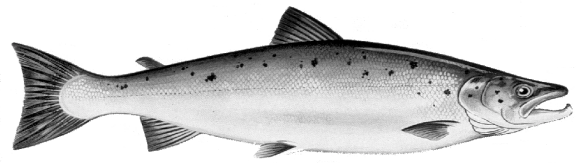


Atlantic Salmon Maritime Provinces Overview for 1999

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.

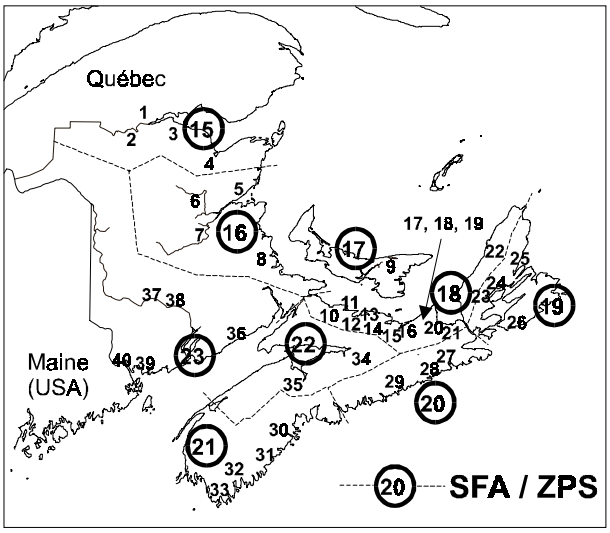
Spawning populations consist of varying proportions of small salmon (fork length <63 cm) and large salmon (fork length >= 63 cm). In the majority of rivers, small salmon (frequently referred to as grilse) are predominantly maiden fish (never spawned before) which have spent one year at sea before returning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

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

Summary

- In spite of restrictive fisheries management measures on salmon in distant and home-water areas over an extended period with the objective of meeting conservation, 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) returns appear to have fallen short of the conservation requirement in 1999 but have oscillated around the conservation level since 1986. Returns in 2000 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 2000. Small salmon in SFA 15 rivers are predominantly male and their current harvest generally is not limiting stock conservation.

- **In SFA 16**, the returns to the Miramichi River and its Southwest branch failed to meet the conservation requirements in 1999 for the third consecutive year. The Northwest Miramichi returns did meet conservation in 1999 after failing to do so in 1998. The outlook for 2000 is for a lower return of large salmon than in 1999 with no chance of meeting the conservation requirement in the Southwest Miramichi and Miramichi River overall. There is a modest chance of meeting conservation in the Northwest Miramichi. The Tabusintac River exceeded the conservation requirement again in 1999 and is expected to repeat in 2000. The Buctouche River is used as an index river for New Brunswick Northumberland Strait rivers. For the first time in seven assessed years, it may have achieved the conservation requirement in 1999 but is unlikely to do so in 2000.

- Because the majority of salmon returning to the Morell (87% in 1999) 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 pesticide kills. It is recommended that retention of wild-reared fish be prohibited to protect natural runs.

- **In Northumberland Strait,** mainland Nova Scotia rivers **(part of SFA 18)**, conservation requirements continue to be exceeded and are expected to be met in almost all rivers in 2000. Egg depositions in these rivers are expected to come from large salmon.

- **On Cape Breton Island (part of SFA 18 and SFA 19)**, conservation requirements continue to be exceeded on the Margaree and probably other west coast Cape Breton rivers. Continued exploitation at current levels should not be a conservation concern in 2000. In contrast, no assessed rivers in SFA 19 (eastern Cape Breton) were likely to have met their conservation requirement in 1999. Of these rivers only the North River may achieve conservation requirement in 2000.

- Salmon returns to rivers along **the Atlantic Coast of mainland Nova Scotia (SFAs 20 and 21)** were insufficient to meet conservation requirements in 1999. Rivers are generally of low productivity and are negatively impacted by acid precipitation. Small and large salmon contribute egg depositions in these rivers equally. Returns in 2000 are not expected to be sufficient to meet requirements for any of the rivers, including those receiving hatchery stocking. The acid-impacted rivers dependent on stocking (East River Sheet Harbour, Mersey, Clyde and Jordan) are expected again to yield returns available for harvest. A comprehensive review of appropriate management actions for rivers in these SFAs is required.

