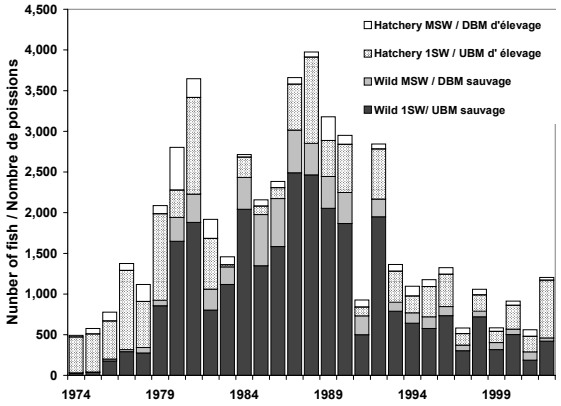
In 2002, total parr (age-1+ and age-2+) densities are the fifth lowest in the 1985 to 2002 series. Fry (age-0+) densities in 2002 are the lowest in the time series.



Counts at Morgans Falls fishway on the **LaHave River** were 1,204 fish (1,133 small and 71 large salmon) which was 109% of the egg requirement in 2002. After broodstock removals, egg deposition was 94% of the egg requirement. The count of wild salmon (423 small and 38 large) improved from the record low of 290 salmon in 2001 but was the ninth lowest since 1974, five years after the fishway began operation.

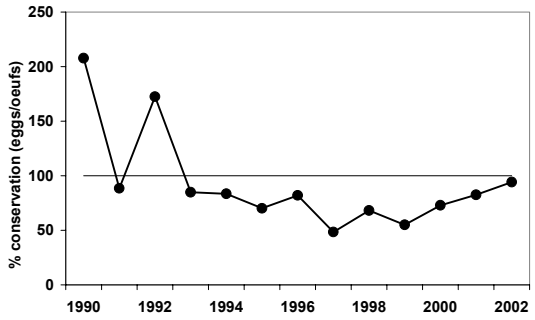
Hatchery origin fish contributed 53% of the estimated egg deposition after removals.

LaHave at Morgans Falls



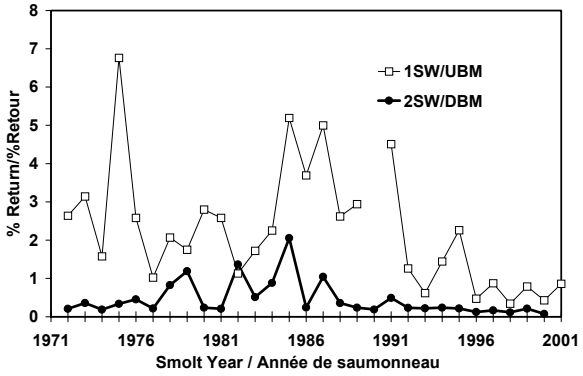
This is the tenth consecutive year that egg deposition above Morgans Falls has been less than the conservation requirement.

LaHave above Morgans Falls



The return rate of 2001 hatchery smolts as 1SW fish in 2002 increased to 0.86% from 0.43% the previous year. Returns of 2SW hatchery salmon in 2002 (the 2000 smolt class) decreased to 0.07% from 0.21% the previous year. The 1SW return rate was greater than the five-year mean of 0.66% from hatchery stocked smolts. The return rate as 2SW fish from hatchery smolt stocked in 2000 was less than the five-year mean of 0.14%.

LaHave at Morgans Falls

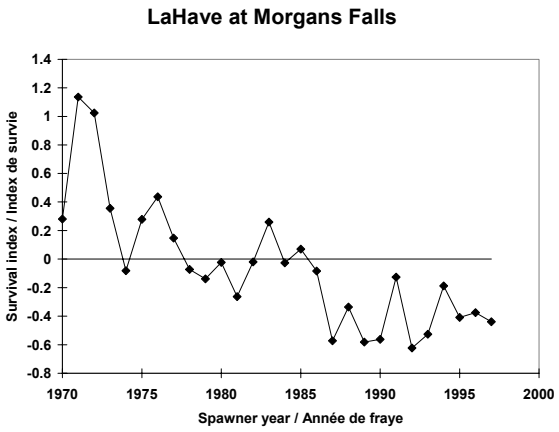


In 2002, a total of 11,860 wild smolts was estimated to have migrated from above Morgans Falls, the second lowest since 1996. The return rate of wild smolts emigrating from above Morgans Falls in 2001 was 2.70%, which is lower than the five-year average of 3.01%.

LaHave River above Morgans Falls

Smolt year	Wild smolts Estimate	Wild smolts per 100 m²	Return rate to 1SW
1996	20510 (19890 – 21090)	0.40	1.47%
1997	16550 (16000 – 17100)	0.32	4.33%
1998	15600 (14700 – 16625)	0.31	2.04%
1999	10420 (9760 – 11060)	0.20	4.82%
2000	16300 (15950 – 16700)	0.32	1.16%
2001	15700 (15230 -16070)	0.31	2.70%
2002	11860 (11510 – 12210)	0.23	-

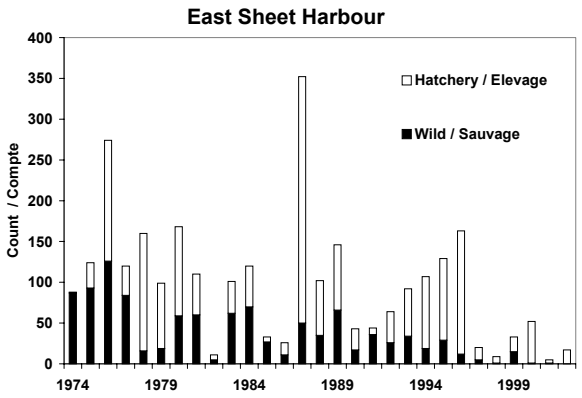
Survival of wild salmon, as inferred from recruits per spawner above Morgans Falls, indicates that the population has not replaced itself (values above 0) since 1985.



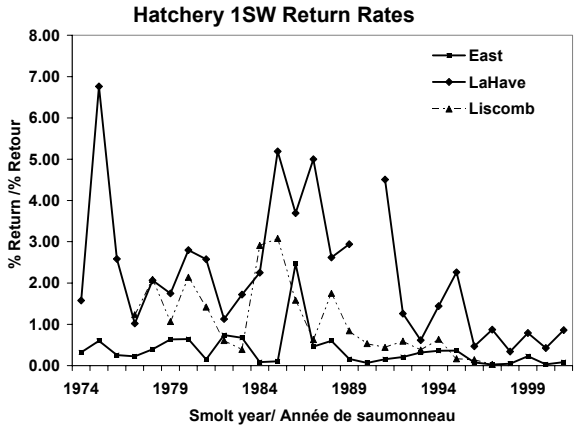
The status of other low-acidified rivers in SFAs 20 and 21, that are still capable of producing wild Atlantic salmon, is expected to be similar or worse than the index rivers. Dissimilarities in the status of salmon stocks among rivers of these SFAs may be attributed to the levels of acidification and to supplementation with hatchery fish. LaHave River above Morgan Falls was the most heavily stocked river on the Southern Upland with 93,543 smolts stocked in 2001. Despite this level of stocking and no significant harvest fisheries this area of the river barely attained the target egg deposition of 1.96 million eggs before broodstock removals.

Partially-acidified rivers

The **East River Sheet Harbour** fishway count data, 1974 to 2002, is provided as an indicator for this class of river in SFA 20. Counts at the East River Sheet Harbour fishway, have been low for the previous five years and totalled 17 fish in 2002, only one of which was a multi-sea-winter salmon.



Mortality of stocked smolts attributed to low pH (i.e., increased acidity) may account for the difference in the hatchery smolt return rate to this river. Returns of 1SW salmon from hatchery smolts stocked in LaHave River, a low acid-impacted river, were consistently higher, than those stocked in the East River Sheet Harbour and the Liscomb River, both partially acidified rivers.



Heavily acidified rivers

Heavily acidified rivers can no longer support the production of salmon. Only the **Mersey River** received hatchery enhancement of LaHave and Tusket smolts in 2002. Enhancement of the **Clyde** and **Jordan** rivers was last conducted in 2000.

Outlook

Low- or non-acidified rivers

Based on the average estimated return to **St. Mary's River** from 1998 to 2002 of 700 small salmon (100 – 1300) and 200 large salmon (30 – 350), there is less than a 1% chance that returns of large and small salmon will exceed the conservation requirement in 2003.

