Atlantic Salmon Maritime Provinces Overview for 2001

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.

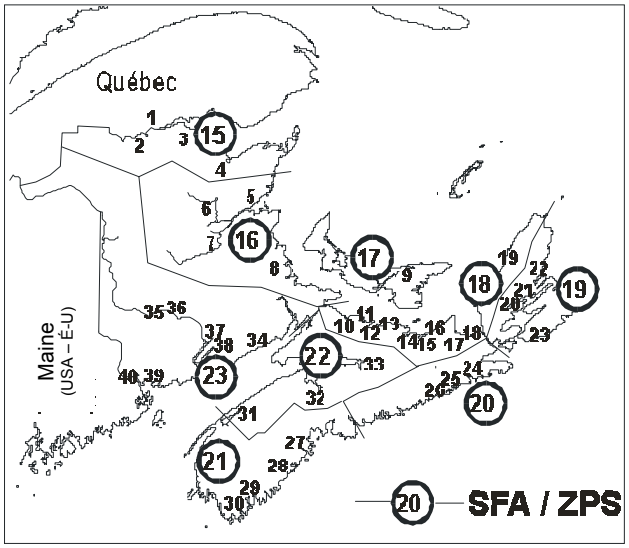
Spawning populations consist of varying proportions of small salmon (fork length <63 cm) and large salmon (fork length >= 63 cm). In the majority of rivers, small salmon (frequently referred to as grilse) are predominantly maiden fish (never spawned before) which have spent one year at sea before returning 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 term conservation 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 requirements. The conservation requirements are 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 through slight increased abundance.*



Index of Rivers

1&2 Restigouche System	13. River John	27. LaHave
1. Matapédia	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

Summary

- Despite restrictive fisheries management measures on salmon in distant and home-water areas over an extended period, returns have fallen short of expectations. These low returns have been associated with low marine survival.

- In Chaleur Bay **(SFA 15)**, the Restigouche River (in New Brunswick) probably met its conservation requirement in 2001. Large salmon abundance was improved from 2000, whereas small salmon abundance was much lower. Spawning escapements have oscillated around the conservation level since 1986. Returns in 2002 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 2002. 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 just exceeded the conservation requirements in 2001, the first time in five years. The Northwest Miramichi did not meet conservation in 2001, for the fourth consecutive year. The outlook for 2002 is for a return of large salmon equal to 2000 and 2001 with a 13% chance of meeting the conservation requirement in the Miramichi River overall, 26% for the Southwest Miramichi and 19% for the Northwest Miramichi River. The Tabusintac River was not assessed for adult returns in 2001. Juvenile abundance on the Tabusintac River in 2001 was below Elson norms, unlike juvenile surveys from recent years. The Buctouche River, used as an index for New Brunswick Northumberland Strait rivers, was not assessed for adult returns in 2001. It 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. Juvenile abundance has been generally low in recent years, suggesting no improvement in adult returns in the short term.

- Because the majority of salmon returning to the Morell (90% in 2001) and to other PEI rivers **(SFA 17)** are of hatchery origin, current fisheries have little impact on future runs. Wild salmon production on PEI is limited by sedimentation and substantial self-sustaining salmon runs cannot be re-established until these impacts are severely reduced. It is recommended that protection for wild-reared salmon be provided.

- Returns to the rivers of the Northumberland Strait Shore of Nova Scotia **(SFA 18)** were not estimated in 2001. Water discharge was low in 2001. The numbers of fish captured were insufficient to estimate the returns. However, juvenile densities were equal to or exceeded the Elson norm in all surveyed rivers. Adult returns to the Margaree River (western Cape Breton Island) were again above the conservation requirement, but lower than in the recent decade. Juvenile densities were above the Elson norm, but the fry densities showed a sharp decrease in 2001 compared with previous years.

- Adult salmon populations of eastern Cape Breton Island **(SFA 19)** were assessed on the Middle, Baddeck and North rivers in 2001. Only the North River is likely to have met adult conservation requirements in 2001. With the exception of the North River, conservation requirements are unlikely to be met in 2002.

- Salmon returns to rivers along the Atlantic Coast of mainland Nova Scotia **(SFAs 20 and 21)** were insufficient to meet conservation requirements in 2001. Rivers are generally of low productivity and are negatively impacted by acid precipitation. Small salmon contribute about half of the egg depositions in these rivers. Returns of salmon in 2002 are not expected to be sufficient to meet requirements for any of the rivers. Based on increased hatchery support, only the LaHave River is expected to reach the conservation requirement in 2002.

- **Inner Bay of Fundy (SFA 22 and part of SFA 23)** salmon stocks are critically low, should not be harvested and are undergoing actions to prevent their extirpation.

- Salmon stocks of the outer Bay of Fundy **(western part of SFA 23)** are unlikely to have met conservation requirements in 2001 and probabilities of most stocks achieving requirements in 2002 are virtually zero. Egg depositions for the Saint John River stock upriver of Mactaquac were 20% of the conservation requirement; the third lowest value in 32 years. The Nashwaak River stock achieved only 16% of its requirement. The Kennebecasis River stock is unlikely to have met conservation requirement. The status of the Hammond River stock with respect to conservation is uncertain but juvenile levels are higher than in the neighbouring Nashwaak and Kennebecasis rivers. Stocks of outer Bay of Fundy rivers west of the Saint John River system (e.g., Magaguadavic River) have declined markedly in the last decade and action has been initiated to prevent their extirpation.

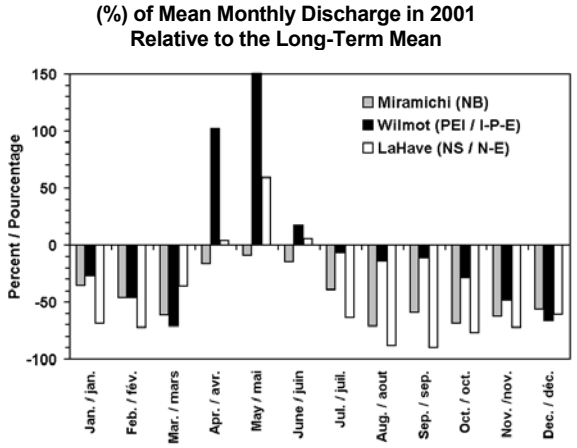
Environmental Conditions

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 2001 were characterized by lower than normal winter precipitation and streamflow, especially in January. Spring peak flows occurred in late April, for most rivers, which was normal. Higher than normal flows were observed in May for Nova Scotia. The daily peak runoff in 2001 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). Wilmot River (PEI) experienced its highest spring peak flows on record with a recurrence interval exceeding the 25-year flood.

Lower than normal precipitation resulted in lower than normal monthly flow conditions in summer, 2001. By August, streamflow conditions became much lower than normal in most rivers. In August, the Southwest Miramichi River (NB) experienced its lowest monthly flow on record. Lower than normal flow conditions persisted throughout the Maritime Provinces from August to December in 2001. Record low monthly flows were recorded on the Northeast Margaree River (NS) in October and in the LaHave River (NS) in December of 2001.



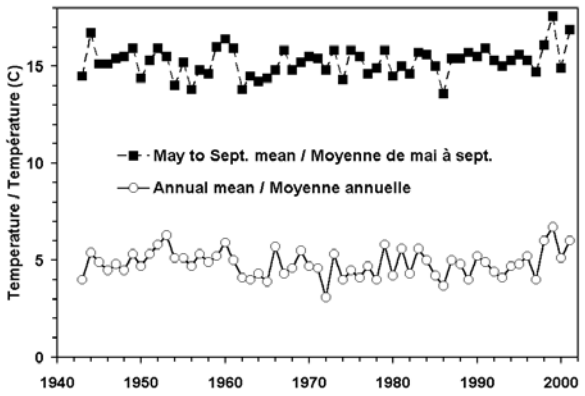
Daily low discharges were generally close to the 2-year low flow in 2001, although many rivers showed more severe drought conditions. Wilmot River (PEI) experienced a 10-year low flow, while both Southwest Miramichi (NB) and St. Mary's River (NS) approached a 15-year low flow.

Air and River Temperatures

Data on air temperature were analysed across the Maritime Provinces. Mean annual and

mean summer air temperatures in 2001 were higher than average but lower than in 1999, for which temperatures were the highest of the time series, dating back to the 1940s for most stations.

Mean Air Temperatures at Chatham, New Brunswick



Lower than normal discharge with slightly higher than normal air temperatures in 2001 resulted in higher than normal water temperatures for many rivers. Maximum recorded water temperatures in the summer of 2001 were close to 28°C. These temperatures were close to the 29-30°C values observed in 1999. As an indicator of water temperature stress on fish, the number of days on which temperatures exceeded 23°C was counted as in previous years. Rivers exceeded 23°C from approximately 36 to 52 days in 2001 .

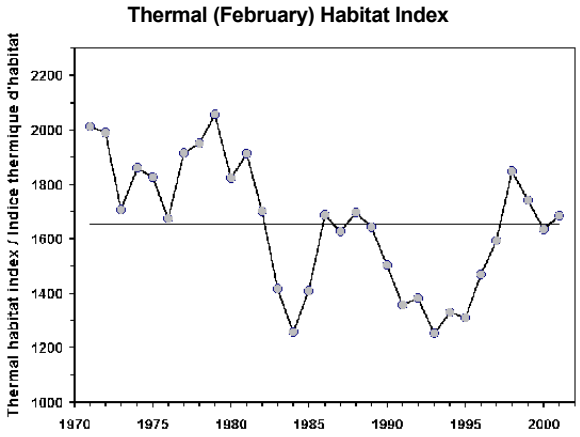
Number of days when maximum water temperature exceeded 23ºC			
Year	Nashwaak River	Little Southwest Miramichi	Southwest Miramichi estuary
1995	55		
1996	6	10	
1997	24	14	
1998	30	15	21
1999	67	62	59
2000	25	19	11
2001	46	52	36

Marine Environment

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

Temperatures, both atmospheric and oceanic, declined for the second consecutive year but were generally warmer than normal during 2001, and continued the warm conditions of the past several years. Based upon previous studies, warm temperatures are usually conducive to improved marine survival of salmon. Warm conditions in the Northwest Atlantic are typically 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 Low and High. The recent warming in the Northwest Atlantic occurred in spite of a high NAO index. In these years, the centres of the Icelandic Low and Azores High shifted eastward and more importantly the High moved farther north on the western side of the Atlantic. This resulted in stronger southerly winds carrying warm air masses into the Maritime Provinces and the southern Labrador Sea.

The thermal habitat index for February, defined by the area at the southern extent of the Labrador Sea that lies within 4-8°C, was high through the 1960s and 1970s, declined through the early 1980s and remained below or near the long-term (1971-2000) mean from 1983 to 1997. After the minima in 1993 to 1995, the index rose rapidly, reaching above normal values by 1998. It then fell and for the past three years has been near its long-term average. In 2001, it rose slightly. It is significantly 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. Increased air temperatures and reduced sea ice coverage are suspected of advancing the timing of smolt runs and affecting the ecology of coastal waters.

The aerial coverage of sea-ice off southern Labrador and northern Newfoundland was below normal in 2001. A late advancement of ice in the spring contributed to the light ice year. Ice-cover in the Gulf of St. Lawrence in 2001 was less-than-usual, a result of both a late formation and early break-up in the spring. For the fourth 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 seventh 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.

Satellite-derived near-surface temperatures from the Labrador Sea to the Gulf of Maine, including the Gulf of St. Lawrence, were above normal in most months of 2001, but declined for the second consecutive year. Satellite-derived temperatures in 1999 were some of the highest on record (which began in 1981), especially for the region from the Grand Banks to the Gulf of Maine. These high ocean temperature anomalies were consistent with the high air temperatures over the region. All-time historic high air temperature records were established from southern Labrador to the Gulf of Maine in 1999 and although they have declined in 2000 and again in 2001, they still remained above the long-term normal.

Coastal surface temperature anomalies for the Gulf of Maine (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 and 1925 at Halifax. The available data for 2001 indicate a continuation of the warm conditions observed in 1999 and 2000 at Boothbay Harbor but cooling at Halifax. The latter was in part a response to wind-induced coastal upwelling.

Data from the northeastern Scotian Shelf and off southwestern Nova Scotia indicate that the subsurface temperatures of these waters cooled dramatically and contrast with the last couple of years when they were on the rise and above normal. The 2001 data show more similarity with the cold period from the mid-1980s to the late 1990s.

In summary, conditions in 2001 indicate generally warm ocean temperatures in the near surface waters in the areas frequented by Atlantic salmon but the water in the subsurface layers on the Scotian Shelf declined to below their long-term means.

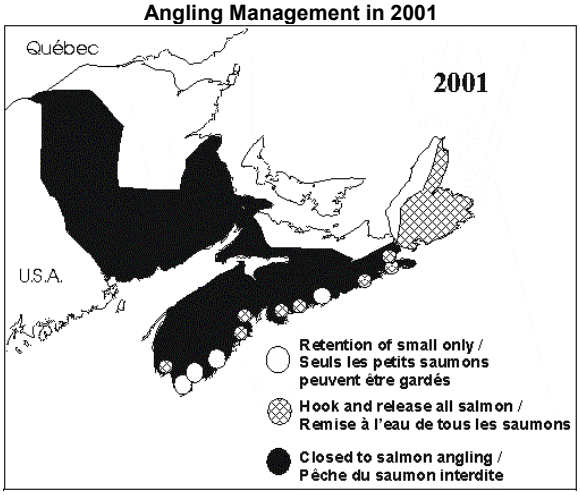
The Fishery

Atlantic salmon were harvested by two user groups in 2001: 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 2001 occurred in the southern Gulf of St. Lawrence rivers generally in accordance with agreements and communal fishing licenses. Under agreements reached in 2001, 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 SFAs 20 and 21, using methods that permitted 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. 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 2001 were allowed only in most of the southern Gulf of St. Lawrence, and in four acid-toxic rivers of the Atlantic coast. There were no changes to the retention fisheries for the 2001 angling season. Eight Atlantic coast rivers were opened for a short hook and release fishery from June 1st until July 15th, in 2001.

Angling Management in 2001



In the Miramichi River (SFA 16) and the Nepisiguit River (SFA 15), 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. 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 2001. 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 subsistence fishery (20.5 t) off west Greenland between August 14 and 18, 2000 intercepted an estimated 5,100 salmon destined to return as large salmon to North America in 2001.

Harvests of small salmon in the aboriginal food fisheries declined in 2001 relative to recent years, whereas large salmon harvests were unchanged in Gulf New Brunswick. Reports for Gulf of St. Lawrence Nova Scotia aboriginal harvests were incomplete to date (Table 1).

Removals (kept plus mortalities from hook and release angling) of large salmon in the recreational fisheries of the Restigouche River in 2001 were up from 2000 whereas small salmon catches were down from the previous year. Large salmon catches were among the highest of recent years (Table 1). For the Miramichi River, the catches of small salmon from the crown reserve waters were down 42% whereas catches of large salmon were up 28% from the previous five-year mean. Removals of small salmon in Gulf of St. Lawrence Nova Scotia rivers in 2001 were generally the lowest of the last five years.