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

- **Outer Bay of Fundy (western part of SFA 23)** assessed stocks did not meet conservation requirements in 1999 and probabilities of achieving requirements in 2000 are virtually zero. Egg depositions for the Saint John River stock upriver of Mactaquac rose to 31% of the conservation requirement and wild salmon continued to be at record lows. The Nashwaak River stock achieved only 19% of its requirement. Stocks of the Kennebecasis and Hammond rivers are unlikely to have met conservation requirements. 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 is required to prevent their extirpation.

Environmental Conditions

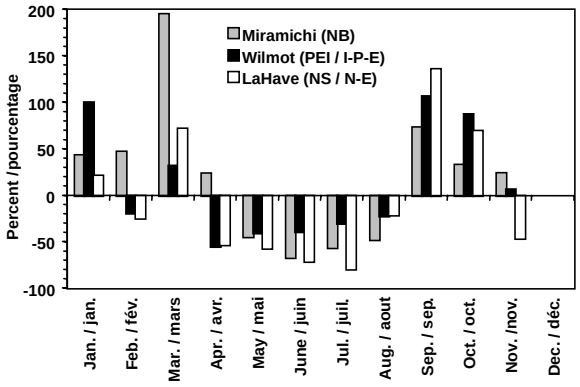
Streamflows

Freshwater conditions can affect Atlantic salmon at different life stages and during different seasons.

There was higher than normal winter precipitation (rainfall) and streamflow in the Maritime Provinces in 1999. Peak flows for many rivers occurred in January to March which is early. The daily spring peak runoff in 1999 was characterized as mild in most rivers with generally normal peak flows.

Lower than normal precipitation in April, May and June resulted in low flow conditions earlier than normal in 1999. By April, streamflow conditions became lower than normal in PEI and NS. Wilmot River (PEI) experienced its lowest April monthly flow on record. By May, most rivers were showing lower than normal flow conditions, and by June all monitored rivers were lower than normal and in some cases, record lows. By August, low water conditions were more prevalent in NB and PEI with normal flow condition in NS. Low water conditions persisted throughout the Maritime Provinces into early September.

(%) of mean monthly discharge in 1999 relative to the long-term mean



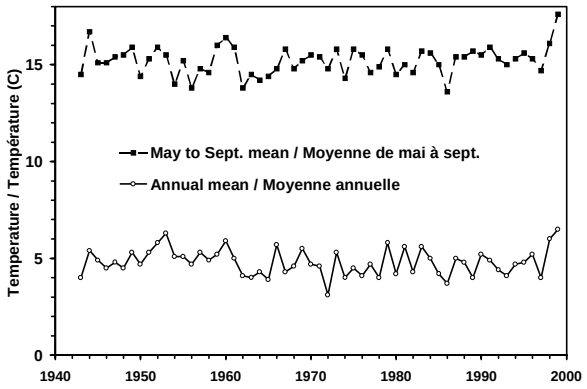
Precipitation from the remnants of hurricane Floyd in September, increased discharges significantly in the region to higher than normal for the month. October showed higher than normal flow conditions for PEI and NS. Streamflows were relatively high in the fall and should have provided good opportunities for ascending fish.

The occurrence of low water conditions in the 1990s has been more severe than in past decades. Winter rather than spring peak flows have been more abundant in the 1990s, particularly in parts of Nova Scotia.

Air and river temperatures

Data on air temperature were analysed for 6 stations across the Maritime Provinces. Summer air temperatures in 1999 were highest of the time series, dating back to the 1940s for most stations. Based on currently available data (mean monthly temperatures for 1943 to 1998 assumed for October to December, 1999), the warmest mean annual air temperature on record was measured in 1999.