For **LaHave River** above Morgans Falls, forecast models based on cohorts for MSW salmon and five-year average return rates and number of smolts migrating in 2002, suggest less than a 25% chance that salmon returning in 2003 will be greater than the conservation requirement. About 20% of the forecast return is expected to originate from 32,937 hatchery smolts stocked at or above Morgans Falls in 2002.

Based on the number of wild smolts emigrating from above Morgans Falls in 2001 and 2002, there is less than a 5% chance that returns of wild small and large salmon to Morgans Falls in year 2003 will be sufficient to meet conservation requirements.

Returns of wild salmon to LaHave River above Morgans Falls have been below replacement since 1986. A measure of generation-to-generation survival shows a consistent decline, despite lower escapements. These trends do not indicate a recovery of salmon stocks in SFA 20 and 21.

Hatchery smolts stocked in low- or non-acidified rivers are expected to return at rates (0.66%) similar to those observed at Morgans Falls. Some contribution from 0+ parr stocked in several rivers will also contribute to salmon returns in 2003.

Smolt releases in 2002		
River	Origin of Stock	No. of smolt
LaHave	LaHave	36,800
Musquodoboit	Musquodoboit	18,200

Partially-acidified rivers

Persistent low pH, declining wild salmon returns and low smolt-to-adult return rates indicate that wild returns will be inadequate to meet conservation requirements in 2003. Survival rates of hatchery smolts in recent years suggest that returns in 2003 will provide insufficient augmentation to meet conservation levels.

Smolt releases in 2002		
River	Origin of Stock	No. of smolt
Sackville	Sackville	9,000
Tusket	Tusket	38,700
Medway	Medway	22,900
Salmon(Digby)	Salmon(Digby)	14,900
East R. Sh. Hb.	East R. Sh. Hbr.	12,200

Heavily acidified rivers

Only the **Mersey River** received hatchery smolts from LaHave and Tusket River origins in 2002. Salmon returns to the Mersey River in 2003 are expected to be minimal. A salmon broodstock collection from the Mersey River was unsuccessful in 2002 due to low returns and harvests below the fishway. Returns to heavily acidified rivers are expected to be low in 2003.

Smolt releases in 2002		
River	Origin of Stock	No. of smolt
Mersey	LaHave, Tusket	8,500

Management Considerations

Based on the status and recent performance of the wild salmon stock above Morgans Falls on the **LaHave River** and estimates of returns to **St. Mary's River**, rivers in SFA 20 and 21 are not expected to achieve conservation requirements in 2003. Return rates of hatchery smolts remain at levels where rivers receiving hatchery supplementation, are again not likely to meet conservation requirements in 2003.

The opportunity for harvests of returning adipose fin-clipped salmon from stocking of hatchery smolts to the heavily acidified Mersey River will be minimal in 2003. Reduced stocking of these heavily impacted rivers is the result of increased demands to utilize N.S. Biodiversity facilities for the preservation of salmon stocks threatened with extinction and recovery of salmon populations in donor rivers. Preservation of "endangered" populations of Atlantic Whitefish (*Coregonus huntsmani*) and inner Bay of Fundy Atlantic salmon has the highest priority for space at these facilities.

Egg depositions from hatchery origin salmon in excess of wild origin salmon in monitored rivers require careful consideration. In these circumstances, future supplementation programs need to utilise options that increase the probability of persistence of the residual wild salmon populations while maintaining genetic diversity. Establishment of living gene banks for the remaining wild populations of the Southern Upland has been initiated and needs to be expanded.

Inner Bay of Fundy (SFA 22 and part of SFA 23)

A formal assessment of the status of salmon in rivers of the **inner Bay of Fundy** (**iBoF**) was last done in 1998. Updates have been provided in 1999 (DFO 2000), 2000 (DFO 2001), 2001 (DFO 2002) and are provided here for 2002. On the basis of data collected to 1999, salmon of the iBoF were classified as "endangered" by the Committee On the Status of Endangered Wildlife in Canada (COSEWIC) in May, 2001.

Salmon of the iBoF are known to have occupied at least 32 rivers (22 rivers of SFA 22 in Nova Scotia and 10 rivers in SFA 23, New Brunswick) and suspected to have occupied most rivers and streams where migration was not obstructed by natural barriers. Rivers in these areas have a variety of habitats and are well suited to the production of salmon. In general, habitat is impacted by forest harvesting and agriculture practices to varying degrees but because of the underlying geology, waters in rivers of the iBoF are not susceptible to acidification. Some rivers have lost their salmon production because of man-made barriers to migration, reduced fish passage and resulting loss in production e.g. Petiticodiac, Shepody, and Avon rivers. The Petiticodiac River represents about 22% of the salmon production potential of the inner Bay of Fundy.

Moderate-to-high production of salmon has been documented in many of these rivers as recently as 1985 and no widespread degradation of freshwater habitat is known to have occurred since.

Salmon of the iBoF are composed of at least two distinct population segments with independent evolutionary histories.

The distinctness of iBoF salmon from other populations has been recognised for over a century. This recognition was based on observation that salmon usually enter these rivers in the fall of the year, have a high proportion that return to spawn after one winter at sea and have annual population abundance that differs from other salmon stocks. Tagging of wild and hatchery smolts indicated that salmon from iBoF rivers rarely migrate to the North Atlantic Ocean, and had higher survival between consecutive spawning years.

Historic catches of iBoF salmon averaged 1,061 fish in the commercial fishery (1970-1984), and 1,462 small salmon and 597 large salmon, in the recreational fishery (1970 - 1990). Two rivers, the Big Salmon River, New Brunswick, and Stewiacke River, Nova Scotia, accounted for more than half of the historic recreational catch.

Status

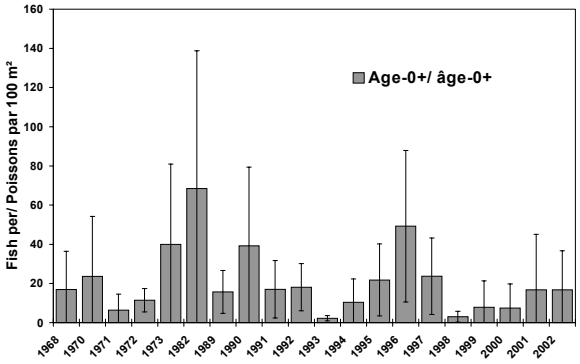
These rivers are assessed through counting of adult salmon at a fishway, streamside observation and diver counts of adult salmon in the clearer more visible rivers, electrofishing of juvenile salmon, and monitoring smolt migration. No quantitative data or qualitative observations indicated that adult salmon returns have increased in recent years.

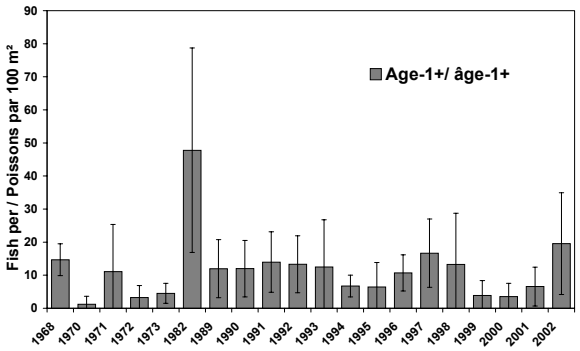
A qualitative survey of the adult salmon population in the **Big Salmon River** in 2002 was conducted by diver counts on four occasions. On August 27, 2002, a total of 17 Atlantic salmon and 23 rainbow trout (*Oncorhynchus mykiss*) were observed in the lower river. On September 3, four small salmon were observed in a diver survey of three pools in the upper river. On September 18, a total of ten salmon were observed during a diver survey in the lower section, and no salmon were observed in a diver survey in the upper river. Two salmon were observed during a diver survey on October 23 and 24. A complete mark and recapture population estimate was not feasible because of the low number of fish observed. No hatchery or escaped-farmed salmon were noted.

An estimated 6,300 (4,100-13,700) smolts emigrated from Big Salmon River in 2002, including 4,300 wild smolt and 2,000 that were stocked as fall fingerlings. The 2002 wild smolt run equates to 0.69 smolts per 100 m^2 or 29% of the average smolt production monitored from 1966 to 1972. In 2001, wild smolt emigration was estimated to have been 5,300 (4,100-8,100) fish.