Resource Description

Information in this document represents an update of 40 rivers for 2001 (Table 2). In an update, there are no important changes in methods. The previous assessment or update for these stocks was conducted in 2000 (DFO 2001).

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 2001 were up 56% from 2000 whereas small salmon catches were down 28% from 2000.

Returns to the Matapédia River are usually determined from visual spawner counts in October. The standard visual count inventory could not be completed in 2001 because of high water conditions at the scheduled time. Instead, a correlation of angling catches with spawner counts from previous years was used to estimate the returns and escapements in 2001. The returns in 2001 were estimated at 3,869 large salmon and 1,541 small salmon; similar to 2000 for small salmon but 50% above the estimate of large salmon in 2000. The escapements to the Matapédia River were estimated at 2,802 large salmon and 926 small salmon. Spawning escapement in 2001 was 246% of requirement (based on fish) and exceeded the conservation requirement for the eighth consecutive year.

Matapédia River				
	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

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

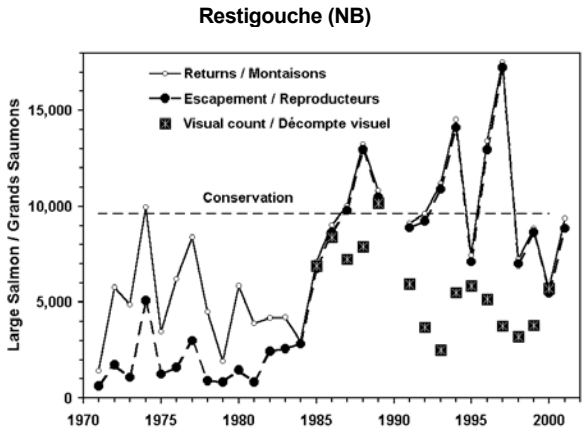
Visual counts of large salmon in three tributaries in October 2001 were up 31% relative to 2000 whereas counts of small salmon were down 41% from the previous year. Counts of small salmon and large salmon from the Northwest Upsalquitch protection barrier and the counting fence on Little Main Restigouche were below the counts in 2000 for both size groups. Reported angling catches from a subset of lodges in 2001 were up 69% for large salmon but down 47% for small salmon relative to 2000; increases for large salmon and decreases for small salmon correspond with those observed for the Matapédia River.

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 1996 to 2000 was applied to the 2001 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 2000 were also a minimum.

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. The estimated catch rate in 1997, based on fry abundance in 1998, was among the lowest on record at 0.10. The catch rate in 2000 was higher than in 1999 as a result of better angling conditions, which were exceptionally good in July 2000, compared to historical conditions for the same month.

Based on the average catch rate of the previous five years (0.20) and a provisional catch of large salmon in 2001 of 1,853 fish, the returns of large salmon were about 9,300 fish. At an assumed catch and release mortality factor of 6%, losses were about 110

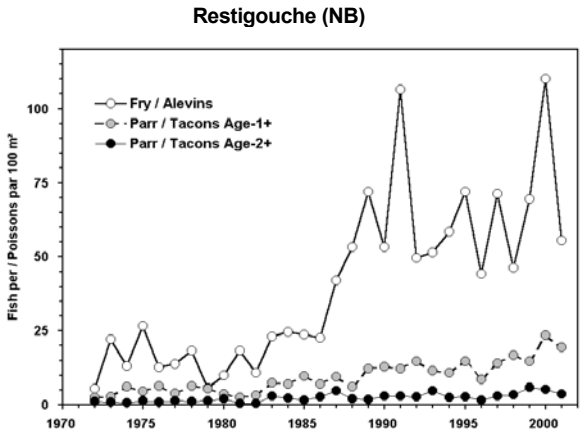
fish and within the error of the returns estimate.



Conservation requirements for the Restigouche (NB) of 55 million eggs are based on 2.4 eggs per m^2 and would on average be obtained from 9,600 large salmon. The estimated escapement of about 9,000 spawners in 2001 represents greater than 95% of the requirement. Point estimates of the escapements since 1984 indicate conservation requirements were met in 7 of the last 17 years. 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 historical and/or the updated Matapédia egg deposition requirements 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 index sites sampled annually since 1972 remain at greatly improved levels relative to the 1970s and early 1980s. Densities of fry in 2001 (from the spawning in 2000) were lower than the previous year but similar to the levels observed between 1988 and 1998. 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.



Densities of juvenile salmon (all age groups) in the Matapédia and Patapédia rivers in 2001 were higher than in the other tributaries of Restigouche (NB). Juvenile levels in these tributaries were as high as those in the tributaries of Restigouche (NB) during 1998 to 2000.

Counts of returning salmon to the **Jacquet River** barrier in 2001 are incomplete because of late installation of the barrier fence. The barrier trap operated from August 3rd to October 31st, enumerating 245 small salmon and 184 large salmon, which represents about 34% of the conservation requirement. Estimates of returns for 1998 to 2000 are unavailable or incomplete due to washouts in October. Conservation requirements of 3.8 million eggs would be obtained from 571 large salmon. Conservation requirements were achieved in 1994 and 1995 but not in the subsequent two years for which counts are considered complete.

Jacquet River

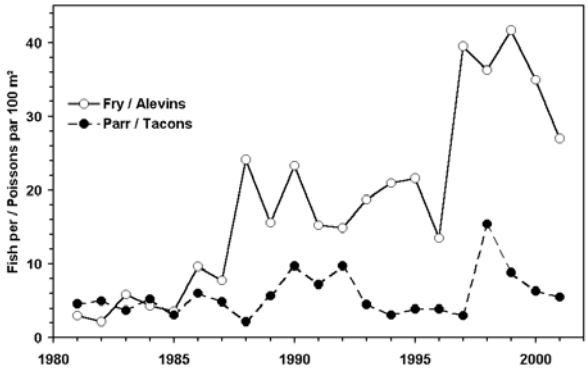
	Salmon Returns		Egg Depositions	
Year	Small	Large	% of Conservation	% by large
1994	613	595	109	95
1995	344	589	106	98
1996	634	359	67	92
1997	372	384	70	96
1998[1]	402	298	55	95
1999[2]	-	-	-	-
2000[1]	209	252	45	97
2001[3]	245	184	34	95

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

The escapement and returns of large salmon to the **Nepisiguit River** are based on redd counts conducted in late October by the Nepisiguit Salmon Association. A relationship between large salmon spawners and redds was derived from the years when complete counts of salmon were obtained at a counting fence. A general conversion rate of 2.5 redds per large salmon female was used. Large salmon were assumed to average 71% female. The conservation requirement for the Nepisiguit River of 9.5 million eggs would be attained from 1,600 large salmon.

An escapement of 2,250 large salmon (138% of egg conservation requirement) was estimated from 4,032 redds observed in 2001. Since 1994, egg depositions, as estimated from redd counts, have been around the conservation requirement. Juvenile abundance has increased during the 1990s and supports the interpretation of improved spawning escapements in recent years.

Nepisiguit



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 requirements for the river in 2002.

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 four 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 returning to the **Restigouche River (NB)** in 1999 and 2000 were estimated to have fallen short of the conservation requirement but returns in 2001 were close to conservation. 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** in recent years 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 escapement to the Restigouche (NB) and Matapédia River have varied close to or above the conservation requirement.

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 jeopardized achievement of a 1:1 male to female sex ratio.

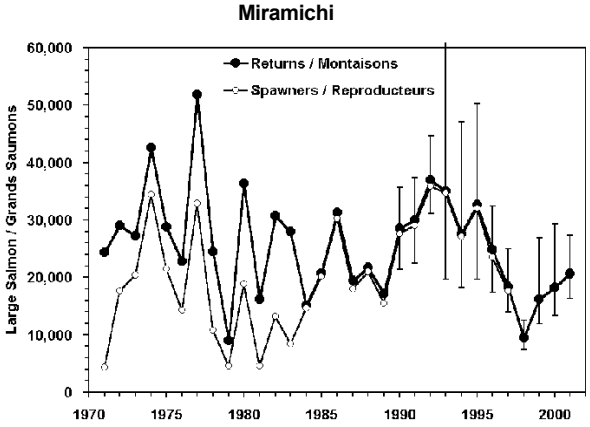
Miramichi and Southeast Gulf New Brunswick (SFA 16)

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 and now 2001. The information for the Miramichi River is based on a full assessment in 2000 and an update for 2001.

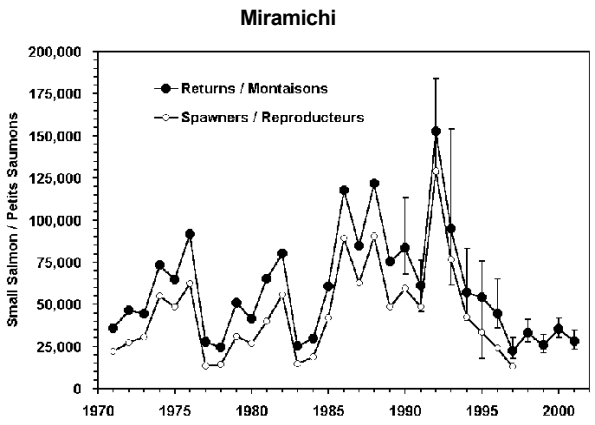
SFA 16 includes the Miramichi River, the largest salmon producing river of eastern Canada, and numerous small coastal rivers along the Northumberland Strait shore of New Brunswick. The Northwest and Southwest branches of the Miramichi River are assessed separately. The Buctouche River is used as an index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

Status

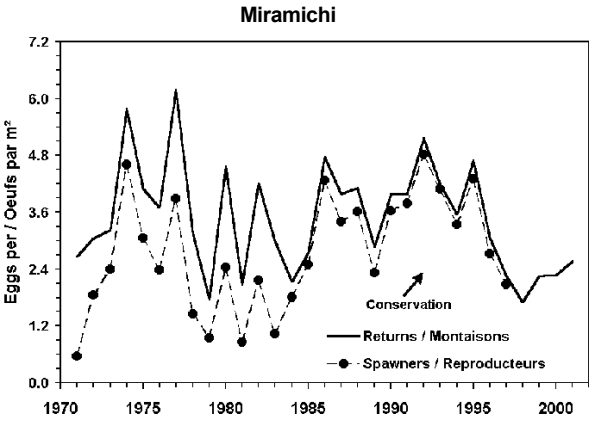
The estimated return of 20,600 large salmon (16,300 - 27,400) to the **Miramichi River** in 2001 was 18% above the previous five-year average. About 15,000 large salmon (10,500 – 22,900) returned to the **Southwest Miramichi** and 5,300 large salmon (1,600 - 9,800) returned to the **Northwest Miramichi**, up 15% from 2000 for the Southwest Miramichi and up 13% from 2000 for the Northwest Miramichi. The continued low abundance of large salmon in 1998 to 2001, relative to the previous decade was consistent with the continued low returns of small salmon in 1997 to 2000.



Small salmon returns in 2001 were 28,200 fish (23,200 – 34,800), down 21% from 2000 and down 13% from the previous five-year average. A total of 20,300 small salmon (15,500 - 27,100) returned to the Southwest Miramichi and 7,700 small salmon (5,800 - 10,300) returned to the Northwest Miramichi, down 10% from 2000 for the Southwest Miramichi and down 40% from 2000 for the Northwest Miramichi.



Conservation requirement for the Miramichi River system 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 2001 are incomplete. In 2001, egg depositions by all salmon returning to the Miramichi River (before any removals) would have equalled 107% of the conservation requirement (64% chance of having met requirement). Egg depositions by large salmon alone would have equalled 94% of requirement. Egg depositions after accounting for removals would be less than these values.



In the Southwest Miramichi, eggs in the returns were 111% (67% chance of having met requirement) of the conservation requirement of 88 million eggs. In the Northwest Miramichi, eggs in the returns were 91% (39% chance of having met requirement) of the 41 million egg conservation requirement. Egg depositions after accounting for removals would be less than these values.

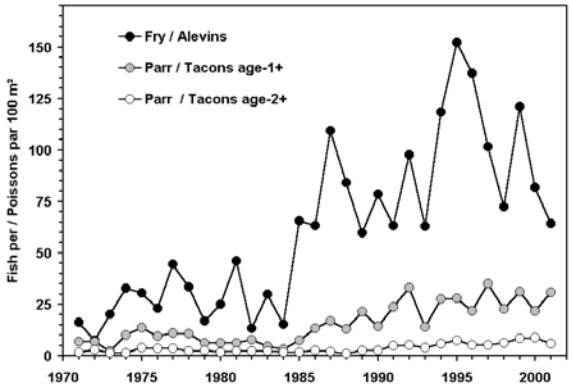
Percent of Conservation Requirement (eggs) Achieved in Returns (Ret.) and Escapement (Esc.)

	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	-

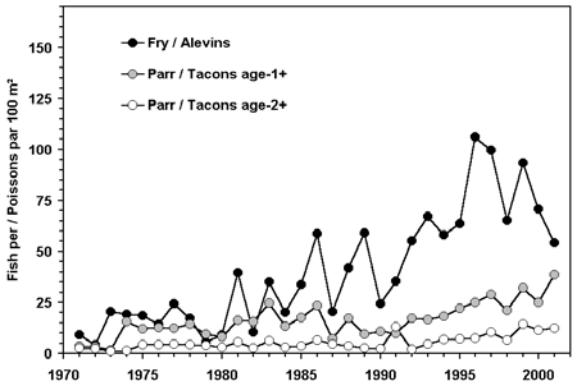
Small salmon could potentially have contributed 15% of the total eggs in the Northwest Miramichi and 11% of the total in the Southwest Miramichi. Eggs in the returns in 2001 were improved from the previous four years in the Southwest Miramichi and unchanged in the Northwest Miramichi from the previous three years, but for both branches were below the levels estimated in the first half of the 1990s.

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. Densities of fry declined in 2001 relative to previous five years whereas parr abundance remained at or above historical levels. Annual variations in densities represent variations in egg depositions, survival rates, and water conditions at the time of sampling.

Southwest Miramichi



Northwest Miramichi



Smolt production from the Northwest Miramichi in 1999 was estimated to have been 2 to 3 times higher than in 2000 and 2001. The survival of smolts from 2000 to small salmon (all 1SW salmon) in 2001 was 5%.

Northwest Miramichi

	Smolts		Survival (%)	
Year	Est.	per 100 m²	to 1SW	to 2SW
1999	390000	2.3	3.3	-[2]
2000	155000	0.9	5.0[1]	-
2001	219000[1]	1.3[1]		

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

For the **Buctouche River**, adult returns were not assessed in 2001. Between 1993 and 2000, returns of large salmon ranged from 95 to 244 fish: small salmon returns have generally been about 100 fish annually.