Mean air temperatures recorded at Chatham, New Brunswick



These high air temperatures were paralleled by high water temperatures for many rivers. Recorded water temperatures during the summer of 1999 were the highest in recent years (e.g. 1992 to 1999) and were expected to be highly stressful for salmon. In several tributaries of the Miramichi River, maximum temperatures exceeded 25 °C, with a few reaching 29-30 °C. These high values were comparable to those measured in 1994 and 1995 for similar sites. The number of days during which temperatures exceeded 23 °C., was the greatest in 1999.

Number of days when maximum water temperature exceeded 23°C

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

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.

Environmental conditions and sea surface temperatures, in particular, were milder and warmer-than-normal during 1998 and 1999. In previous studies such conditions have been associated with better survival of salmon in their second winter at sea. This warming trend occurred in spite of a significant increase in the North Atlantic Oscillation (NAO) index (winter sea surface pressure at the Azores minus that at Iceland) in 1999. An increase in the NAO index usually results in increased northwest winds, colder-than-normal winter air temperatures, earlier and more extensive ice coverage and colder ocean temperatures over the Labrador Sea, south to the Grand Banks.

The January-March habitat index, defined by the area within 4-8 °C, at the southern extent of the Labrador Sea was high in 1999, and has been increasing since 1995. It explains less variability than previously in the forecast numbers of salmon returning to Atlantic Canadian rivers, i.e., the high index had been associated with better than average recruitment. The index had been declining from 1979 with a brief recovery during 1986-1989.

The southern extent of winter ice cover off the Newfoundland and Labrador coasts is related to winter air temperatures and has been shown to influence the return timing of salmon. Increased air temperatures and reduced sea ice coverage are suspected of advancing the timing of smolt runs and affecting the ecology of coastal waters.

Ice coverage off Newfoundland and southern Labrador in 1999 was similar to that of 1996 and 1998 but less than that of 1997, and much less than the heavy ice years of the early 1990s (salmon returns to many rivers were extraordinarily early in 1999). The area of ice-cover in the Gulf of St. Lawrence was near normal in 1999 until March when higher-than-average temperatures resulted in below average ice

cover. The Gulf ice was thinner-than-normal throughout the entire 1999 ice-season. Very little ice was transported onto the Scotian Shelf from the Gulf, resulting in the ice coverage seaward of Cabot Strait being among one of the smallest on record (slightly larger than 1998). The low area of ice coverage on the Scotian Shelf contrasts the general trend of increasing sea-ice coverage from 1963 to 1990.

Coastal surface temperature anomalies for the Gulf of Maine (Booth Bay, Maine and St. Andrew's, New Brunswick) and the Scotian Shelf (Halifax Harbour) may be indicative of environmental 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. Values in 1998 were positive at all three sites and what data are available for 1999 indicate a continuation of the warm conditions. This contrasts with the previous four years when surface temperature anomalies in the Gulf of Maine and along the Atlantic coast of Nova Scotia were opposite, i.e., warm in the Gulf and cold off Nova Scotia.

The cooling trend of Labrador Sea water in the early 1990s was accompanied by a major shift in biological communities. Arctic cod, a northern species, became more abundant in the southern Labrador Sea and capelin shifted southward, extending its distribution in the Gulf of St. Lawrence and invading the eastern Scotian Shelf.

The return of warmer surface temperatures in the late 1990s has not reversed these changes. Arctic cod are still common in the southern Labrador Sea and capelin numbers in the Newfoundland area still appear to be low. Cold-water species continued to dominate diet of gannets at Funk Island, Newfoundland, in August 1998 and 1999. Post-smolt salmon as a proportion of gannet diet increased sharply in the early 1990s, peaking at 6.4% in 1993. Salmon fell to 0.3% of diet in 1998 and no salmon were detected in 1999. Cold water species (Pandaliid shrimp, turbot, capelin) remain common on the eastern Scotian Shelf.

In summary, there has been a general continuance of warmer surface layer waters since 1995 in the areas frequented by Atlantic salmon.