Between three and seven sites have been electrofished on the Big Salmon River, annually since 1989 and intermittently since 1968, providing a record of the abundance of juvenile salmon within the watershed. The densities of parr increased from 1996 to 1998 as a result of supplementation through the release of cage-reared broodstock in 1994 and 1995. This increase indicated the effectiveness of cage-reared broodstock for increasing in-river juvenile populations. Densities of both age-0+ parr and age-1+ parr in the Big Salmon River subsequently decreased with reduced adult salmon abundance. Hatchery raised un-fed fry and feeding fry, a product of the iBoF Living Gene Bank (LGB), were released into the Big Salmon River in 2001 and 2002. As a result, densities of both 0+ and 1+ salmon increased at the electrofishing survey sites in 2001 and 2002.

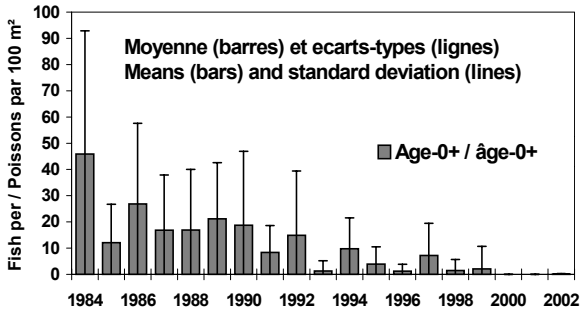
Big Salmon River

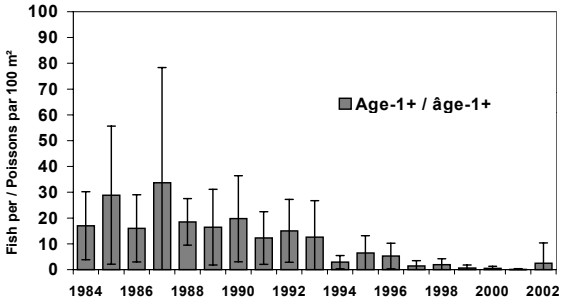




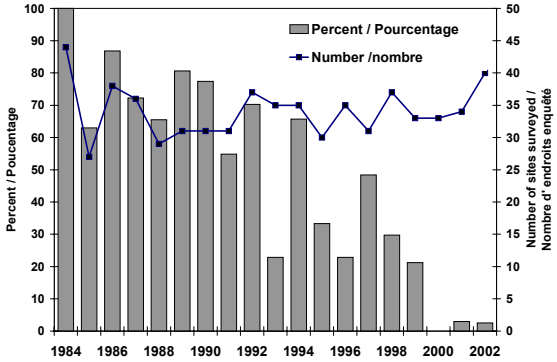
Electrofishing at 40 sites in the **Stewiacke River** in 2002 indicated a continued low abundance of juvenile salmon. The average density of age-0+ parr was 0.05 per 100m^2, and the density of age-1+ parr was 2.50 per 100 m^2. The increase in juvenile densities from 2001 was the result of the release of 230,000 LGB progeny (fry and parr) at 42 sites in the Stewiacke River in 2001 and 2002. Age-0+ parr were found in only 1 of 40 locations sampled, in 2002. That single location in Goshen Brook, a tributary midway up the main Stewiacke River, contained a density of 1.8 fry per 100 m^2. It is close to a LGB release site.

Stewiacke



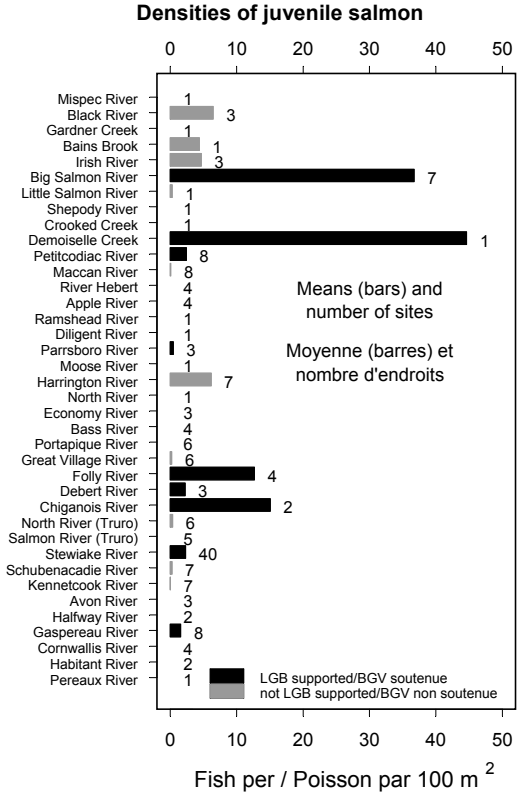


Stewiacke River Electrofishing Sites Containing Age-0+ Parr



During 2002, an intensive electrofishing survey of inner Bay of Fundy rivers was undertaken to assess the status of juvenile salmon in these rivers. Including the Big Salmon and Stewiacke Rivers, 171 sites were electrofished in 38 watersheds, including 129 single-pass surveys, 26 mark-recapture surveys, and 16 multiple-pass surveys. No salmon were captured in 19 of the 38 rivers. In rivers where salmon were captured, but without LGB support, the density ranged from 0.03 fish per 100 m^2 (Kennetcook River) to 6.4 fish per

100 m^2 (Black River), with an average density of 2.3 fish per 100 m^2.



Salmon of the **Gaspereau River**, Kings County, Nova Scotia, although genetically identified as an iBoF salmon stock, migrate to the northwest Atlantic, and follow a recruitment and life history pattern similar to other Atlantic coast rivers. In 2002, a total of 14 fish (6 hatchery and 8 wild) were counted at the new White Rock Dam fishway installed upriver of the old timber fishway at the powerhouse. This number of fish could potentially provide only 8% of the conservation egg requirement. All fish were retained for the LGB program.

Counts at the White Rock Dam Fishway, Gaspereau

			Year				
	Origin	Size	1998	1999	2000	2001	2002
Escapement	Wild	Large	6	11	3	6	0
		Small	9	1	7	7	0
	Hatchery	Large	10	13	4	10	0
		Small	42	0	30	5	0
Broodstock	Wild	Large	3	14	4	14	0
		Small	7	2	14	6	8
	Hatchery	Large	2	0	9	3	4
		Small	20	0	5	6	2
Total count		Large	21	38	20	33	4
		Small	78	3	56	24	10
Total count all sizes			99	41	76	57	14
%		counted	56	30	16	24	8
Conservation		escapement	42	15	9	18	0

A LGB program to prevent the extirpation of inner Bay of Fundy salmon was initiated in 1998. Fish of various ages, from eggs to adults, are being held in captivity to prevent the loss of these stocks. These fish originate primarily from two river stocks (Stewiacke and Big Salmon), although nine other rivers are also represented in the program (Gaspereau, Folly, Economy, Great Village, Harrington, Portapique, Debert, Black and Irish).

Living Gene Bank Holdings December 2002

Province	Life Stage			
River of origin	Egg	Parr	Post-Smolt	Adult
Nova Scotia:				
Gaspereau	45,000	28,000	34	26
Stewiacke	800,000	15,000		502
Great Village		57		
Economy		56		
Harrington		200		
Portapique		10		
Folly		2		
Debert		2		
New Brunswick:				
Big Salmon	790,000	41,000	1,300	402
Black			217	
Irish			6	

LGB progeny were released in nine inner Bay of Fundy rivers during 2001 and 2002. All fish released into New Brunswick iBoF rivers were progeny of Big Salmon River salmon. All fish released into Nova Scotia iBoF rivers were progeny of Stewiacke River salmon, with the exception of the

Gaspereau River which received progeny of native fish.

Living Gene Bank Releases

Year / River	Life Stage				
	Fry	0+ Parr	1+ Parr	Smolt	Adult
2001:					
Big Salmon	185,000	78,000			
Stewiacke	42,000	34,000			
Gaspereau		43,000		11,000	
Demoiselle	16,000				
2002:					
Big Salmon	139,000	34,000		20,000	
Stewiacke	66,000	88,000		6,000	
Petitcodiac	56,000				53
Folly	59,000	25,000			
Debert	37,000	46,000			
Gaspereau	7,000			17,000	
Chiganois	51,000	37,000			
Salmon					189
Demoiselle	10,000		1,000		

Outlook

Atlantic salmon spawners and juveniles of the **iBoF** are critically low. It is unlikely that any salmon surplus to conservation will be available until there are at least three generations of recovery.

The **Gaspereau River** (above the White Rock Dam) has received hatchery supplementation, did not meet conservation requirements between 1998 and 2002, and is not expected to do so in 2003.