Buctouche River

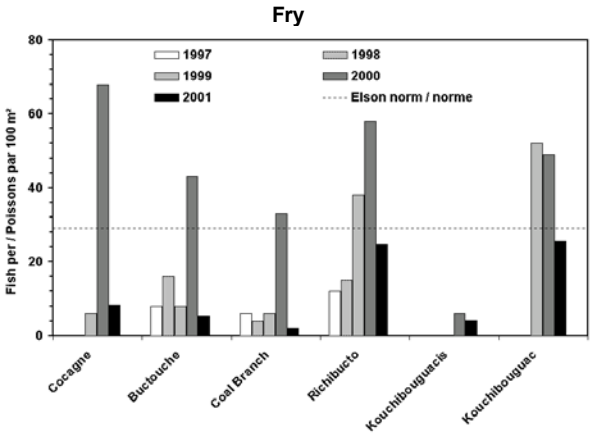
	Returns		Escapement	
Year	Large	Small	Large	Small
1993	95	78	94	21
1994	225	77	212	59
1995	154	98	147	67
1996	134	127	124	78
1997	200	97	191	67
1998	102	92	101	91
1999	244	115	244	111
2000	100	38	100	28
2001	-	-	-	-

Egg depositions from large and small salmon in the Buctouche River have failed to achieve the conservation requirement in seven of the eight assessed years. In any given year it is unlikely that the requirement will be met.

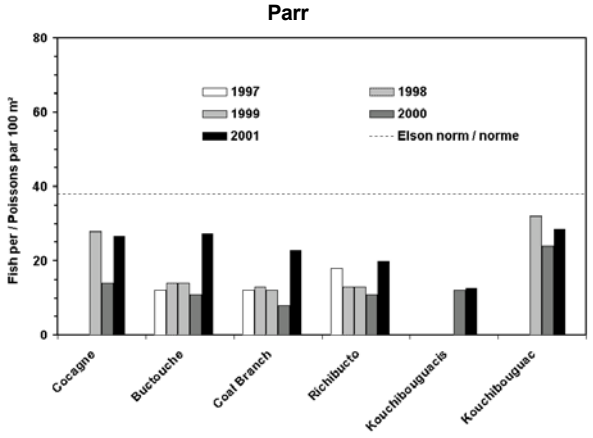
Egg Deposition (%) Relative to Conservation Requirement

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
2001	-	-

In 2001, mean fry densities (2-8 per 100 m^2) in the Buctouche and three other southeastern New Brunswick rivers (Cocagne, Coal Branch and Kouchibouguasis) were well below both the levels observed in 2000 and the Elson norm (29 per 100 m^2), confirming the 2000 estimate of low adult returns to the Buctouche. The Richibucto and Kouchibouguac rivers showed mean fry densities (25-26 per 100 m^2) approaching the norm, but still substantially lower than the previous year.



Mean parr densities in 2001 (13-29 per 100 m^2), although below the Elson norm (38 per 100 m^2) in all rivers sampled, were generally higher than in recent years. This was consistent with the high abundance of fry observed in most rivers the previous year.



Juvenile surveys conducted on the small rivers of southeastern New Brunswick indicate that adult returns are highly variable annually, and that relative abundance may not be synchronous among rivers. In most years the egg conservation requirement as presently defined was probably not met.

Quality spawning and rearing habitat on most rivers appears to be limited. For the Buctouche at least, egg-to-fry survival is generally low, suggesting there may be a habitat constraint at that life stage. However, in years of high egg depositions, these rivers responded by producing more fry, as observed in 1999-2000. Survival of fry (age-0+) to yearling parr (age-1+), as inferred from stocking of fall fingerlings and survival of wild fry, does not appear to be a constraint. Juveniles are generally distributed throughout the rivers but abundance is typically below Elson norms. An exception to this may be the Kouchibouguac River, where juvenile densities have been close to or somewhat above the norms for the three years sampled.

Average fry densities (24 per 100 m²) in the **Tabusintac River** in 2001 were well below levels measured in 2000 and below the Elson norm. The average parr density (35 per 100 m²) measured at 23 sites in 2001 was slightly improved from 2000 and just below the Elson norm. Spawning in 1998 to 2000 in the Tabusintac River, as inferred from fry densities, had occurred throughout the watershed.

Outlook

For the **Miramichi River**, the sustained high juvenile abundance levels observed since 1990 suggest that returns are likely to be unchanged from those of the last five years. The ratios of small salmon to large salmon the following year suggest a return of large salmon in 2002 similar to that of the previous year. Based on the range of ratios observed in the last five years, large salmon returns in 2002 are expected to be between 12,000 and 20,000 fish. Small salmon returns in 2002 may number 29,000 fish based on the previous five-year average return. Eggs in the returns of small and large salmon have a 13% probability of meeting or exceeding conservation requirement, with small salmon potentially accounting for 20% (13% - 27%) of the total eggs in the returns.

For the **Southwest Miramichi**, the return of large salmon in 2002 is expected to be

between 7,400 and 18,500 fish. The average small salmon return in the previous five years has been 19,000 fish (range of 13,500 – 24,000). Eggs in the returns of small and large salmon have a 26% probability of meeting or exceeding conservation requirement. Small salmon may account for 16% (8% to 25%) of the eggs in the total returns.

For the **Northwest Miramichi**, the return of large salmon in 2002 is expected to be between 1,700 and 4,600 fish. The average small salmon return in the previous five years has been 9,900 fish (range of 7,700 - 12,900 fish). There is a 19% chance that eggs in the returns of small and large salmon will meet or exceed the conservation requirement. Small salmon may account for 27% (15% to 40%) of the eggs in the total returns.

Adult returns were not assessed for the **Buctouche River** in 2001. The conservation requirement was not met in seven of eight previously assessed years and is unlikely to do so in 2002. Juvenile abundance indicates that conditions will not improve in the short term.

The conservation requirement for the **Tabusintac River** was exceeded during the five years the stock was assessed between 1993 and 1999. Juvenile levels in 2001 fell below the Elson norm for the first time ever recorded. The expectation is for this stock to continue meeting or exceeding the conservation requirement.

Management Considerations

In the absence of fisheries-related mortality on salmon in the **Miramichi River** in 2002, there is a 13% chance that the eggs in the returns of small and large salmon will meet the requirement. Considering the uncertainties in the expected small and large salmon returns in 2002, a cautious approach to fisheries management is recommended.

The early-run small salmon have a higher female proportion (>25%) than late-run fish (10%). In years of low large salmon abundance, the harvest of early-run small salmon has a greater impact on achieving conservation requirements than fisheries removing fall-run fish.

In the **Tabusintac River**, the escapement of salmon exceeded the conservation requirement in every year assessed. Present fisheries exploitation levels are similar to those in stock assessment years and are not a conservation concern.

The **Buctouche River** is used as an index for New Brunswick Northumberland Strait rivers. Although not assessed for adult returns in 2001, 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)

The last assessment of rivers in SFA 17 was for 2000 (DFO 2001). The assessment is updated for 2001.

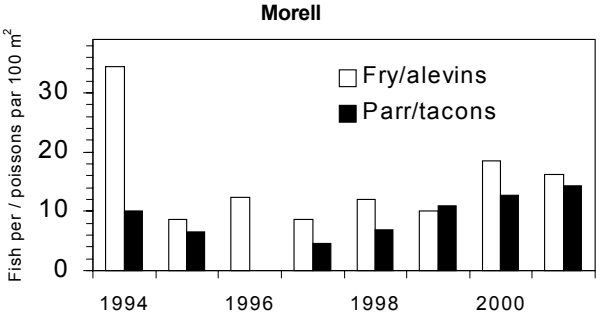
Most original runs of Atlantic salmon in Prince Edward Island were eliminated due to over-exploitation, barriers to migration, and habitat degradation. Salmon are stocked in up to six of PEI's larger rivers by release of smolts that have been raised semi-naturally in open impoundments. This program has 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 2001 were 51% of the 1995-2000 mean. A small amount of natural production occurs in the Morell and other stocked rivers. Small runs of late-returning salmon persist in several unstocked rivers.

Status

Egg deposition in the **Morell River** was not estimated because the Leards Pond counting facility did not operate in 2001. Estimated egg deposition was below conservation requirements in three of the four years in which the counting facility operated between 1995 and 1999. Most (90%) adult salmon captured for broodstock on the Morell in 2001 were of hatchery origin.

Mean total densities of juvenile salmon (fry plus age-1+ and older parr) on the Morell were 20.3 fish per 100 m^2 in 1995-2000 and 30.5 fish per 100 m^2 in 2001.



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

Outlook

Based on recent years' experience, returns in 2002 to the **Morell River** will probably not meet conservation requirements, 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 2002 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

The chief limitation to Atlantic salmon production in PEI is stream sedimentation caused by agriculture and other land use activities (DFO 2000b). Cultivation techniques which reduce erosion and pesticide run-off have become more widespread in recent years, but potato acreage has also increased. Substantial self-sustaining salmon runs cannot be re-established until these impacts are severely reduced. It is recommended that protection for wild-reared salmon be provided.

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-reared fish. Egg deposition from wild-reared spawners is far below conservation requirements in all systems. It is recommended that protection be provided for wild-reared salmon (as indicated by an intact adipose fin). Increased spawning escapement of wild-reared fish can be expected to benefit wild production and also provide more fish of wild origin for broodstock use. Measures to protect 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)

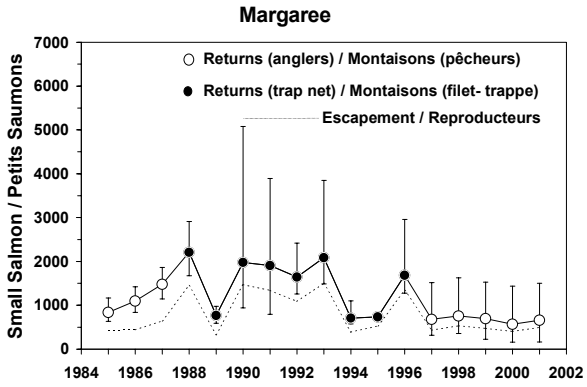
The Salmon Fishing Area 18 includes the rivers from the Northumberland Strait shore of Nova Scotia and western Cape Breton Island. Sixteen rivers from the Northumberland Strait Shore of Nova Scotia are known to support Atlantic salmon stocks. The last stock assessment was conducted for eight of these rivers in 1999 and stock status information was updated for nine rivers in 2000 (DFO 2001). 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 updated in 2000 (DFO 2001) and again for 2001.

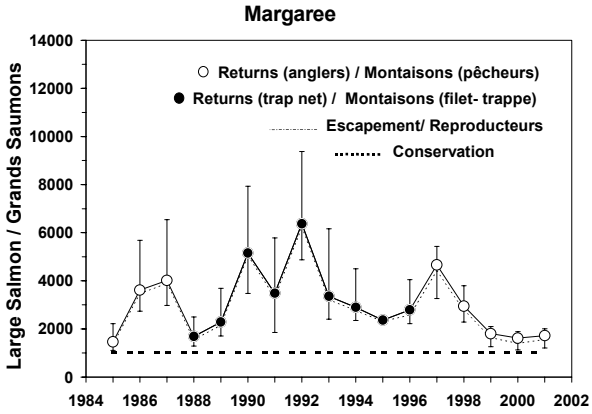
Status

Returns of Atlantic salmon to the rivers of the **Northumberland Strait of Nova Scotia** were not estimated in 2001 because of insufficient information. In previous years, returns to those rivers were based on recreational catches and assumed catch rates in the recreational fishery. Catch rates in the recreational fishery are influenced by factors such as discharge, run timing, and the limited angling season. Annual variations in these factors can affect the estimates of returns. Water discharge in the rivers of the Northumberland Strait of Nova Scotia was very low during the autumn of 2001 and salmon entered these rivers in late autumn. Based on angler diaries, some salmon were observed in the lower part of the rivers (head of tides) on October 4 but most observations of fish in the rivers occurred after the middle of October. The fishing season in these rivers is short (September 1st – October 31st) and few fish were captured in 2001. Based on preliminary license stub returns, only 49 small and 41 large salmon were captured from all the rivers of the Northumberland Strait of Nova Scotia, in 2001. Most of these occurred in River Philip, Wallace River, West River (Antigonish), West River (Pictou) and East River (Pictou). These numbers were insufficient to estimate salmon returns.

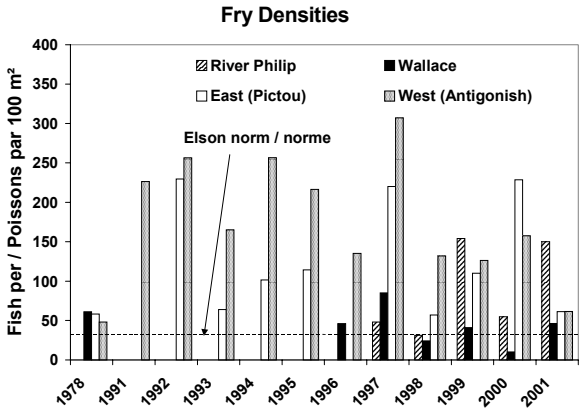
Discharge was also low in **Margaree River** in 2001, but the number of salmon captured was sufficient to estimate salmon returns to the river. Different techniques have been used to estimate the salmon returns to the Margaree River since 1985. During 1985 – 1987, returns were estimated from angling catches and assumed catch rates. From 1988 to 1996, returns were estimated from catches at an estuarine trapnet with trapnet efficiencies estimated from mark and recapture experiments. Salmon returns between 1997 – 2001 were estimated from the Nova Scotia License stub returns and an average capture rate estimated from the mark-recapture experiment conducted from 1991-1996. In 2001, small and large salmon returns were estimated at 660 (160-1,500) and 1,720 (1,200-2,000), respectively. Estimated small salmon returns increased by 17% from 2000 but large salmon returns were similar to 2000.

The estimated escapements were 490 small and 1,560 large salmon. Large salmon escapement in 2001 was about 150% of the conservation requirement of 1,036 large salmon. Conservation requirements have been exceeded in every year since 1985. Ninety-eight percent of the fish sampled during broodstock collection were of wild origin.

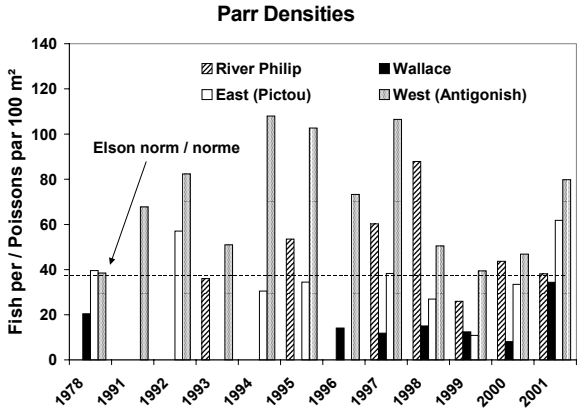




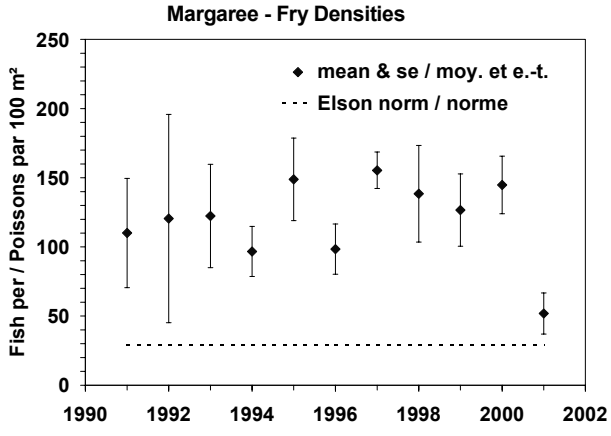
Juvenile surveys were conducted in four rivers of the Northumberland Strait of Nova Scotia (**River Philip, East River (Pictou), Wallace River and West River (Antigonish)**). Fry densities in all four surveyed rivers exceeded the Elson norm in 2001. In comparison with the year 2000, the fry density in River Philip and Wallace River increased but the densities in East River (Pictou) and West River (Antigonish).