Management Considerations

The **iBoF** salmon population is critically low. Both smolt production and marine survival remain very low and all adult recruitment is required for spawning. Special measures, such as the LGB program, are required to prevent extirpation of iBoF salmon. Recovery of these stocks is not anticipated in less than 3 generations.

Outer Bay of Fundy (western part of SFA 23)

The last assessment of rivers of the outer Bay of Fundy was for 2001 (DFO 2002). The following information is an update of that document, with the addition of data (1992-2002) for six additional electrofishing sites upstream of Mactaquac and estimates of Nashwaak River smolt return rates as 2SW salmon. Information for the Magaguadavic and St. Croix river assessments continues to be provided courtesy of the Atlantic Salmon Federation and St. Croix River International Waterway Commission, respectively.

Salmon populations of the western part of SFA 23 are bounded on the east by the “endangered” inner Bay of Fundy populations and on the west by the United States “endangered” populations of eastern Maine. By virtue of their exclusion from either listing, outer Bay of Fundy populations may be considered distinct. Similar to listed populations, many outer Bay populations have also declined precipitously and have failed to meet egg conservation requirements for 15 or more years.

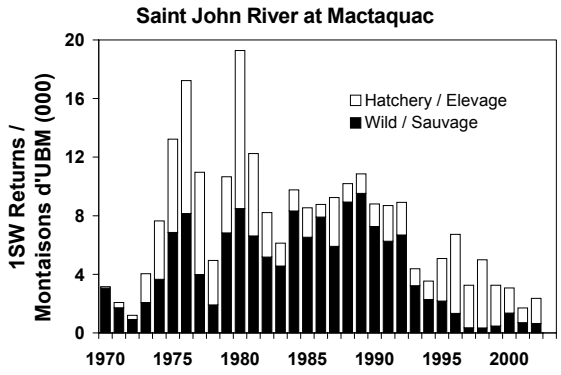
Many of these outer Bay stocks face a multitude of constraints including hydroelectric dams (with upriver passage facilities but mostly devoid of safe downstream passage) artificial flow regimes, headponds, significant industrial, and municipal effluents, run-off from intensive agricultural operations, and developing communities of potentially effective invasive predators on juveniles and smolts. As well, escapes from the Fundy-Isle (NB) or Cobscook Bay (ME) aquaculture industry are the most probable source of escapes identified at all primary counting facilities.

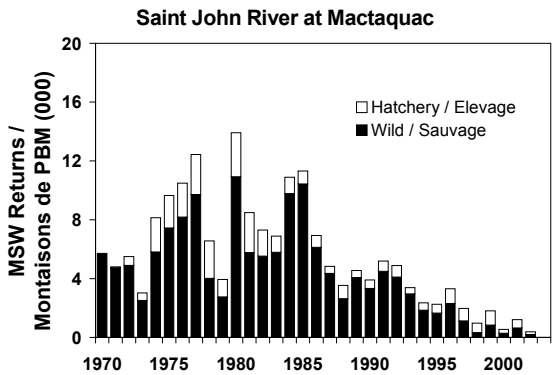
Status

Saint John River upstream of Mactaquac

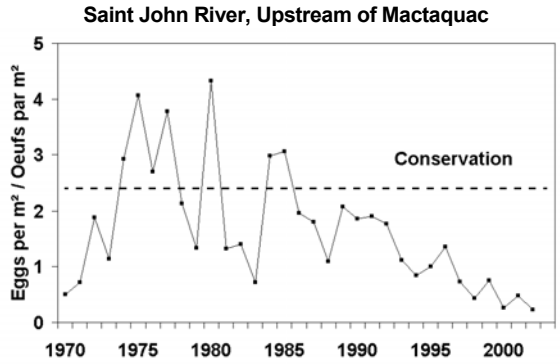
The total count of salmon at **Mactaquac** on the **Saint John River** dam in 2002 was 2,715 fish. Total returns (including estimated losses downriver of Mactaquac) were 2,358 1SW and 376 MSW salmon. An additional 13 fish were identified as farm escapes. About 27% of 1SW and 54% of MSW returns were of wild origin. Despite high discharge levels in July, which could have delayed entry into the fishway, the run-timing in 2002 was similar to previous years.

1SW returns were the fourth lowest and MSW returns were the lowest of the 33-year record. For wild 1SW fish the lowest returns on record have been observed in 7 of the last 10 years; for wild MSW fish the lowest returns have been observed in 9 of the last 10 years.

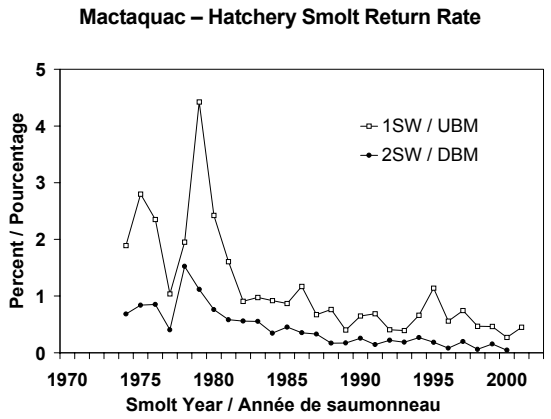




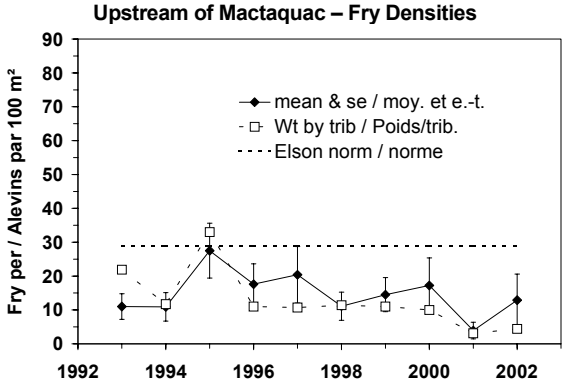
Spawning escapement upriver of Mactaquac in 2002 was an estimated 209 MSW (44% wild) and 2,165 1SW (25% wild) salmon. Eighty-six percent of escaping MSW fish were female, while only 7% of escaping 1SW fish were female. Conservation requirement upriver of Mactaquac is 32.3 million eggs to be provided by 4,900 MSW and 4,900 1SW fish. Only 6% of the conservation egg requirement was met which is the lowest value in 33 years. Hatchery-origin fish provided 53% of the eggs. A total of 844,000 eggs (30% reduction from 2001), representing 31% of the total eggs arriving at Mactaquac, were retained for hatchery incubation and rearing. These eggs came from 105 MSW and two 1SW female salmon of which 67% were wild origin fish. Eggs in total returns (3.1 million) would have accounted for 10% of conservation requirement.



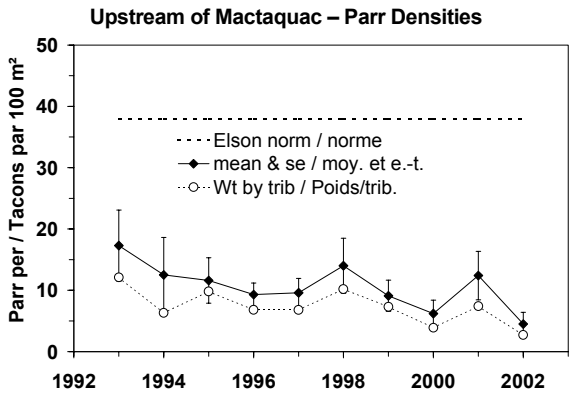
Aged returns from reared smolts released via the Mactaquac smolt migration channel have been used as an index of marine survival. Return rates remain low at 0.45% for 1SW and 0.05% for 2SW salmon.



Mean densities of wild fry (age-0+) at 21 sites upriver of Mactaquac were 12.9 fry per 100 m^2; mean densities weighted according to relative production area of the tributaries in which they are located were only 4.4 fry per 100 m^2. The weighted mean value is the second lowest estimated since 1993 and consistent with low egg depositions in 2001.



Mean densities of age-1+ and older wild parr at the same 21 sites were 4.5 parr per 100 m^2; mean densities weighted according to relative production area were 2.7 parr per 100 m^2. These values are the lowest observed since 1993 and consistent with the record low fry densities in 2001, and egg deposition in 2000.

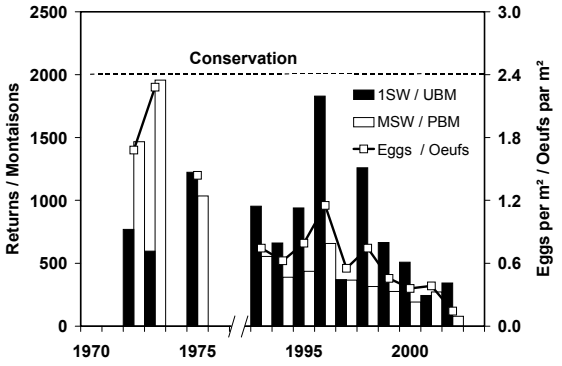


Saint John River downstream of Mactaquac

Counts at the **Nashwaak River** fence in 2002 numbered 343 1SW and 79 MSW salmon. Unlike most years but similar to 2001, the count was complete and therefore a late-season mark-and-recapture estimate was not required. Scale analysis revealed that one 1SW and six MSW salmon were believed to be of hatchery origin and likely originated from a non-government organization (NGO) enhancement project. No suspected farm escapes were identified at the fence or during ageing of the scales.

Returns of 1SW salmon increased by 40% over those in 2001 but were the second lowest since 1993. MSW returns decreased 70% from 2001 and were the lowest since 1993 and only 40% of the previous lowest return.

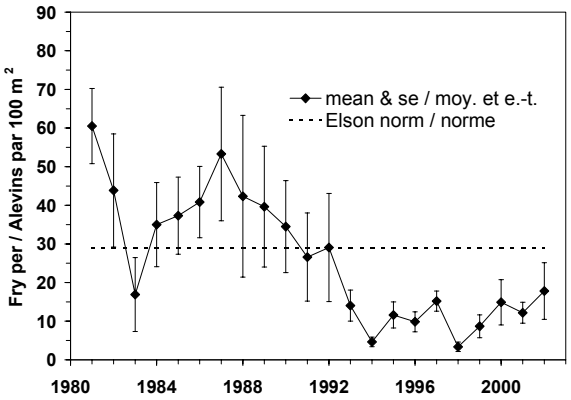
Nashwaak



The conservation egg requirement (12.8 million) upstream of the fence is expected from 2,040 MSW salmon and an equal number of 1SW salmon to provide male spawners. Escapement of about 320 1SW and 70 MSW salmon indicates that egg deposition in 2002 was only about 6% of the requirement. Females among 1SW salmon (30%) contributed almost half (46%) of the estimated egg deposition. Approximately 53,000 eggs, representing less than 7% of the total eggs returning to the Nashwaak, were retained for future NGO enhancement activities on the river. Female broodstock consisted of seven MSW and seven 1SW wild salmon and were mated with 10 male 1SW (wild) salmon.

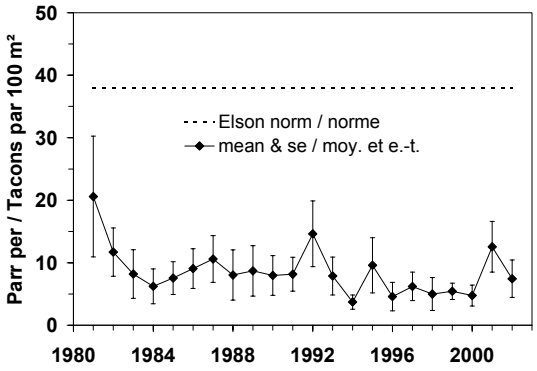
Juvenile densities have been monitored since 1981 at six sites upriver and one site downriver of the Nashwaak River counting fence. A mean fry density of 17.8 fish per 100 m^2 in 2002, was the highest value since 1992. Fry densities since 1981 have trended downwards and since 1993 have fluctuated around 11 fry per 100 m^2 or about one-third the Elson norm.

Nashwaak – Fry Densities



A mean density of 7.4 parr per 100 m^2 for the same seven sites in 2002 was down from the 12.6 parr per 100 m^2 in 2001 but similar to the previous 10-year average, and less than one quarter of the Elson norm.

Nashwaak – Parr Densities

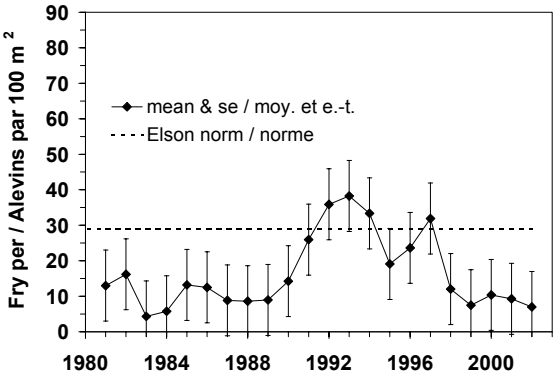


Smolts emigrating from upstream of the fence site in 2002 were estimated to number 15,000 (12,300 – 19,000) fish or 0.28 smolts per 100 m^2. This is about 35% higher than the number estimated in 2001. The percentage of wild smolts returning as 1SW salmon in 2002 was 3.1% - twice that of the 1999 and 2000 smolt classes. Only 0.3% of the 2000 smolt class returned as 2SW salmon in 2002 - about one third of the return rate observed from the 1999 smolt class.

Nashwaak River				
	Wild Smolts		% Return	
Smolt Year	Estimate	per 100 m²	to 1SW	to 2SW
1998	22750 (17900 – 32850)	0.43	2.9	0.7
1999	28500 (25300 – 33200)	0.53	1.8	0.8
2000	15800 (13400 – 19700)	0.30	1.5	0.3
2001	11000 (8100 – 17400)	0.21	3.1	
2002	15000 (12300 – 19000)	0.28		

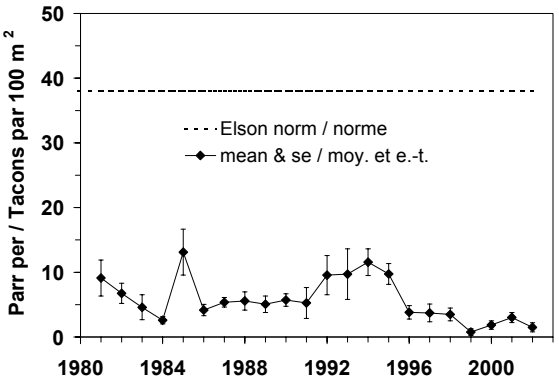
Adult returns to the headwaters of the **Kennebecasis River** were assessed in 1996 and 1997 and found to be less than 50% of egg conservation requirement. Juvenile densities have been monitored since 1981 at four sites. Fry densities in 2002, averaged 7.0 fish per 100 m^2, similar to that for 1999, but less than one-third the Elson norm and the lowest since 1984.

Kennebecasis – Fry Densities



A value of 1.5 parr per 100 m^2 in 2002 was the second lowest of the 22 year data series and less than 5% of the Elson norm.

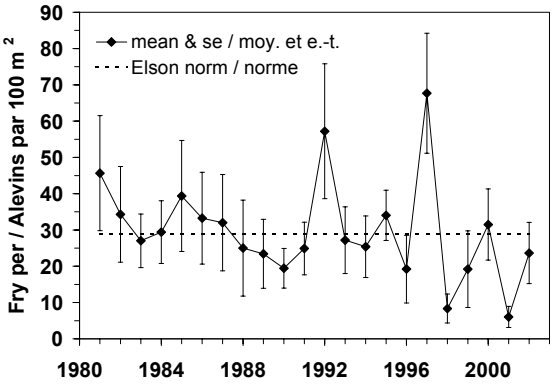
Kennebecasis – Parr Densities



There was no assessment of adults returning to the **Hammond River** in 2002. The last and only recent assessment of adults was in 1998 when it was estimated that about 30% of the conservation requirement was met.

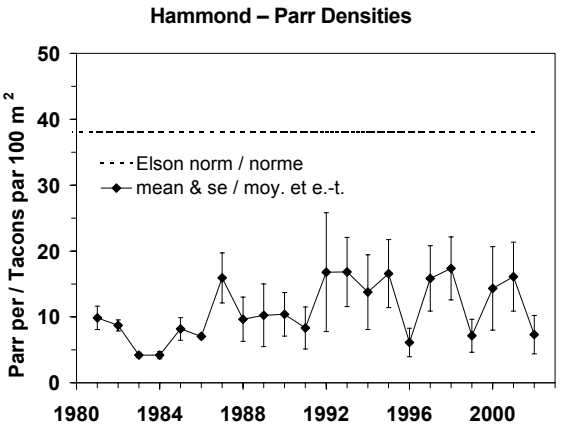
In 2002, fry densities at four sites averaged 23.7 fish per 100 m^2, four times higher than the observed density in 2001 and similar to the 10-year average density (exclusive of the value for 1997 which was influenced by hatchery stocking). In general, fry densities have declined since 1981 and have been at or below the Elson norm in the last five years.