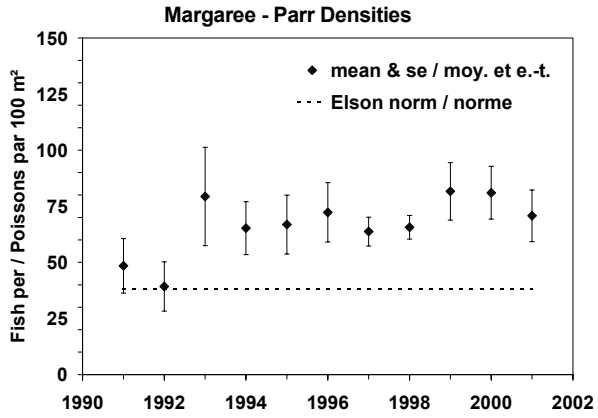


Parr (age-1+ and older) densities equalled or exceeded the Elson norm in River Philip and West River (Antigonish) in most years. In contrast, parr densities in Wallace River and East River (Pictou) were generally below this level. Compared with 2000, parr densities increased in three rivers during 2001 with the exception of River Philip where abundance was similar to previous years.



The mean juvenile densities at four index sites in Margaree River in 2001 were 52 fry and 71 parr per 100 m^2; values 1.8 and 1.9 times the Elson norms, respectively. Fry densities decreased considerably in 2001 compared with previous years. The reduced abundance of fry at the index sites in 2001 is greater than expected based on the estimated returns of salmon from the previous year. Parr densities remained high.





Outlook

Based on the sustained juvenile abundance in the rivers of **Northumberland Strait of Nova Scotia**, no change in status from previous years is expected. Sustained juvenile levels in the **Margaree River** suggest that adult returns in 2002 should be similar to those of recent years.

Management Considerations

The rivers in **Northumberland Strait Nova Scotia** are relatively small and returns of salmon typically range from a few dozen to a few hundred. The level of directed fisheries exploitation in recent years generally has not been of concern to conservation.

Escapement to the **Margaree River** has exceeded the conservation requirement in each of the last 18 years.

Little or no data were available for First Nation catches on many of the area rivers. Closer monitoring of returns and harvests in 2002 and beyond would be necessary to improve the accuracy of the stock status 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. The non-Highlands, Grand River is of lower gradient, has flows and temperatures moderated by headwater lakes and a fishway that by-passes Grand River falls.

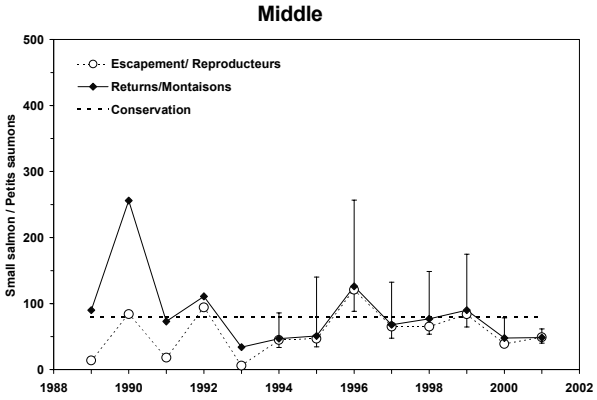
The last assessment for these rivers was for 2000 (DFO 2001). Assessments in this area are reliant on fall season diver counts of salmon. Fall diver counts of salmon were adversely affected by unusually low water levels in 2001. A count without applying marks was conducted on November 5, 2001 in the Middle River. A mean of observation rates from previous mark and recapture estimates was used to derive the 2001 value. Only the summer, July 15, 2001 diver count of salmon was available for the North River. The North River has a small and variable number of fall salmon. Therefore, a minimum population estimate was developed from the summer count and the mean observation rate determined from previous years diver counts of salmon in the North River.

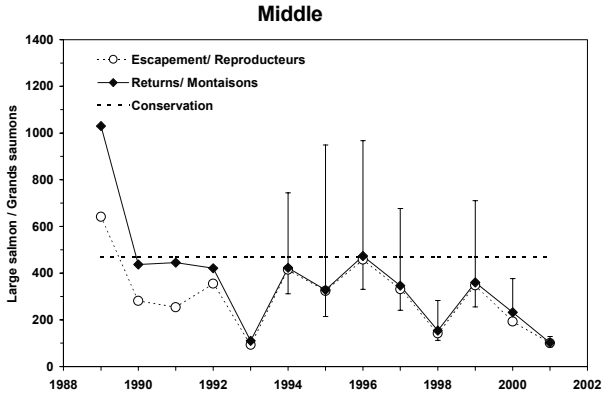
In all assessed rivers, relationships between previous estimates by mark and recapture or fishway counts and recreational catches were closely correlated. This analysis indicated that reported catches could serve as surrogates for direct counts. The 2001 escapement to the Baddeck River was therefore derived from the preliminary estimate of recreational catches and the relationship between angling catches and mark-recapture estimates from 1994-2000.

Electrofishing surveys were repeated in six rivers and initiated in an additional 11 rivers in 2001.

Status

Returns to **Middle River** in 2001 were estimated from diver counts and the average observation rate of 0.66 (0.52-0.80) to be 150 (124-190) fish, comprised of 49 small and 101 large salmon. Large salmon returns were down 56% from 2000.

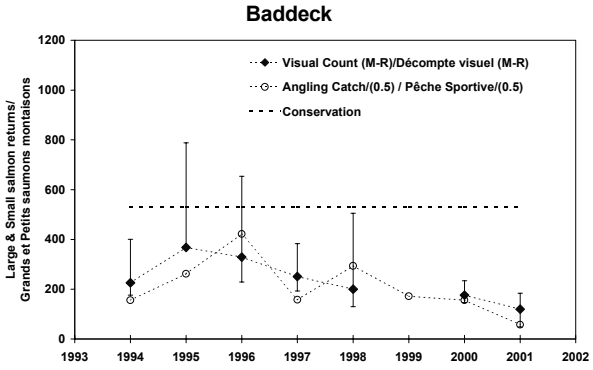




Conservation requirements for the Middle River of 2.07 million eggs have been expected from 470 large and 80 small salmon. Small salmon escapement (49 fish) was about 61% of requirement, large salmon (101 fish) were about 21% of requirement.

Mean juvenile densities of 11 fry and 44 parr per 100 m^2 at two mainstream index sites on Middle River in 2001 were 0.4 and 1.2 times the Elson norms. Monitoring since 1996 revealed densities to be slightly above norms, however fry densities dropped below norm in 2001.

As river conditions precluded diver counts of salmon on the **Baddeck River** in 2001, returns were estimated from angling catch with calibrations from historical snorkel counts. Estimates were 120 (46-186) fish comprised of 37 small and 83 large salmon.

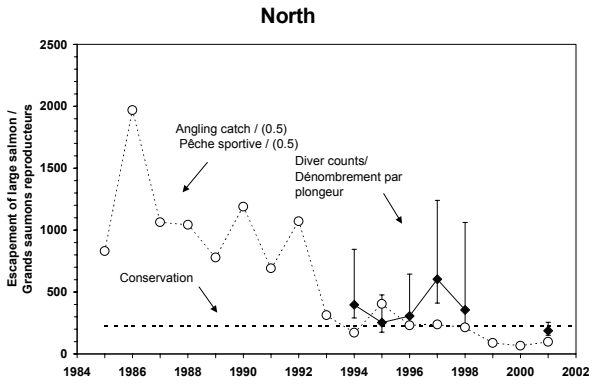


The conservation requirements for the Baddeck River are 2.0 million eggs, expected from 450 large and 80 small salmon. Small salmon escapement (37 fish) was 46% of requirement, large salmon (82 fish) were about 18% of requirement. Thus egg conservation requirements were unlikely to have been met in 2001.

Mean juvenile densities of 48 fry and 27 parr per 100 m^2 for three mainstream sites on Baddeck River in 2001 were 1.6 and 0.7 times the Elson norms. Monitoring since 1996 indicates that densities of fry fluctuate above, and that densities of parr fluctuate around or slightly below the Elson norms.

Returns of 45 small and 190 large salmon to the **North River** in 2001 were estimated from diver counts and the average observation rate of 0.49 (0.36-0.61). Estimates based on angling, 1994–1998 and 2001, were on

average 72% (39% - 159%) of those based on diver counts.

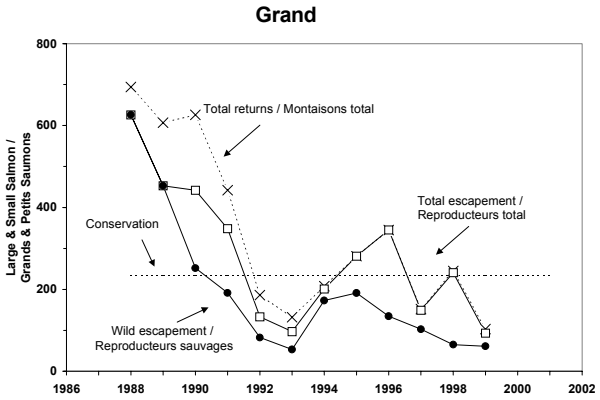


Conservation requirements for the North River are 0.85 million eggs expected from 200 large and 30 small salmon. Small salmon escapement (44 fish) was about 147% of requirement, large salmon (188 fish) were about 95% of requirement. Thus egg conservation requirements were likely to have been met in 2001.

Mean juvenile densities of 13 fry and 46 parr per 100 m^2 for four mainstream sites on North River in 2001 were 0.5 and 1.2 of the Elson norms.

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 area is upstream of the falls. There are now no stocked fish contributing to returns.

The salmon movements at the Grand River fishway were not monitored in 2001. Estimates of catch from only four voluntary returned Nova Scotia Salmon License stubs were 21 small salmon in 2000 and one small salmon in 2001. No large salmon were caught in either year. Low catches, coupled with recent low returns of wild fish to Grand River, suggest a low probability that egg conservation requirements were met. Conservation requirement upstream of the fishway is 475,000 eggs that would be expected from 234 salmon.



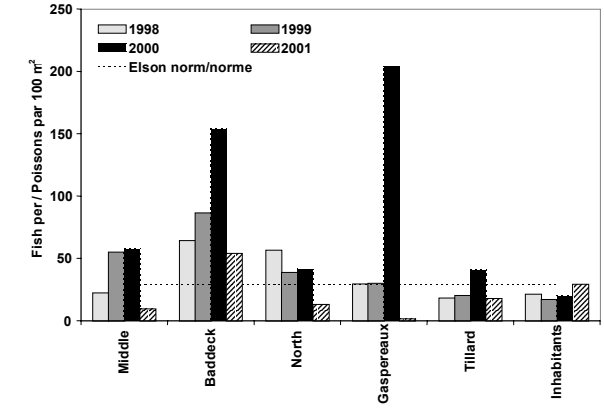
No sampling for juveniles was conducted in 2001 in Grand River.

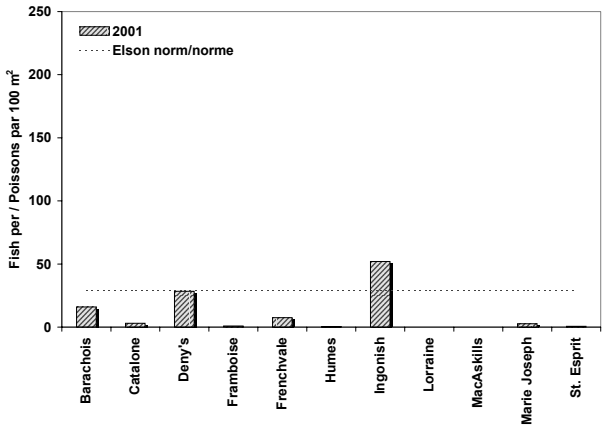
Juvenile salmon surveys were continued in 2001 in the **Gaspereaux**, **Tillard** and **Inhabitants** rivers. Eleven other rivers, the **Barachois, Catalone, Deny's, Framboise, Frenchvale, Humes, Ingonish, Lorraine, MacAskills, Marie Joseph,** and **St. Esprit** were also sampled in 2001.

Relative to the Elson norm, high fry densities at 3 sites on the Baddeck River in 2001 are inconsistent with the estimated under escapement of spawners in 2000. Higher densities of fry from a limited number of sites may be affected by their potential for limited distribution from spawning areas. Thus, high densities of fry observed at single sites on the Deny's, Inhabitants and Ingonish rivers are suspect as indicators of the previous years escapement. Nonetheless, considered collectively fry densities estimated in 2001 in only two of 17 rivers were above the normal value, two were near and 13 were below. Together, these data suggest that egg conservation requirements were not generally met in SFA 19 in 2000.

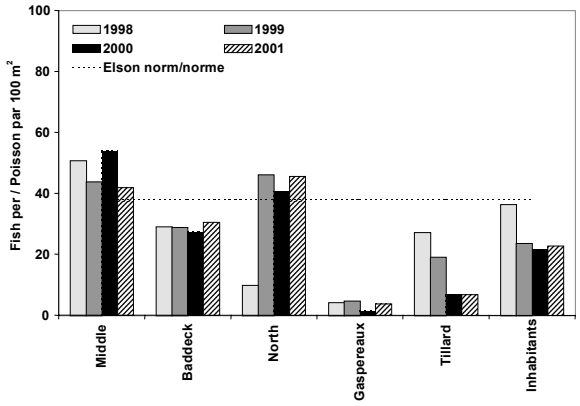
Age-1+ and older parr densities, a stage that has had more time to distribute within a river, are less susceptible to low sample size. In 2001 only four rivers were above and two rivers near the normal density of age-1+ and older parr. These data support the conclusion that recent escapements have generally been below conservation requirements. Only for the North River have both adult and juvenile indicators been above conservation requirements in recent years.

Eastern Cape Breton – Fry Densities

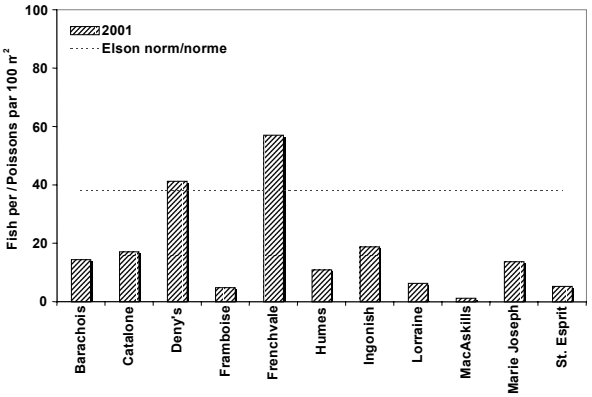




Eastern Cape Breton – 1+ and Older Parr Densities



Eastern Cape Breton – 1+ and older Parr Densities



Outlook

The outlook is based on the average returns of the previous five years.

For the **Middle River**, the forecast of small and large salmon returns in 2002 is about 305 fish (106-511). The probability of returns exceeding the conservation requirement (550 fish) is about 2%.

For the **Baddeck River**, the forecast return in 2002 is 184 fish (86-283) and the probability of exceeding the conservation requirement of 530 salmon is near zero.

Projected returns of small and large salmon to **North River** in 2002 are 346 fish (82-657). The probability of exceeding the conservation requirement of 230 fish is 76%.

For **Grand River,** the recent trend in low returns and low angling catches in 2001 suggests that the conservation requirement is unlikely to be met in 2002.

Management Considerations

On the basis of adult escapements, conservation requirements were unlikely achieved in recent years on the **Middle** and **Baddeck** rivers. As indicated by juvenile densities, few rivers of SFA 19 have met conservation in recent years. Based on these observations, expectations are that returns to most rivers in SFA 19 will not meet conservation requirements in 2002.

However, there is a 76% chance that returns in 2002 to the **North River** will be sufficient to meet conservation requirements of 230 salmon.

The **Grand River** salmon did not meet the conservation requirement upriver of the fishway in 1999 and 2000. As in 2001, returns in 2002 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 2002.

Based on observations of juvenile salmon, recent management plans have been successful in maintaining densities in many rivers despite low returns of salmon. These results are in part attributed to low harvests due to 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 (DFO 2001) and are again provided here for 2001.

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 of the Southern Upland of Nova Scotia (most of SFAs 20 and 21) were known to maintain salmon populations.

Fourteen rivers in SFA 20 and eight rivers in SFA 21 are **low- or non-acidified (**pH greater than 5.1) and have 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), were used as index rivers.

There are twenty rivers that are **partially acidified** where main-river annual mean pH is between 4.7 and 5.0.

As of 1986, at least fourteen rivers were **heavily acidified** (<pH 4.7) and had lost their population of Atlantic salmon. At recent measured acidity and marine survival levels, only seven of 47 rivers where data were available are expected to be self sustaining (DFO 2000c).

There is evidence that reductions in river water quality attributed to acid precipitation have occurred since 1986. Some of these rivers are additionally impacted by impoundment for hydroelectric or domestic water use.

Status

Low- or non-acidified rivers

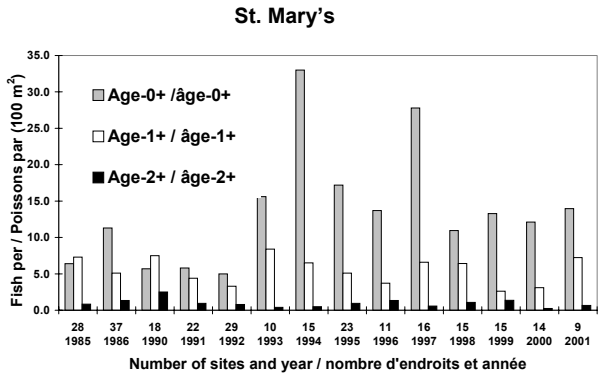
Conservation requirements have been assigned for two low acidified rivers: 1.9 million eggs equivalent to 1,320 fish for the LaHave River above Morgans Falls, and 7.4 million eggs equivalent to 3,155 fish for the entire St. Mary's River.

The estimated escapement to the West River St. Mary's, in 2001, was 425 fish (275 – 1,360) of which 75% were small salmon. Based on the proportion of habitat sampled, total escapement to **St. Mary's River** in 2001 was estimated to be 775 fish that yielded 30% of the egg requirement for the entire river.

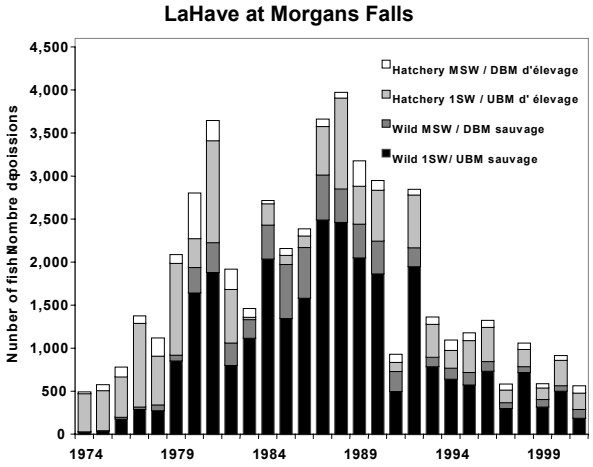
Escapement Estimates – St. Mary's River

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

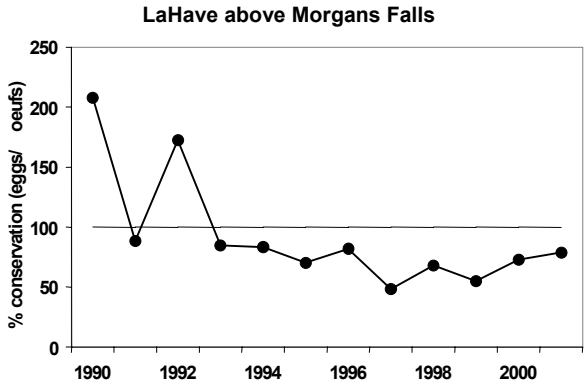
Parr (age-1+ and age-2+) densities remain low while fry (age-0+) densities are higher since 1993.



Counts at Morgans Falls fishway on the **LaHave River** were 563 fish, 379 small and 184 large salmon, which indicated a potential of 98% of the egg requirement in 2001. After broodstock removals, egg deposition was 83% of the egg requirement. The count of wild salmon was the lowest (189 small and 103 large) since 1976. Consequently, hatchery origin fish contributed 49% of the estimated egg deposition after removals.

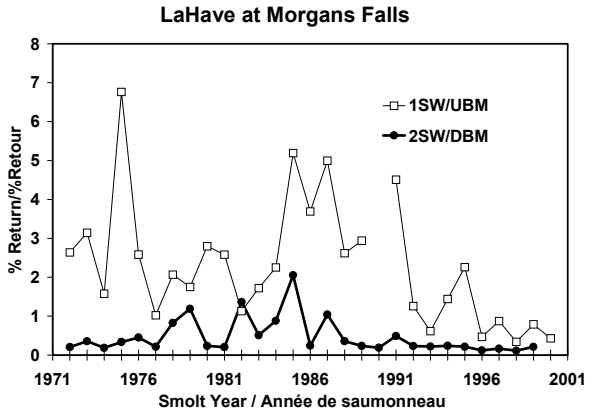


This was the ninth consecutive year that egg deposition above Morgans Falls has been less than the conservation requirement.



Return rate of the 2000 hatchery smolts as 1SW fish in 2001 decreased to 0.43% from 0.79% the previous year. Returns of 2SW hatchery salmon in 2001 (the 1999 smolt class) increased to 0.21%. The 1SW return rate was less than the five year mean of 0.55% from hatchery stocked smolts. The

return rate to 2SW for hatchery smolts stocked in 1999 was greater than the five year mean of 0.16%.

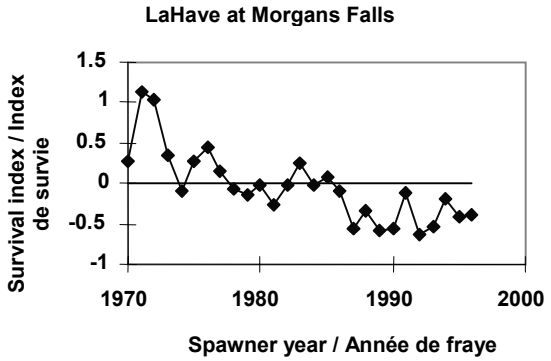


In 2001, a total of 15,700 wild smolts was estimated to have migrated from above Morgans Falls, similar to the 1996 to 2000 average of 15,850 smolts. The return rate of wild smolts emigrating from above Morgans Falls in 2000 was 1.16%, the lowest observed since counts began in 1996.

LaHave River above Morgans Falls

Year	Wild smolts Estimate	Wild smolts per 100 m²	Survival 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	

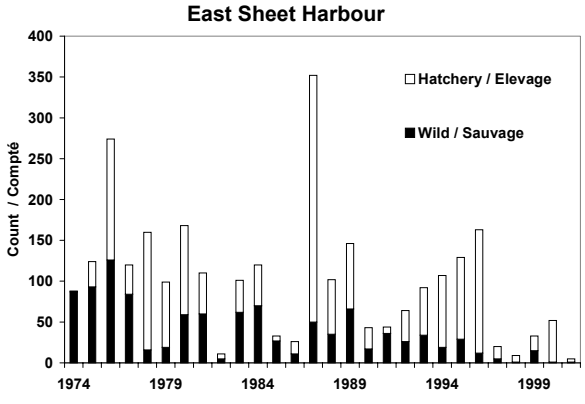
Survival of wild salmon, as inferred from recruits per spawner above Morgans Falls, indicates that the population has not replaced itself (values above 0) since the 1985 escapement.



The status of all low-acidified rivers in SFAs 20 and 21, which 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 produced smolts.

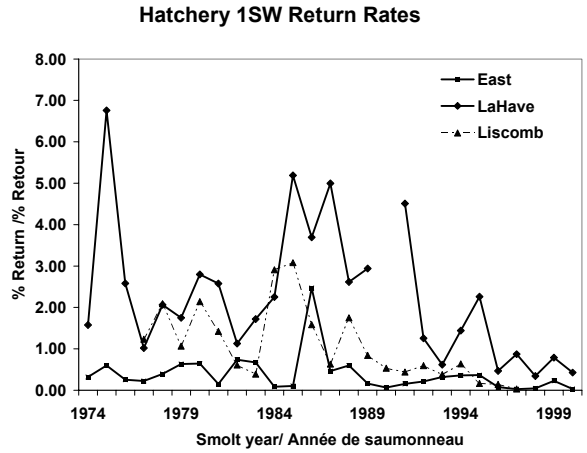
Partially-acidified rivers

The **East River Sheet Harbour** fishway count data, 1974 to 2001, 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 last four years (5 to 46 fish) and totalled five fish in 2001, one of which was of wild origin.



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, compared to those stocked in the East River Sheet Harbour as well as 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 in 2001. Due to low escapements in the LaHave River, hatchery smolts were not available for enhancement in the **Clyde** and **Jordan** rivers in 2001.

Outlook

Low- or non-acidified rivers

Based on the average estimated return to **St. Mary's River** from 1997 to 2001 of 869 small salmon (162 – 1,863) and 115 large salmon (29 – 211), there is less than a 0.5% chance that returns of large and small salmon in the year 2002 will exceed the conservation requirement.

For **LaHave River** above Morgans Falls, forecast models based on cohorts for MSW salmon and the previous five-year average return of 1SW salmon by smolt origin, suggest a better than 95% chance that salmon returning in 2002 will be greater than the conservation requirement. About a third of the forecast return is expected to originate from 93,500 hatchery smolts stocked at or above Morgans Falls in 2001.

Based on the number of wild smolts emigrating from above Morgans Falls in 2000 and 2001, there is less than a 3% chance that returns of wild small and large salmon to Morgans Falls in year 2002 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 independent of escapement. This trend does not support the recovery of salmon stocks in SFA 20 and 21.

Hatchery smolts stocked in low- or non-acidified rivers are expected to return at rates similar to that observed at Morgans Falls. Stocking in other low- or non-acidified rivers with smolts originating from the LaHave River broodstock was reduced in 2001 in order to enhance the production above Morgans Falls on the LaHave River.

River	Origin of Stock	No. of smolt
LaHave	LaHave	93500
Mushamush		0
Petite		0
Musquodoboit	Musquodoboit	20100

Partially-acidified rivers

Deteriorating water quality due to acid precipitation, declining wild salmon returns and low smolt-to-adult return rates indicate that wild returns will be inadequate to meet conservation requirements in 2002. Survival

rates of hatchery smolts in recent years suggest that returns in 2002 will provide insufficient augmentation to meet conservation levels.

River	Origin of Stock	No. of smolt
Sackville	Sackville	25700
Tusket	Tusket	39600
Gold	Gold	9600
Medway	Medway	10900
Salmon(Digby)	Salmon(Digby)	24200
East R. Sh. Hb.	East R. Sh. Hb.	18600
Liscomb		0

No broodstock were obtained from the Liscomb River in 1998 and the last hatchery smolts were released in 2000.

Heavily acidified rivers

Hatchery produced smolts, formally of LaHave origin, were not stocked in the **Clyde** and **Jordan** rivers in 2001. Salmon returns in 2002 from stocking in 2000 are expected to be minimal. A salmon broodstock collection from the **Mersey** River was unsuccessful in 2000 and 2001 due to low returns and harvests below the fishway. Returns to these rivers are expected to be low in 2002.

River	Origin of Stock	No. of smolt
Clyde		0
Jordan		0
Mersey	LaHave	10800

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 2002. Return rates of hatchery smolts have declined to levels where rivers receiving hatchery supplementation equal to or less than that received in 2000, are again not likely to meet conservation requirements in 2002. Increased supplementation to the LaHave River above Morgans Falls may serve to increase returns above the conservation requirement. This expectation is heavily based on hatchery contribution, which has varied in age composition and therefore contribution to egg deposition. This renders forecasts of expected egg deposition unreliable and an in-season assessment of the returns in 2002 is recommended.

Small and large salmon have historically contributed equally to egg depositions in these rivers. Therefore, the harvest of small salmon has the potential to significantly affect stock conservation. This dependence on the 1SW component has increased to include 1SW hatchery fish. The reasons for the increase in contribution to egg deposition by 1SW hatchery fish are unknown and require confirmation. The increased contribution could be related to the change in broodstock selection and breeding from predominantly 2SW salmon to more 1SW and MSW salmon, similar to observed population proportions. Regardless, the contribution of hatchery salmon may become increasingly important for maintenance of the stock and not all 1SW-hatchery fish may be available for harvest in 2002.

The opportunity for harvests of returning adipose fin-clipped salmon from stocking of hatchery smolts to the heavily acidified **Mersey, Clyde** and **Jordan rivers** will be minimal in 2002. Reduced stocking of these rivers is the result of increased demands to utilize NS 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.

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 were provided in 1999 (DFO 2000) and 2000 (DFO 2001) and are again provided here for 2001. 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 productive capacity 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 have been shown to be composed of at least two distinct population segments with suspected independent evolutionary histories. The distinctness of salmon in iBoF rivers has been recognized 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 annual population abundance was different from other salmon stocks. Subsequent 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 historical recreational catch.

Status

These rivers were typically assessed through counting of adult salmon as well as streamside observation of adult salmon in the clearer more visible rivers, electrofishing of juvenile salmon, and smolt monitoring. No quantitative data or qualitative observations indicated that salmon returns substantially increased in 2000 or 2001.