Hammond – Fry Densities



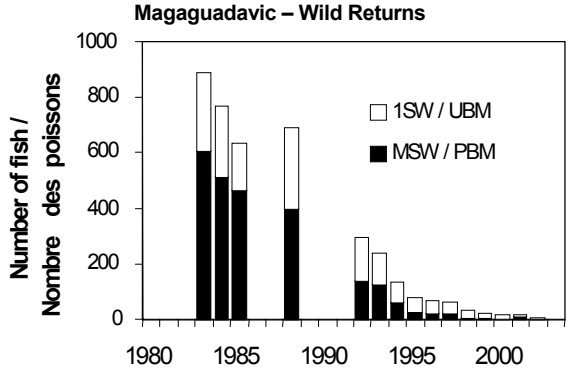
Densities of parr in 2002 averaged 7.3 fish per 100 m^2, consistent with the record low fry density in 2001. Parr densities on the Hammond have generally been 2-3 times greater than

those of either the Nashwaak or Kennebecasis rivers but remain below the Elson norm. The influence of hatchery stocking by NGO's on these densities is believed to be minimal.

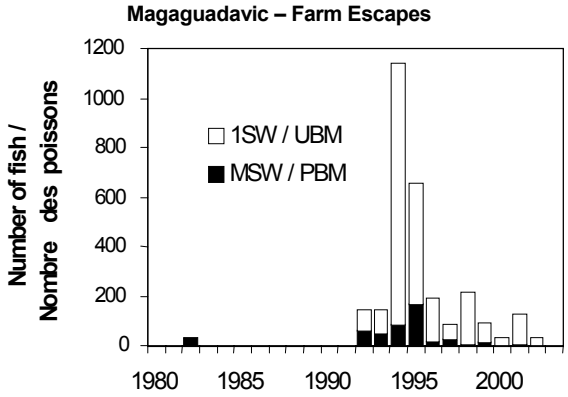


Other outer Bay of Fundy rivers

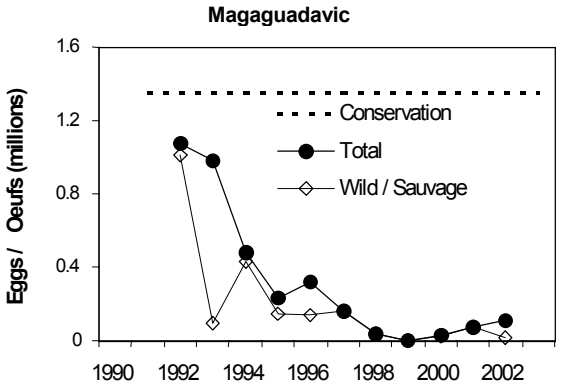
Wild returns to the St. George fishway and trap located at the head-of-tide on the **Magaguadavic River** in 2002 numbered only 7 1SW and zero MSW salmon, the lowest returns on record.



Farm escapes ascending the fishway in 2002, numbered 6 postsmolts, 29 1SW, and zero MSW salmon and were in total the second lowest on record. No fish tested positive for ISA virus.



Interim conservation requirement is 1.35 million eggs from 230 MSW and 140 1SW salmon, an objective which in all likelihood was met by returns in the 1980s. In 2002, 3 male and 4 female wild return 1SW salmon were released to the river and potentially deposited an estimated 13,700 eggs. In addition 103 captive-reared adults, progeny of 1998 wild adult returns were released into the river. Based on secondary sexual characteristics, fifty-six (20 females) of those fish were mature. Total potential egg deposition was 122,500 eggs representing only 9.1% of the river's conservation requirement.

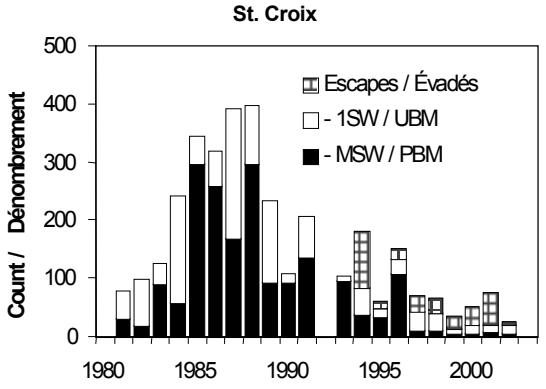


Surveys of juvenile salmon in 1995, 1997 and 1999 to 2001 revealed low fry and highly variable parr densities. Also found were parr escapes (14.0 and 18.7 parr per 100 m^2 in 1999 and 2000, respectively) from hatcheries supplying the aquaculture industry and juvenile

smallmouth bass (*Micropterus dolomieui* Lacépède; as many as 12 per 100 m^2).

In 2002, the densities of fry and parr in 24 sites believed to have been unaffected by stocking of Magaguadavic unfed fry hatched at Mactaquac, ranged from zero to 1.8 fish per 100 m^2. All but one parr was captured in the five sites situated near private hatcheries. The presumed escapes were the lowest number observed since the electrofishing surveys were initiated in 1995. Surveys were also conducted at four additional sites into which the unfed fry from Mactaquac had been released and yielded densities ranging from zero to 45 fry per 100 m^2.

Counts of salmon at the Milltown fishway near head-of-tide on the **St. Croix River** in 2002 numbered 6 MSW and 14 1SW hatchery-origin fish, 4 MSW and two 1SW farm escapes; there were no wild fish. Farm escapes were removed from the trap, sacrificed for laboratory disease analysis and found to be negative for the ISA virus. All hatchery-origin fish were live-tested for the ISA virus and also found to be negative.



As part of a salmonid restoration program, all 20 hatchery returns were retained as broodstock and transported to the Mactaquac Biodiversity Facility where the 7 females provided an estimated 32,000 eggs.

Between Sept. 28 and Oct. 11, 2001 a total of 524 captive-reared adults from eastern Maine populations were released at two locations in the St. Croix River. Of these, 304 fish were female and at an average weight of 7.6 kg might have been expected to yield 3.67 million eggs or 50% of a 7.39 million egg conservation requirement (updated from DFO 2002). Fry densities from 14 sites sampled in 2002, however, averaged less than 1.0 fish per 100 m^2 and are inconsistent with the egg depositions from captive-reared adults in 2001. Densities of parr also averaged less than 1.0 fish per 100 m^2.at the same 14 sites.

An adult salmon counting fence was monitored in **Dennis Stream** in 2002. Only one wild 1SW salmon was captured.

Outlook

The following projections and probabilities are for the most part, based on the average returns of the previous five years.

Saint John River upstream of Mactaquac

Projected returns for stocks originating upriver of **Mactaquac** on the **Saint John River** in 2003 are 3,070 (1,100-5,090) 1SW and 980 (210–1,910) MSW salmon. The probabilities of attaining the conservation requirement of 4,900 of each of 1SW and MSW fish are less than 1% for 1SW salmon and near zero for the MSW forecast. Low densities of wild parr, reliance on a diminishing production of hatchery smolts and persistent low MSW return rates for reared smolts suggest that MSW returns will be inadequate to achieve egg the conservation requirement for several generations.

Saint John River downstream of Mactaquac

Predicted returns to the **Nashwaak River** in 2003 using the five year average are 600 1SW fish (110-1,270). There is less than a 1% probability that the 1SW requirement of 2,040 fish will be met. The forecast of MSW returns is 230 fish (80-380) and the probability that the conservation requirement of 2,040 MSW fish will be met is near zero. An estimate based on the average smolt-to-1SW return rate suggests that 1SW returns in 2003 could be as few as 350 fish (230-470). Declining numbers of adult returns, particularly MSW salmon and low densities of parr suggest that returns will not be adequate to achieve the egg conservation requirement for several years to come.

Current low fry and parr densities on the **Kennebecasis River** coupled with apparent low marine survival are not suggestive of sufficient adult returns to achieve the egg conservation requirement.

Over the last decade, **Hammond River** fry densities have approximated the Elson norm on several occasions. Parr densities have averaged about 0.4 of the Elson norm and are the highest exhibited by a tributary downstream of Mactaquac. The higher parr densities of 2000 - 2001 compared with those of 1999 – 2000 are suggestive of the potential for increased returns in 2003. As in the past however, no inference can be made with respect to the possibility of attaining the egg conservation requirement.