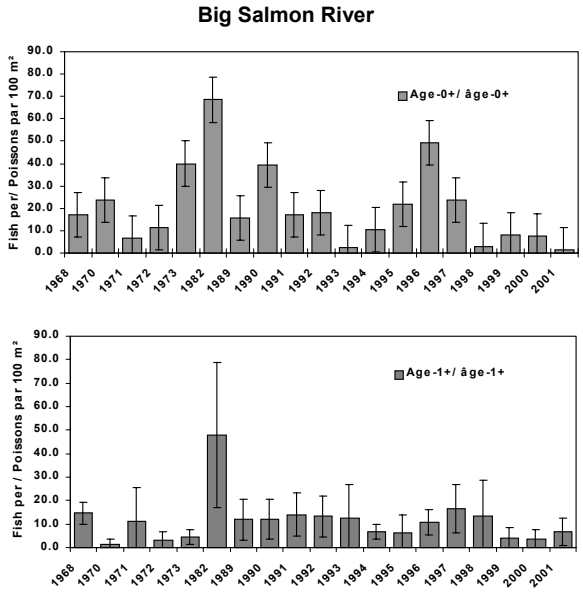
A qualitative survey of the adult salmon population in the **Big Salmon River** in 2001 was conducted by snorkel diving on three occasions. On August 23, 2001, a total of nine Atlantic salmon and eight rainbow trout (*Oncorhynchus mykiss*) were observed. On October 16, 2001, a total of 15 fish, (eight large and seven small salmon) were observed in 16 of 35 known pools. On

October 22nd and 23rd a total of eight large and 12 small salmon were observed from Walton Dam in the upper river to the Foot Bridge near the mouth of the river. Water levels subsequently increased and prevented the completion of a mark and re-capture population estimate. No hatchery or escaped-farmed salmon were noted.

An estimated 5,300 (4,100-8,100) wild smolts emigrated from Big Salmon River in 2001. The 2001 smolt run equates to 0.58 smolts per 100 m^2 or 25% of the average smolt production monitored from 1966 to 1972.

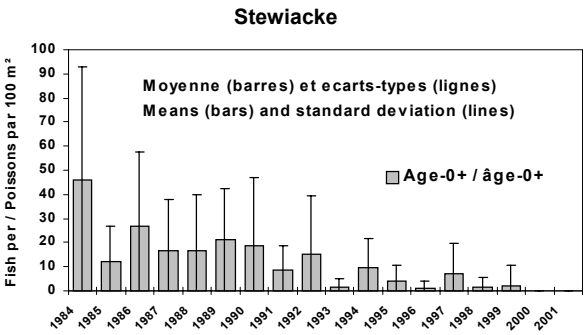
The population of Atlantic salmon in the Big Salmon River was recently enhanced through the release of captive-reared broodstock in 1994 and 1995. These fish were raised in sea cage culture from hatchery smolts derived from wild adult salmon captured from the Big Salmon River.

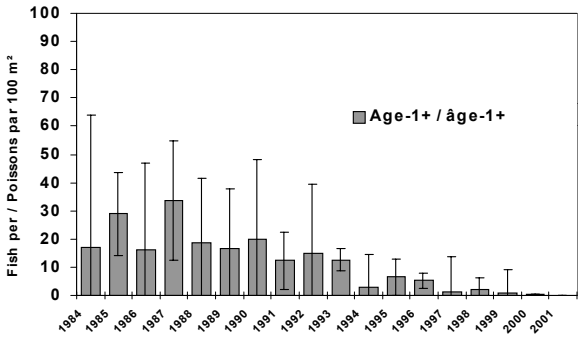
The subsequent increased densities of age-1+ parr from 1996 to 1998 indicated the effectiveness of cage-reared broodstock to increase in-river juvenile populations. The procedure also suggests that the decline in parr densities that were generally noted in other iBoF rivers, was the result of reduced spawning escapements and not a general loss of habitat productivity within the region. Densities of both age-0+ parr and age-1+ parr in the Big Salmon River have subsequently decreased with reduced escapements of salmon. Wild age-0+ (fry) density at the standard five monitored sites reached a new low of 1.6 per 100 m^2 in 2001.



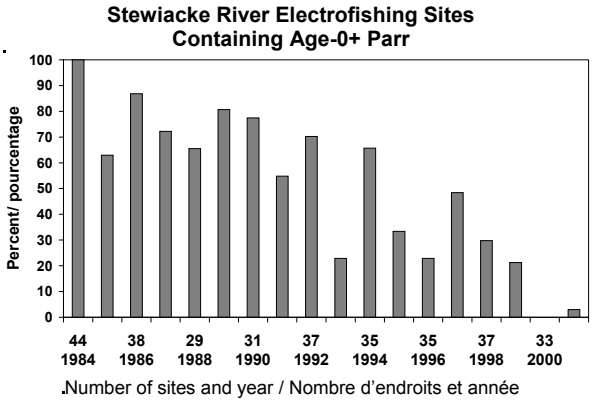
Densities of hatchery released fry, a by-product of the Big Salmon River Live Gene Bank, were determined at two new sites in 2001. Densities were determined below fry release sites on Falls Brook and Saddleback Brook, tributaries of the North West Branch. Densities of hatchery fry at these sites were 52.2 and 66.9 per 100 m^2, respectively.

Electrofishing for juvenile salmon at 35 sites in the **Stewiacke River** in 2001 indicated a continued low abundance of juvenile salmon. The density of age-0+ parr was 0.006 and the density of age-1+ parr was 0.07 per 100 m^2.

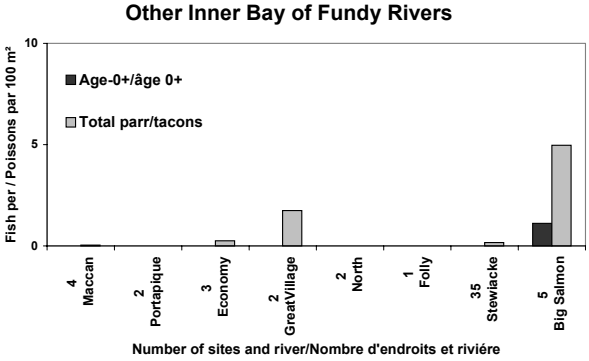




The percentage of electrofishing locations that contained age-0+ parr increased from 0% in 2000 to 3%, or 1 of 35 locations in 2001. That location in Goshen Brook, a tributary midway up the main Stewiacke River, contained a density of 0.1 fry per 100 m^2.



Electrofishing at a total of 14 locations in six other rivers (**Maccan, Portapique, Economy, Great Village, North and Folly**) indicates that there were few salmon of any age in rivers of the iBoF in 2001.



No Atlantic salmon juveniles were located in 20 of 40 rivers of the iBoF surveyed by electrofishing in 2000. In the 20 rivers where juvenile salmon were encountered, densities were less than 1.0 per 100 m^2 in all but the Big Salmon River, New Brunswick, and in the Great Village, Gaspereau, and Cornwallis rivers, Nova Scotia.

Salmon of the **Gaspereau River**, Kings County, Nova Scotia, although genetically identified as an iBoF salmon stock, migrate to the northwest Atlantic, and have followed a recruitment and life history pattern similar to other Atlantic coast rivers. In 2001 a total of 57 fish (24 hatchery and 33 wild) were counted at the White Rock Dam fishway. This number is potentially 24% of the conservation egg requirement. A total of 29 fish was removed for broodstock. Egg deposition in 2001 after broodstock removal was 18% of the conservation requirement.

Gaspereau River at White Rock Dam Fishway

			Year				
	Origin	Size	1997	1998	1999	2000	2001
Escapement	Wild	Large	5	6	11	3	6
		Small	30	9	1	7	7
	Hatchery	Large	2	10	13	4	10
		Small	22	42	0	30	5
Broodstock	Wild	Large	7	3	14	4	14
		Small	23	7	2	14	6
	Hatchery	Large	5	2	0	9	3
		Small	8	20	0	5	6
Total count		Large	19	21	38	20	33
		Small	83	78	3	56	24
Total count all sizes			102	99	41	76	57
%		counted	74	56	30	16	24
Conservation		escapement	43	42	15	9	18

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 three generations of recovery.

The **Gaspereau River** has received hatchery supplementation but did not meet conservation requirements in 2001 and is not expected to do so in 2002.

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 are required to prevent extirpation of iBoF salmon. A live gene bank program to prevent the extirpation of inner Bay of Fundy salmon was initiated in 1998. Large numbers of fish and eggs of various ages are presently held in the Biodiversity Facilities. These fish originate from two river stocks (Stewiacke and Big Salmon) and a combined total of 122 parr collected from the Economy, Great Village, Portapique, Folly and Debert rivers that required 14 hours of electrofishing machine-time. Releases of juvenile salmon to Stewiacke, Big Salmon and Petitcodiac rivers began another phase of live gene banking of iBoF salmon in 2001.

Outer Bay of Fundy (western part of SFA 23)

The last assessment of rivers of the outer Bay of Fundy was for 2000 (DFO 2001). The following information is an update of that document, with the addition of fry data (1992-2001) for tributaries upstream of Mactaquac.

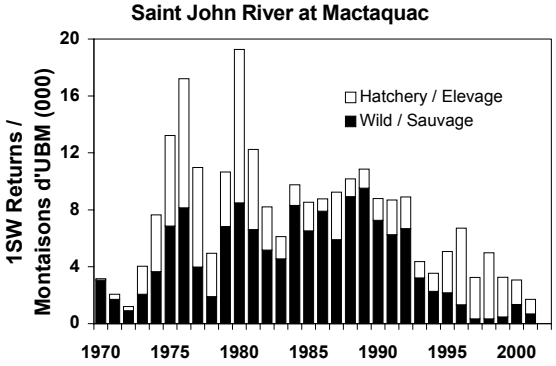
Stocks in this area generally have not met conservation requirements during the last decade. Many of these stocks face a multitude of constraints including hydroelectric dams (with upriver passage facilities but mostly devoid of safe downstream passage) artificial flow regimes, headponds, significant industrial, and municipal effluents, run-off from intensive agricultural operations, and new developing communities of potentially effective predators on juveniles and smolts. As well, escapes from the Fundy-Isle (NB) and Cobscook Bay (ME) aquaculture industry (2000 production estimates of 45,000 t) have been identified at all primary counting facilities and have the potential to transmit diseases and genetically swamp those small wild stocks proximate to cage sites and production hatcheries.

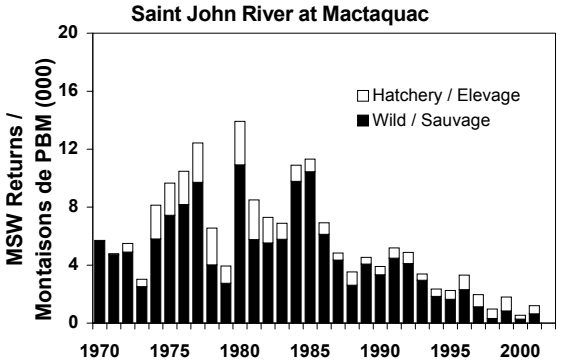
Status

Saint John River upstream of Mactaquac

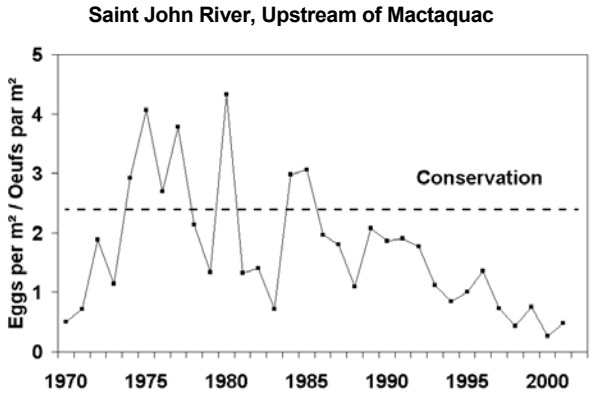
The total count of salmon on the **Saint John River at Mactaquac** dam in 2001 was 2,873 fish. Total returns (including assumed losses downriver of Mactaquac) were estimated to be 1,700 1SW and 1,206 MSW salmon, exclusive of 14 fish that were identified as farm escapes. About 60% of 1SW and 47% of MSW returns were of hatchery origin. Run-timing in 2000 and 2001 was relatively normal compared to the unusually early arrival of fish in 1999.

Wild and hatchery-origin 1SW returns were the second lowest of a 32-year record; wild and hatchery MSW returns were the third lowest of the 32-year record.

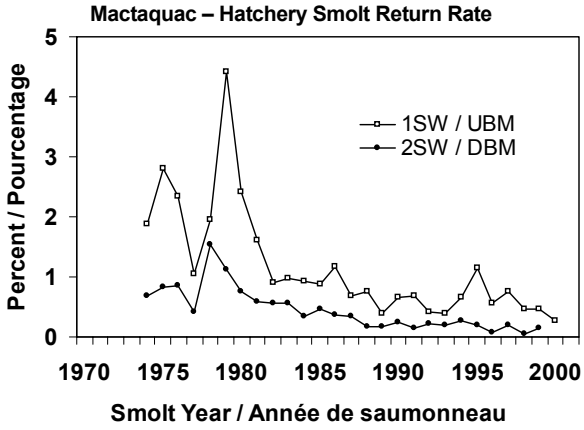




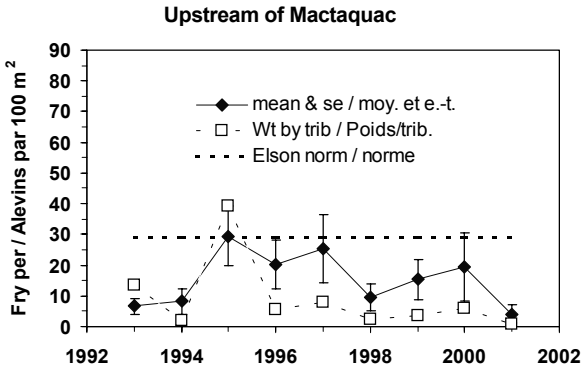
Spawning escapement upriver of Mactaquac numbered an estimated 944 MSW (50% wild) and 1,463 1SW (37% wild) salmon. Ninety-two percent of escaping MSW fish were female, 7% of escaping 1SW fish were female. Conservation requirements upriver of Mactaquac are 32.3 million eggs to be provided by 4,900 MSW and 4,900 1SW fish. Only 20% of the conservation egg requirement was met - the third lowest value in 32 years. Hatchery-origin fish provided 47% of the eggs. A total of 1.2 million eggs, representing 15% of the total eggs arriving at Mactaquac, were retained for hatchery incubation and rearing. These eggs came from 132 MSW and one 1SW female salmon of which 83% were wild origin fish. Eggs in total returns (8.2 million) would have accounted for 25% of conservation requirement.



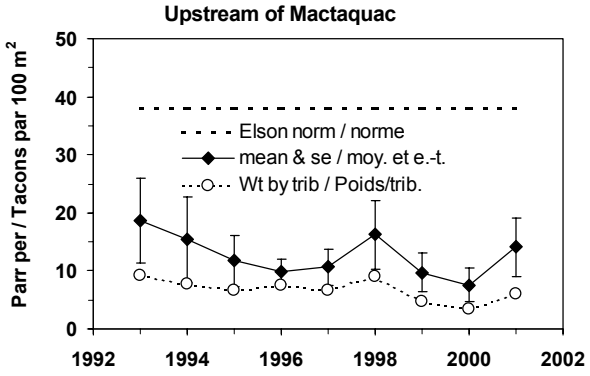
Aged returns from reared smolts released via Mactaquac smolt migration channel have been used as an index of marine survival. Return rates remain low with the 1SW rate the lowest on record.