Other outer Bay of Fundy Rivers

Wild 1SW and MSW returns to the **Magaguadavic River** in 2003 are projected to be no greater than the few fish returning in 2002. There is a near-zero probability of attaining the conservation requirement and with the exception of progeny at Mactaquac Biodiversity Facility and in a sea cage which originated from seven wild parents, the stock has been virtually extirpated. Progeny resulting from the release of the 103 captive reared broodstock in 2002 will be assessed in the coming years for their potential contribution to adult returns in 2006-2007.

Returns to the **St. Croix River** in 2003 are unlikely to differ greatly from the mean value of 22 wild and hatchery returns in 1998 to 2002. This is because all returning adults (of both wild and hatchery origin) have been retained as broodstock since 1997 and the number of stocked juveniles from these collections has remained constant and low. Under any scenario for returns in 2003, there is no probability of attaining the conservation requirement.

Returns of progeny from the release of captive-reared adult fish in 2000 and 2001 will not yield spawners before 2004. Low juvenile densities observed in 2002 from these spawners suggest that returns, especially in 2004 are unlikely to differ greatly from those of recent years.

Management Considerations

Saint John River upstream of Mactaquac

For the **Saint John River** stocks **upstream of Mactaquac**, egg depositions have been less than 50% of requirement for nine of the last ten years. There is essentially a zero probability that MSW returns will be adequate to meet the conservation requirement in 2003. For 1SW salmon which are mostly males, there is less than a 1% probability of

attaining the 4,900 1SW salmon requirement.

In an effort to maintain existing genetic integrity for potential recovery of the upstream populations, a captive-reared broodstock program is being phased in at Mactaquac Biodiversity Facility. The hatchery program is moving away from collecting adult broodstock and stocking of smolts. Rather, juveniles are collected, reared to maturity in the hatchery and plans are to release these adults into streams for spawning. Returns from this new strategy are not expected for at least 5 years.

Saint John River downstream of Mactaquac

The **Nashwaak River** stock met only about 6% of conservation requirement in 2002 and has failed to achieve more than 50% of requirement since 1993. Prospects for attaining the conservation requirement in 2003 are near zero and based on parr densities, the prospects for increased returns for the next several years are extremely low.

One-sea-winter salmon, from 1998 to 2002, averaged 41% female and over the last 5 years have contributed an average of 38% of the total egg depositions. As large salmon returns diminish, losses of 1SW salmon, will have a significant impact on egg depositions.

The prospects for returns to the **Kennebecasis River** are similar to those of the Nashwaak River. Female composition of 1SW salmon is similar to that of the Nashwaak and with diminishing large salmon returns are important to total egg depositions.

The number of salmon returning to the **Hammond River** in 2002 is unknown and forecasts of returns in 2003 are not possible. Similar to other assessed tributaries downriver of Mactaquac, 1SW salmon make an important contribution to egg depositions.

Other outer Bay of Fundy Rivers

Populations in these rivers have declined dramatically in the last decade. Returns of wild salmon to the **Magaguadavic** and the **St. Croix** rivers in 2002 were near zero. There is no chance that the conservation requirement will be met from natural production on these rivers in the immediate future. Actions have been initiated to address the pending extirpation of these salmon populations.

For more Information

Contact:

Gérald Chaput
Oceans and Science Branch
Dept. of Fisheries & Oceans
Gulf Region
P.O. Box 5030
Moncton, NB E1C 9B6

Tel: (506) 851-6253
Fax: (506) 851-2147
E-mail: ChaputG@dfo-mpo.gc.ca

Or:

Larry Marshall
Science Branch
Dept. of Fisheries & Oceans
Maritimes Region
P.O. Box 1006
Dartmouth, NS B2Y 4A2

Tel: (902) 426-3605
Fax: (902) 426-6814
E-mail: MarshallL@mar.dfo-mpo.gc.ca

References

DFO, 2000a. Atlantic Salmon Maritime Provinces Overview for 1999. DFO Science Stock Status Report D3-14(2000).

DFO, 2000b. Effects of land use practices on fish, shellfish, and their habitats on Prince Edward Island. DFO Maritimes, Regional Habitat Status Report 2000/1E.

DFO, 2000c. The effects of acid rain on Atlantic salmon of the Southern Upland of Nova Scotia. DFO Maritimes, Regional Habitat Status Report 2000/2E.

DFO, 2001. Atlantic Salmon Maritime Provinces Overview for 2000. DFO Science Stock Status Report D3-14(2001) (revised).

DFO, 2002. Atlantic Salmon Maritime Provinces Overview for 2001. DFO Science Stock Status Report D3-14(2002).

Elson, P.F. 1967. Effects on wild young salmon of spraying DDT over New Brunswick forests. J. Fish. Res. Board Can. 24(4): 731-767.

This report is available from the:

Maritime Provinces
Regional Advisory Process
Department of Fisheries and Oceans
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2
Phone number: 902-426-7070
Fax number: 902-426-5435
e-mail address: myrav@mar.dfo-mpo.gc.ca

Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1480-4913

La version française est disponible à l'adresse ci-dessus.

Correct citation for this publication

DFO, 2003. Atlantic Salmon Maritime Provinces Overview for 2002. DFO Science. Stock Status Report 2003/026.

Table 1. Fisheries removals (number of fish) of Atlantic salmon from rivers of the Maritime provinces, 1998 to 2002. Removals refer 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. 2002 data are provisional.

			Aboriginal Fisheries Removals[1]										Recreational Fisheries Removals[1]									
			Small Salmon					Large Salmon					Small Salmon					Large Salmon				
River	SFA	Index	'98	'99	'00	'01	'02	'98	'99	'00	'01	'02	'98	'99	'00	'01	'02	'98	'99	'00	'01	'02
Matapédia	15	1	0	0	0	0	0	0	0	0	0	0	650	707	853	615	1317	441	587	683	1067	507
Restigouche-NB [3]	15	2	26 [2]		-	-	-	37 [2]		-	-	-	2305	1881	2275	-	1238	86	114	122	-	78
Jacquet	15	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nepisiguit	15	4	-	-	-	-	-	-	-	-	-	-	150	300	450	300	205	6	3	10	9	6
Miramichi	16	6&7	1180	2400	2953	2076	2577	214	700	460	460	220	-	-	-	-	-	-	-	-	-	-
NW Miramichi	16	6	782	1700	2502	1500	1780	195	650	460	460	220	-	-	-	-	-	-	-	-	-	-
SW Miramichi	16	7	378	627	451	576	797	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-
Buctouche	16	8	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Morell	17	9	28	0	28	28	29	0	0	0	0	0	289	200	154	189	93	3	5	1	3	1
River Philip	18	10	0	14	6	0	0	7	17	20	0	0	85	104	42	4	38	12	15	5	1	2
Wallace	18	11	-	-	-	-	-	-	-	-	-	-	30	11	10	3	19	3	3	1	0	1
Waugh	18	12	-	-	-	-	-	-	-	-	-	-	18	10	12	0	7	2	1	0	0	0
River John	18	13	0	-	-	0	3	18	-	-	0	8	21	17	6	0	6	2	3	1	0	0
West (Pictou)	18	14	0	-	-	0	2	12	-	-	3	9	32	30	17	0	20	5	8	2	0	1
East (Pictou)	18	15	3	0	11	0	4	15	12	2	18	18	29	26	13	8	8	6	8	2	1	3
Sutherlands	18	16	0	0	7	[4]	[4]	14	14	12	[4]	[4]	0	0	0	0	0	0	0	0	0	0
West (Ant.)	18	17	-	-	-	-	-	-	-	-	-	-	67	81	35	0	40	9	11	7	1	3

[1] "Closed" means no salmon fishing was allowed, "-" means no data were available, "0" means no removals occurred.
[2] Aboriginal fisheries removals exclude removals by the Listiguij First Nation in the estuary because the data are not available.
[3] Restigouche River angling catches for 2001 and 2002 are incomplete.
[4] A proportion of the Merigomish Harbour removals (40 large in 2001 and 32 large and 11 small in 2002) were destined for the Sutherlands River.

Table 1. (continued). Fisheries removals (number of fish) of Atlantic salmon from rivers of the Maritime provinces, 1998 to 2002. Removals refer 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. 2002 data are provisional.