Mean densities of wild fry (age-0+) at 15 sites upriver of Mactaquac, and mean densities weighted according to relative production area of the tributaries in which they are located were, 4.0 and 0.9 fry per 100 m^2, respectively. These values are the lowest estimated since 1993 and consistent with record low egg depositions in 2000.



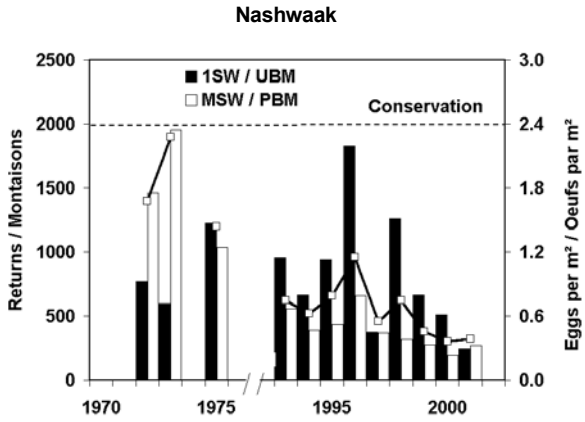
Mean densities of wild parr (age-1+ and older) at the same 15 sites were, 14.1, and 5.9 parr per 100 m^2, respectively. These values are nearly twice those of 2000 and consistent with higher fry densities on 2000.



Saint John River downstream of Mactaquac

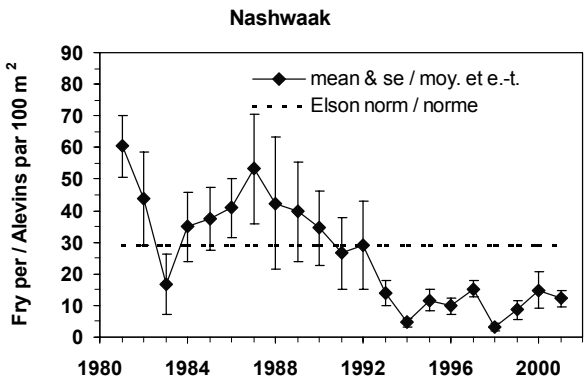
Counts at the **Nashwaak River** fence in 2001, numbered 244 1SW and 272 MSW salmon. Unlike most years, the count was complete and nullified the need for a late-season mark-and-recapture estimate. Scale analysis revealed that two 1SW and one MSW salmon were of hatchery origin and likely returns from a local enhancement project. No farm escapes were identified at the fence.

Returns of 1SW salmon were only 50% of those in 2000 and the lowest since 1993. MSW returns increased 40% from 2000 and were similar to those of 1999.

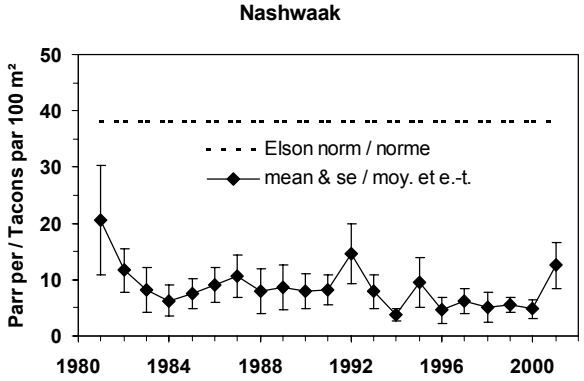


The conservation egg requirement (12.8 million) upstream of the fence is expected from 2,040 MSW salmon and an equal number of 1SW salmon to provide males. Escapement of about 224 1SW and 266 MSW salmon indicates egg deposition in 2001 to have been only about 16% of requirement. Females among 1SW salmon (39%) contributed to 15% of the estimated egg deposition. Approximately 29,000 eggs, representing less than 2% of the total eggs returning to the Nashwaak, were retained for future enhancement activities on the river. Female broodstock consisted of five MSW and two 1SW wild salmon and were mated with 12 male 1SW (wild) salmon.

Juvenile densities have been monitored since 1981 at six sites upriver and one downriver of the Nashwaak River counting fence. The mean fry density observed in 2001 was 12.2 fish per 100 m^2, slightly lower than that of 2000. Fry densities since 1981 have trended downwards and since 1993 have fluctuated around 10 fry per 100 m^2, about one-third the Elson norm.



Densities of parr at the seven sites in 2001, averaged 12.6 parr per 100 m^2 – two and a half times higher than 2000. Despite being the highest parr density since 1992, the value is low with respect to the Elson norm.

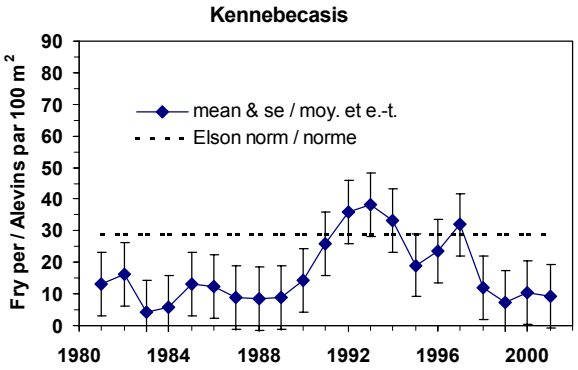


Smolts emigrating from upstream of the fence site were estimated to number 11,000 in 2001, equivalent to 0.21 smolts per 100 m^2. This is about 70% of the number estimated in 2000.

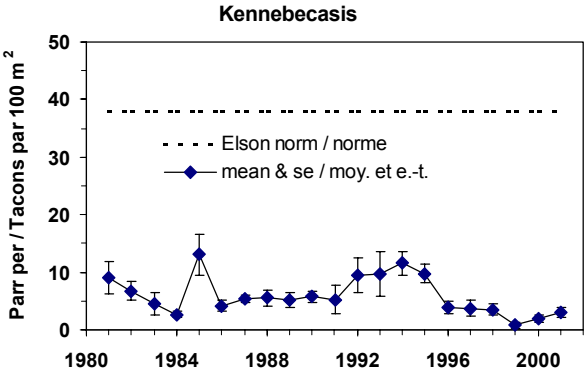
Nashwaak River

Year	Wild Smolts Estimate	Wild Smolts per 100 m²	% Survival to 1SW
1998	22750 (17900 – 32850)	0.43	2.92
1999	28500 (25300 – 33200)	0.53	1.79
2000	15800 (13400 – 19700)	0.30	1.53
2001	11000 (8100 – 17400)	0.21	

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 2001, averaged 9.4 fish per 100 m^2, similar to that for 2000, about one-third the Elson norm and the second lowest in the last decade.

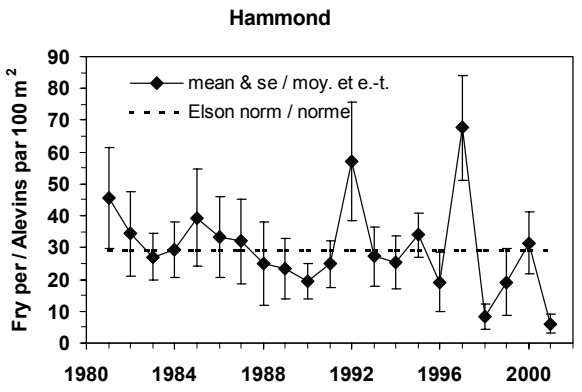


Values for parr in 2001 are low (3.0 parr per 100 m^2) with respect to the Elson norm and half the average density for the last decade.

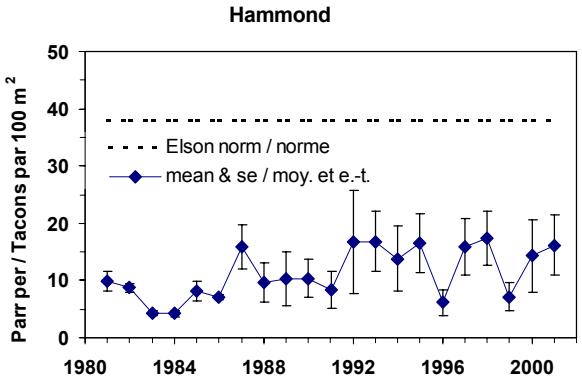


There was no assessment of adults returning to the **Hammond River** in 2001.

In 2001, fry averaged 6.1 fish per 100 m^2 at four sites, only 25% of the observed density in 2000 and the lowest value since 1981. (The value for 1997 was influenced by hatchery stocking.) In general, fry densities have declined since 1981.

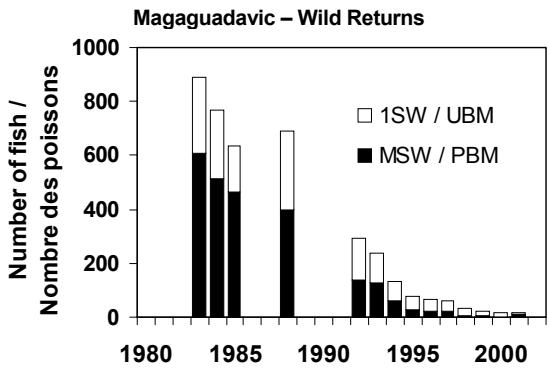


Densities of parr in 2001 averaged 16.1 fish per 100 m^2, similar to that for 2000. Unlike the Nashwaak and Kennebecasis, the parr densities since 1981 appear to trend upwards. Parr densities on the Hammond have generally been 2-3 times greater than those of either the Nashwaak or Kennebecasis rivers. The influence of hatchery stocking on these densities is believed to be minimal.

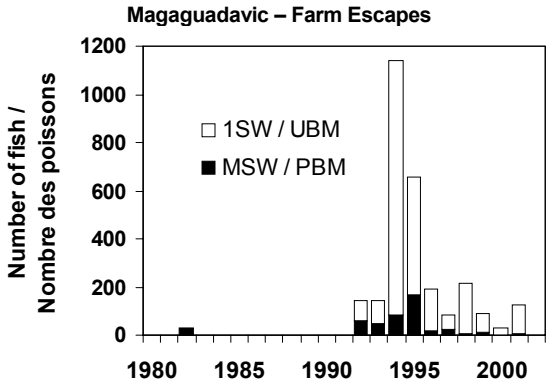


Other outer Bay of Fundy rivers

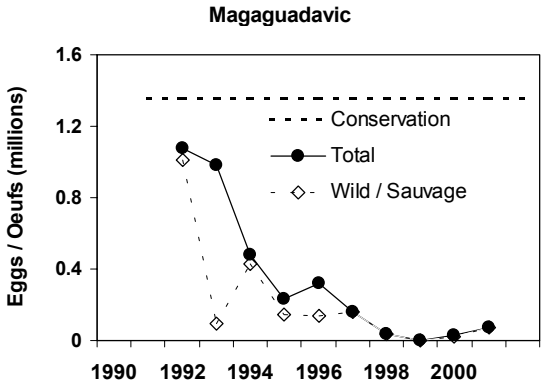
Wild returns to the St. George fishway and trap located at the head-of-tide on the **Magaguadavic River** in 2001 numbered only 8 1SW and 9 MSW salmon, the second fewest on record.

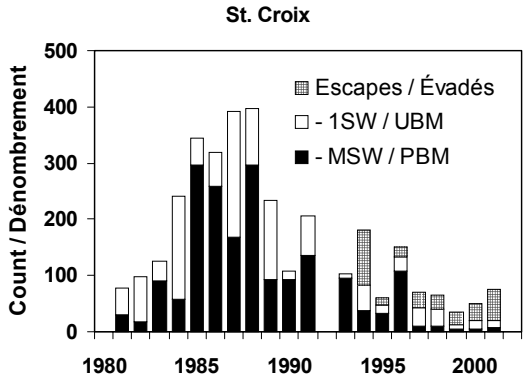


Farm escapes ascending the fishway in 2001 numbered 8 postsmolts, 120 1SW, and 4 MSW salmon; none tested positive for ISA virus.



Interim conservation requirements are 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 2001, 8 wild 1SW (4 females) and 9 MSW (8 females) salmon were released to the river. Potential egg deposition was 71,349 eggs, which is only 5.3% of the river's conservation requirement. Some 300 broodstock, progeny of 1998 adult returns, are being reared to maturity in captivity. These fish are expected to mature in 2002.





Surveys of juvenile salmon in 1995 and 1997 revealed low fry and highly variable parr densities. Also found were parr escapes from hatcheries supplying the aquaculture industry and as many as 12 juvenile smallmouth bass (*Micropterus dolomieui* Lacépède) per 100 m^2. Nine electrofishing sites completed in 1999 were again fished in 2000. Sites proximate to aquaculture industry hatcheries contained up to 18.7 parr per 100 m^2 (14 parr per 100 m^2 in 1999), sites distant to the hatcheries had 0 to 0.4 fish per 100 m^2 as in 1999. In 2001, parr were found at only 6 of 20 sites electrofished. Five of those sites were in proximity to hatcheries and all parr were suspect escapes based on size at age ratios. Only one wild parr was found at a site away from hatcheries.

Counts of salmon at the Milltown fishway, near head-of-tide on the **St Croix River** in 2001 numbered 7 MSW and 13 1SW hatchery-origin fish, 33 MSW and 23 1SW farm escape fish and 1 MSW returning adult-stocked fish; there were no wild fish. All farm escapes were removed from the trap for disease analysis and found to be negative. All other fish were live-tested for the ISA virus; five of these were initially found positive by RT-PCR testing but later proved negative under cell culture.

As part of a salmonid restoration program, all hatchery returns were retained as broodstock and 18 of these were transported as broodstock to the Mactaquac Fish Culture Station where they provided an estimated 49,700 eggs.

A total of 524 captive-reared adults from eastern Maine stocks were released into the St. Croix River at two locations between September 28 and October 11. Of these, 412 fish were female, and at an average weight of 8.1 kg, might have been expected to yield 5.3 million eggs, 73% of a 7.39 million conservation requirement). Subsequent canoe-based redd surveys recorded over 400 redds in the river believed to be resultant of the stocking; additional redds were identified in tributaries to one of the headwater lakes.

An adult salmon counting fence was monitored in **Dennis Stream** in 2001. No fish were captured.

Outlook

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

<u>Saint John River upstream of Mactaquac</u>

Projected returns for stocks originating on the **Saint John River** at and upriver of

Mactaquac in 2002 are 3,250 (1,359-5,138) 1SW and, at best, 1,400 (393–2,255) MSW salmon. The probabilities of attaining conservation requirements of 4,900 of each of 1SW and MSW fish are 8% for 1SW salmon and near zero for the MSW forecast. Low densities of wild parr, reliance on hatchery production and persistently low MSW return rates suggest that MSW returns will not be adequate to achieve egg conservation requirements for the next several years.

Saint John River downstream of Mactaquac

Predicted returns to the **Nashwaak River** in 2002 are 610 1SW fish (120-1,270). There is less than a 1% probability that 1SW requirements of 2,040 fish will be met. The forecast of MSW returns is 280 fish (180-390) and the probability that conservation requirements of 2,040 MSW fish will be met is near-zero. An estimate based on smolt-to-1SW survival suggests that 1SW returns in 2002 could be as few as 230 fish (170-360). Declining numbers of adult returns, particularly MSW salmon and low densities of parr suggest that returns will not be adequate to achieve egg conservation requirements for the next several years.

Current low fry and parr densities on the **Kennebecasis River** suggest that returns are likely to be similar to those in recent years.

Hammond River fry densities have approximated the Elson norm on several occasions during the last decade. Parr densities over the last decade, however, have averaged about 0.4 of the Elson norm, and suggest that returns in the next several years will likely be similar to those of recent years.

Other outer Bay of Fundy Rivers

Wild 1SW and MSW returns to the **Magaguadavic River** in 2002 are projected to be no greater than the few fish returning in 2001. There is a near-zero probability of attaining conservation requirements and without hatchery assistance and a recovery plan, the stock may soon be extirpated.

Mean numbers of wild and hatchery returns to the **St. Croix River**, 1997-2001, have been 20 1SW and 8 MSW fish. As there was no natural spawning in the river, 1997-1999 (all of the small stock of adults being collected for broodstock) current recruitment is entirely from limited juvenile stockings of St. Croix-origin and Penobscot-origin smolt, and unlikely to exceed 20 fish. Under any scenario for returns in 2002-2003, there is no probability of attaining conservation requirements. Returns of progeny from the release of captive-reared adult fish in 2000 and 2001 will not yield spawners before 2004.

Management Considerations

Saint John River upstream of Mactaquac

For the **Saint John River** stocks **upriver of Mactaquac**, egg depositions have been less than 50% of requirements for eight of the last nine years. There is essentially a zero probability that MSW returns will be adequate to meet conservation requirements in 2002. For 1SW salmon, there is less than a 10% probability of attaining the 4,900 1SW salmon requirement.

In 2001, MSW spawners were relatively more abundant than 1SW spawners with the result that egg depositions from 1SW fish were only 6% of the total. Based on record low returns of 1SW fish in 2001, MSW salmon returns are expected to be extremely few in 2002. Thus, egg contributions from 1SW are likely to be as important as they were in 2000 when they comprised 25% of egg depositions.

Saint John River downstream of Mactaquac

The **Nashwaak River** stock met only about 16% of conservation requirement in 2001 and has failed to achieve more than 50% of requirements since 1993. Prospects for attaining the conservation requirement in 2002 are near-zero and based on parr densities, the prospects for increased returns for the next several years are low.

One-sea-winter salmon average 43% (5-year mean) female and make a significant contribution towards egg depositions (31% in 2000; 15% in 2001; 32%, 5-year mean). Losses of any fish, including those less than 63 cm, now have an increasing impact on egg depositions as large salmon returns diminish.

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 thus losses of 1SW salmon will have an increasing impact on egg depositions as large salmon returns diminish.

The number of salmon returning to the **Hammond River** in 2001 is unknown. Returns to the Hammond River in 2002 are unlikely to change from those of recent years. Similar to other assessed tributaries downriver of Mactaquac, 1SW salmon make an important contribution to egg depositions.

Other outer Bay of Fundy Rivers

Stocks of these rivers have declined dramatically in the last decade. Returns of wild salmon to the **Magaguadavic** and the **St. Croix rivers** in 2001 are near zero. There is no chance that conservation requirements will be met from natural production on these rivers in 2002 or before 2005. Actions have been initiated to prevent extirpation of salmon stocks of these, but not other outer Bay of Fundy rivers.

For more Information

Contact:

Gérald Chaput
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, 1999. Atlantic Salmon Maritime Provinces Overview for 1998. DFO Science Stock Status Report D3-14(1999).

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).

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

Table 1. Fisheries removals (number of fish) of Atlantic salmon from rivers of the Maritime provinces, 1997 to 2001. 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. 2001 data are provisional.

			Aboriginal Fisheries Removals[1]										Recreational Fisheries Removals[1]									
			Small Salmon					Large Salmon					Small Salmon					Large Salmon				
River	SFA	Index	'97	'98	'99	'00	'01	'97	'98	'99	'00	'01	'97	'98	'99	'00	'01	'97	'98	'99	'00	'01
Restigouche System[2]	15	1&2	26	26	-	-	-	166	234	-	-	-	2956	2958	2589	3131	-	865	528	702	805	1177
Matapédia	15	1	0	0	0	0	0	0	0	0	0	0	450	650	707	853	615	689	441	587	683	1067
Restigouche-NB	15	2	26	26	-	-	-	11	37	-	-	-	2506	2305	1881	2275	-	146	86	114	122	110
Jacquet	15	3	-	-	-	-	-	-	-	-	-	-	67	-	-	-	-	2	-	-	-	-
Nepisiguit	15	4	85	-	-	-	-	0	-	-	-	-	190	150	300	450	300	9	6	3	10	9
Tabusintac	16	5	-	18	31	-	-	-	18	19	-	-	75	16	38	75	27	2	2	3	3	0
Miramichi	16	6&7	1197	1180	2400	2953	2076	548	214	700	460	460	8311	-	-	-	-	152	-	-	-	-
NW Miramichi	16	6	871	782	1700	2502	1500	548	195	650	460	460	3153	-	-	-	-	46	-	-	-	-
SW Miramichi	16	7	326	378	627	451	576	0	0	0	0	0	5158	-	-	-	-	106	-	-	-	-
Buctouche	16	8	25	Closed	Closed	Closed	Closed	5	Closed	Closed	Closed	Closed	5	Closed	Closed	Closed	Closed	0	Closed	Closed	Closed	Closed
Morell	17	9	1	28	0	28	28	0	0	0	0	0	325	289	200	154	189	2	3	5	1	3
River Philip	18	10	0	0	14	6	-	21	7	17	20	-	43	85	104	42	4	5	12	15	5	1
Wallace	18	11	-	-	-	-	-	-	-	-	-	-	13	30	11	10	4	5	3	3	1	0
Waugh	18	12	-	-	-	-	-	-	-	-	-	-		18	10	12	0	1	2	1	0	0
River John	18	13	-	0	-	-	-	-	18	-	-	-	25	21	17	6	0	3	2	3	1	0
West (Pictou)	18	14	-	0	-	-	-	-	12	-	-	-	5	32	30	17	0	1	5	8	2	1
East (Pictou)	18	15	0	3	0	11	-	40	15	12	2	-	23	29	26	13	10	3	6	8	2	1
Sutherlands	18	16	0	0	0	7	-	14	14	14	12	-	0	0	0	0	0	0	0	0	0	0
West (Ant.)	18	17	-	-	-	-	-	-	-	-	-	-	21	67	81	35	1	5	9	11	7	0
South	18	18	-	-	-	-	-	-	-	-	-	-	1	3	11	5	0	0	1	1	2	0

[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.

Table 1. (continued). Fisheries removals (number of fish) of Atlantic salmon from rivers of the Maritime provinces, 1997 to 2001. 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. 2001 data are provisional.

			Aboriginal Fisheries Removals[1]										Recreational Fisheries Removals[1]									
			Small Salmon					Large Salmon					Small Salmon					Large Salmon				
River	SFA	Index	'97	'98	'99	'00	'01	'97	'98	'99	'00	'01	'97	'98	'99	'00	'01	'97	'98	'99	'00	'01
Margaree	18	19	20	30	8	10	20	124	120	45	49	25	204	213	206	145	139	105	66	41	36	39
Middle	19	20	3	5	Closed	Closed	0	15	9	Closed	Closed	0	4	6	1	2	0	4	2	3	2	0
Baddeck	19	21	5	3	Closed	Closed	0	13	7	Closed	Closed	0	1	2	1	1	0	3	3	2	2	1
North	19	22	0	0	0	0	0	0	0	0	0	0	4	4	1	1	1	7	4	1	1	2
Grand	19	23	0	0	Closed	Closed	0	0	0	Closed	Closed	0	4	2	1	2	0	1	1	0	0	0
St. Mary's	20	24	0	Closed	Closed	Closed	-	0	Closed	Closed	Closed	-	8	22	1	Closed	6	3	0	0	Closed	6
Liscomb	20	25	Closed	Closed	Closed	-	-	Closed	Closed	Closed	-	-	0	Closed	0	0	-	0	Closed	0	0	-
East Sheet Hbr.	20	26	0	0	0	0	-	0	0	0	0	-	1	0	2	0	0	0	0	0	0	0
LaHave	21	27	58	Closed	42	Closed	40	0	Closed	Closed	Closed	-	377	Closed	7	Closed	6	17	Closed	3	Closed	3
Mersey	21	28	-	-	-	-	-	-	-	-	-	-	1	3	4	6	0	-	-	-	0	0
Jordan	21	29	-	-	-	-	-	-	-	-	-	-	0	0	0	0	-	-	-	-	0	-
Clyde	21	30	-	-	-	-	-	-	-	-	-	-	19	3	8	36	0	-	-	-	1	0
Annapolis	22	31	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
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	361	Closed	154	105	74	265	Closed	76	18	32	24	Closed	Closed	Closed	Closed	15	Closed	Closed	Closed	Closed
Nashwaak	23	36	-	Closed	Closed	Closed	Closed	-	Closed	Closed	Closed	Closed	5	Closed	Closed	Closed	Closed	3	Closed	Closed	Closed	Closed
Kennebecasis	23	37	-	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
Magaguadavic	23	39	0	Closed	Closed	Closed	Closed	0	Closed	Closed	Closed	Closed	<1	Closed	Closed	Closed	Closed	<1	Closed	Closed	Closed	Closed
St. Croix	23	40	0	Closed	Closed	Closed	Closed	0	Closed	Closed	Closed	Closed	<1	Closed	Closed	Closed	Closed	<1	Closed	Closed	Closed	Closed

[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.

Table 2. Summary of stock status of Atlantic salmon in the Maritime provinces. All 2001 information is provisional.

River	SFA	Method	Map Index	Returns in 2001		% hatchery Origin	Conservation Met			Abundance			Potential Constraints To Production
				Small	Large		In 2001 Returns	In 2001 Escapement	In 1984 – 2001	All Juveniles	Adults Wild	Hatchery	
Restigouche System	15	Ang	1&2	-	13200	< 1%	No	No	7 of 17⇔	High⇔	Med⇔		
Matapédia	15	Vi	1	1541	3869	0 %	340%	246%	8 of 8 ⇔	High	High		
Restigouche NB	15	Ang	2	-	9300	< 1%	95%	95%	7 of 17⇔	High⇔	Med⇔		
Jacquet	15	Fe	3	-	-	0%	-	-	2 of 6🡻				
Nepisiguit	15	RC	4	-	2250	?	142%	138%	11 of 15⇔	Med⇧	Med	Low🡻	
Tabusintac	16	-	5	-	-	0%	-	-	5 of 5	Med🡻	Med⇔		
Miramichi	16	MR	6&7	28200	20600	< 1%	107%	Yes	12 of 18⇔	High⇔	Med🡻	Low ⇔	
NW Miramichi	16	MR	6	7700	5300	< 2%	111%	Yes	6 of 10🡻	High⇧	Med🡻	Low ⇔	
SW Miramichi	16	MR	7	20300	15000	< 1%	91%	No	6 of 10🡻	High⇔	Med🡻	Low ⇔	
Buctouche	16	-	8	-	-	-	-	-	1 of 8 ⇔	Low	Low⇔	Low	Habitat quality
Morell	17	-	9	-	-	90%	No	No	8 of 14	Low⇧	Low	Low	LU
River Philip	18	Ang	10	-	-	0%	-	-	6 of 9⇔	Med⇔	Med⇔		
Wallace	18	Ang	11	-	-	0%	-	-	1 of 6⇔	Low	Low⇔		
Waugh	18	Ang	12	-	-	0%	-	-	1 of 6⇔		Low⇔		
River John	18	Ang	13	-	-	0%	-	-	2 of 6⇔		Low⇔		
West (Pictou)	18	Ang	14	-	-	0%	-	-	5 of 6⇔		Med⇔		
East (Pictou)	18	Ang	15	-	-	0%	-	-	6 of 9⇔	Med⇔	Low⇔		
Sutherlands	18	Vi	16	-	-	0%	-	-	5 of 6⇔		Med⇔		
West (Ant.)	18	Ang	17	-	-	0%	-	-	6 of 9⇔	High⇔	Med⇔		
South	18	Ang	18	-	-	0%	-	-	-				Fp

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 2001 information is provisional.

River	SFA	Method	Map Index	Returns in 2001 Small	Returns in 2001 Large	% hatchery Origin	Conservation Met: In 2001 Returns	Conservation Met: In 2001 Escapement	Conservation Met: In 1984 – 2001	Abundance: All Juveniles	Abundance: Adults Wild	Abundance: Hatchery	Potential Constraints To Production
Margaree	18	Ang	19	660	1720	2%	166%	151%	18 of 18	High⇔	High🡻	Low⇔	
Middle	19	ViM	20	49	101	0%	27%	27%	2 of 13	Med⇔	Low⇔	-	
Baddeck	19	Ang+ ViM	21	37	83	0%	23%	22%	0 of 8	Med⇔	Low🡻	-	
North	19	ViM	22	45	190	0%	102%	101%	15 of 17	Med⇔	Med🡻	-	
Grand	19	Ang	23	-	-	-	-	-	7 of 13	-	Low🡻	-	Fp
St. Mary's	20	MR	24	580	195	0%	30%	30%	8 of 18 🡻	Med ⇔	Low 🡻	-	
Liscomb	20	Fw	25	-	-	-	-	-					
East Sheet Hbr	20	Fw	26	4	1	80%	-	-	-	-	Low🡻	Low🡻	Ac, Fp
LaHave	21	Fw	27	379	184	49%	98%	83%	7 of 18 🡻	Med ⇔	Low 🡻	Med ⇔	Ac, Fp
Mersey	21		28	-	-	100%	-	-	-	-	-	-	Ac, Fp
Jordan	21		29	-	-	100%	-	-	-	-	-	-	Ac
Clyde	21		30	-	-	100%	-	-	-	-	-	-	Ac
Annapolis	22	Fw	31	-	-	-	-	-	-	-	-	-	
Gaspereau	22	Fw	32	24	33	42%	24%	18%	0 of 5	Low	Low	Low	WU, Fp,Aq
Stewiacke	22	Electro	33	-	-	-	-	-	0 of 12	Low 🡻	Low	Low 🡻	
Big Salmon	23	Sh+Vi	34	-	-	0%	-	-	1 of 13	Low⇔	Low	-	
Saint John at / upst. Mactaquac	23	Fw	35	1700	1206	54%	30%	20%	2 of 18🡻	Low ⇔	Low🡻	Med⇔	Fp, Aq, LU, WU
Nashwaak	23	Fe/MR	36	244	272	<1%	13%	16%	0 of 9⇔	Low🡻	Low⇔	Low🡻	Aq, LU
Kennebecasis	23	Electro	37	-	-	-	-	-	-	Low⇔	-	-	Aq, LU
Hammond	23	Electro	38	-	-	-	-	-	-	Med⇧	-	-	Aq, LU
Magaguadavic	23	Fw	39	8	9	0%	5%	5%	3 of 13🡻	-	Low🡻	-	Fp, Aq, WU
St. Croix	23	Fw	40	13	7	100%	1%	0%	0 of 17🡻	-	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