			Aboriginal Fisheries Removals[1]										Recreational Fisheries Removals[1]									
			Small Salmon					Large Salmon					Small Salmon					Large Salmon				
River	SFA	Index	'98	'99	'00	'01	'02	'98	'99	'00	'01	'02	'98	'99	'00	'01	'02	'98	'99	'00	'01	'02
Margaree	18	19	30	8	10	20	27	120	45	49	25	62	213	206	145	153	178	66	41	36	43	33
Middle	19	20	-	Closed	Closed	0	1	-	Closed	Closed	0	5	6	1	1	0	7	3	3	2	0	2
Baddeck	19	21	3	Closed	Closed	0	0	7	Closed	Closed	0	0	3	1	1	0	1	4	2	2	1	1
North	19	22	0	0	0	0	0	0	0	0	0	0	3	1	1	1	1	3	1	1	2	1
Grand	19	23	0	Closed	Closed	0	0	0	Closed	Closed	0	0	3	1	1	0	1	0	0	0	0	0
St. Mary's	20	24	Closed	Closed	Closed	-	-	Closed	Closed	Closed	-	-	2	0	Closed	10	4	0	0	Closed	8	2
Liscomb	20	25	Closed	Closed	-	-	-	Closed	Closed	-	-	-	Closed	0	0	0	0	Closed	0	0	0	0
East Sheet Hbr.	20	26	0	0	0	-	-	0	0	0	-	-	0	2	0	0	0	0	0	0	0	0
LaHave	21	27	Closed	42	Closed	40	40	Closed	Closed	Closed	-	0	Closed	9	Closed	9	22	Closed	4	Closed	6	5
Mersey	21	28	-	-	-	-	-	-	-	-	-	-	6	6	12	0	13	0	0	0	0	0
Jordan	21	29	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
Clyde	21	30	-	-	-	-	-	-	-	-	-	-	3	8	34	0	0	0	0	1	0	0
Gaspereau	22	32	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Stewiacke	22	33	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Big Salmon	23	34	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Saint John at / upst. Mactaquac	23	35	Closed	154	105	74	31	Closed	76	18	32	7	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Nashwaak	23	36	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Kennebecasis	23	37	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Hammond	23	38	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Magaguadavic	23	39	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
St. Croix	23	40	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed

[1] "Closed" means no salmon fishing was allowed, "-" means no data were available, "0" means no removals occurred.

Table 2. Summary of stock status of Atlantic salmon in the Maritime provinces. All 2002 information is provisional and "-" means no data were available.

River	SFA	Method	Map Index	Returns in 2002		% hatchery Origin	Conservation Met			Abundance			Potential Constraints To Production
				Small	Large		In 2002 Returns	In 2002 Escapement	In 1984 – 2002	All Juveniles	Adults Wild	Hatchery	
Matapédia	15	Vi	1	2540	2292	0 %	201%	157%	9 of 9 ⇔	High	High		
Restigouche NB	15	Ang	2	-	7000	< 1%	75%	75%	12 of 18 ⇔	High ⇔	Med ⇔		
Jacquet	15	Fe	3	-	-	0%	-	-	2 of 7 🡻	High ⇔			
Nepisiguit	15	-	4	-	-	-	-	-	11 of 16 ⇔	Med ⇧	Med	Low 🡻	
Miramichi	16	MR	6&7	37600	10600	< 1%	83%	No	12 of 19 ⇔	High ⇔	Med 🡻	Low ⇔	
NW Miramichi	16	MR	6	16800	1700	< 1%	79%	No	6 of 11 🡻	High ⇔	Med 🡻	Low ⇔	
SW Miramichi	16	MR	7	20500	8800	< 1%	84%	No	6 of 11 🡻	High ⇔	Med 🡻	Low ⇔	
Buctouche	16	-	8	-	-	-	-	-	1 of 8 ⇔	Low ⇔	Low ⇔		
Morell	17	-	9	-	-	91%	No	No	8 of 14	Low 🡻	Low	Low	LU
River Philip	18	-	10	-	-	-	-	-	6 of 9 ⇔	High ⇔			
Wallace	18	-	11	-	-	-	-	-	1 of 6 ⇔	Low ⇔			
Waugh	18	-	12	-	-	-	-	-	1 of 6 ⇔	Low			
River John	18	-	13	-	-	-	-	-	2 of 6 ⇔	Low			
West (Pictou)	18	-	14	-	-	-	-	-	5 of 6 ⇔				
East (Pictou)	18	-	15	-	-	-	-	-	6 of 9 ⇔	Med ⇔			
Sutherlands	18	-	16	>24	>15	-	-	-	5 of 6 ⇔				
West (Ant.)	18	-	17	-	-	-	-	-	6 of 9 ⇔	High ⇔			

Assessment methods: Ang = angling catches and assumed exploitation rates; CR = catch rate index; RC = redd count; Fe = counting fence; Fw = fishway; MR = mark and recapture experiment; Electro = electrofishing; Sh = shore count; Vi = snorkel count; ViM = snorkel count and mark/recapture calibration

Map index numbers refer to text figure and legend.

Trend symbols (over recent ten years): 🡻 = decline; ⇔ = no change; ⇧ = increase

Potential constraints to production: Ac = acid impacted rivers; Aq = aquaculture escapes; Fp = fish passage constraints; LU = land use practices; WU = water use practices

Table 2. (continued). Summary of stock status of Atlantic salmon in the Maritime provinces. All 2002 information is provisional and "-" means no data were available.

River	SFA	Method	Map Index	Returns in 2002 Small	Returns in 2002 Large	% hatchery Origin	Conservation Met: In 2002 Returns	Conservation Met: In 2002 Escapement	Conservation Met: In 1984 – 2002	Abundance: All Juveniles	Abundance: Adults Wild	Abundance: Hatchery	Potential Constraints To Production
Margaree	18	Ang	19	840	1460	7%	141%	>100%	19 of 19	High ⇔	Med 🡻	Low⇔	
Middle	19	ViM	20	53	99	0%	28%	25%	2 of 14	-	Low ⇔	-	
Baddeck	19	ViM	21	13	86	0%	18%	17%	0 of 9	-	Low 🡻	-	
North	19	ViM	22	19	57	0%	33%	23%	15 of 18	-	Low ⇔	-	
Grand	19	Ang	23	32	0	0%	14%	6%	7 of 14	-	Low 🡻	-	Fp
St. Mary's	20	CR	24	400	30	0%	14%	14%	8 of 19 🡻	Low ⇔	Low 🡻	-	
Liscomb	20	Fw	25	-	-	-	-	-					
East Sheet Hbr	20	Fw	26	16	1	100%	-	-	-	-	Low🡻	Low🡻	Ac, Fp
LaHave	21	Fw	27	1,133	71	62%	108%	94%	7 of 19 🡻	Med ⇔	Low 🡻	High ⇔	Ac, Fp
Mersey	21		28	-	-	100%	-	-	-	-	-	-	Ac, Fp
Jordan	21		29	-	-	100%	-	-	-	-	-	-	Ac
Clyde	21		30	-	-	100%	-	-	-	-	-	-	Ac
Gaspereau	22	Fw	32	10	4	42%	8%	0%	0 of 6	Low	Low	Low	WU, Fp,Aq
Stewiacke	22	Electro	33	-	-	-	-	-	0 of 13	Low 🡻	Low	Low 🡻	
Big Salmon	23	Sh+Vi	34	-	-	0%	-	-	1 of 14	Low ⇔	Low	-	
Saint John at / upst. Mactaquac	23	Fw	35	2358	376	70%	10%	6%	2 of 19 🡻	Low 🡻	Low 🡻	Med ⇔	Fp, Aq, LU, WU
Nashwaak	23	Fe/MR	36	343	79	2%	6%	6%	0 of 10 🡻	Low ⇔	Low 🡻	Low 🡻	Aq, LU
Kennebecasis	23	Electro	37	-	-	-	-	-	-	Low 🡻	-	-	Aq, LU
Hammond	23	Electro	38	-	-	-	-	-	-	Med ⇔	-	-	Aq, LU
Magaguadavic	23	Fw	39	7	0	0%	2%	1%	3 of 14 🡻	-	Low 🡻	-	Fp, Aq, WU
St. Croix	23	Fw	40	14	6	100%	1%	0%	0 of 18 🡻	-	Low 🡻	Low 🡻	Fp, Aq, WU

Assessment methods: Ang = angling catches and assumed exploitation rates; CR = catch rate index; RC = redd count; Fe = counting fence; Fw = fishway; MR = mark and recapture experiment; Electro = electrofishing; Sh = shore count; Vi = snorkel count; ViM = snorkel count and mark/recapture calibration

Map index numbers refer to text figure and legend.

Trend symbols (over recent ten years): 🡻 = decline; ⇔ = no change; ⇧ = increase

Potential constraints to production: Ac = acid impacted rivers; Aq = aquaculture escapes; Fp = fish passage constraints; LU = land use practices; WU = water use practices