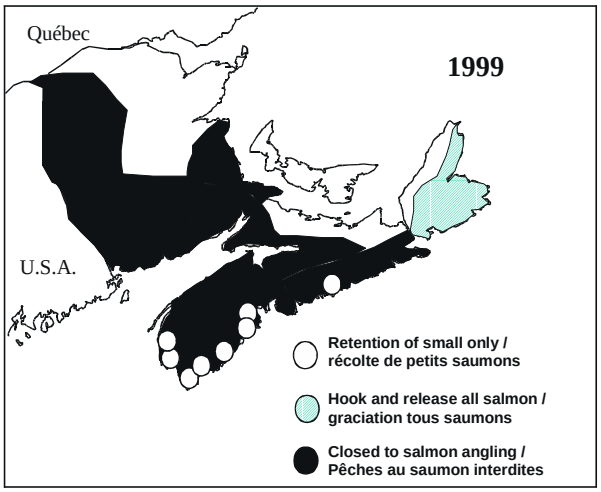
The Fishery

Atlantic salmon were harvested by two user groups in 1999: 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 1999 occurred in all areas of the Maritimes with the exception of the Inner Bay of Fundy, generally in accordance with agreements and communal fishing licenses. Some Aboriginal communities in Nova Scotia chose not to exercise their right to the communal allocations because of conservation considerations.

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 in 1998 were allowed in most of the southern Gulf of St. Lawrence, and in four acid-toxic rivers of the Atlantic coast. These measures were generally carried forward into 1999 except for some rivers in SFA 21 (Mushamush, Salmon (Digby Co.), LaHave, Tusket)

which had a small salmon retention fishery for a three week period.

Angling Management in 1999



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 P.E.I. remained unchanged from previous years in those areas with angling fisheries.

Other management measures in effect in 1999, which potentially affected the salmon stocks from the Maritime Provinces, include the eighth year of the commercial salmon moratorium for insular Newfoundland, the second year of closure of the entire Labrador commercial fishery, and reductions in quota and licenses of the commercial fishery along the Québec north shore (Zone Q9).

There was a small subsistence fishery (11 t) at west Greenland in August to December 1998 which was estimated to have intercepted about 3,100 salmon destined to return as large salmon to North America in 1999.

Reported harvests of small and large salmon in aboriginal fisheries in 1999 increased in the Gulf New Brunswick rivers. In Gulf of St. Lawrence Nova Scotia, aboriginal harvests in 1999 decreased compared to previous years (Table 1).

Removals (kept plus mortalities from hook and release angling) of small and large salmon in the recreational fisheries of the Restigouche River were down about 30% from the previous five years (Table 1). For the Miramichi River, the catches of small and large salmon from the crown reserve waters were down 60% and 40%, respectively, from the previous five-year mean probably as a result of poor angling conditions due to low and warm water conditions. Removals of small salmon in Gulf of St. Lawrence Nova Scotia rivers in 1999 increased compared to previous years.

Resource Description

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.

Updates for 32 rivers are available in 1999. Estimates of returns are based on various techniques ranging from entire counts (such as fishways) to indices of abundance based on catch rates (Table 2). 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.

Chaleur Bay (SFA 15)

SFA 15 includes northern New Brunswick rivers of which the major ones are the Restigouche, Jacquet and Nepisiguit rivers. The Restigouche River has the second most abundant run of large salmon in eastern Canada.

The Restigouche River was 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 requirements for the Matapédia River are based on 1.68 eggs per m^2 whereas the Restigouche (NB) has a conservation requirement based on 2.4 egg per m^2. This difference is under review.

Status

Returns to the **Matapédia River** are determined from visual spawner counts in early October. The returns in 1999 were estimated at 2,600 large salmon and 1,600 small salmon; higher than 1998 but below the returns of large salmon in 1996 and 1995. The end-of-year escapements to the Matapédia River were estimated at 1983 large salmon and 890 small salmon. Spawning escapement was estimated to have exceeded the conservation requirement (1,929 large salmon equivalents) in the last five years except for 1998. Conservation requirements were not achieved from 1984 to 1994.

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	1823	2084	1643
1999	1600	890	2591	1983

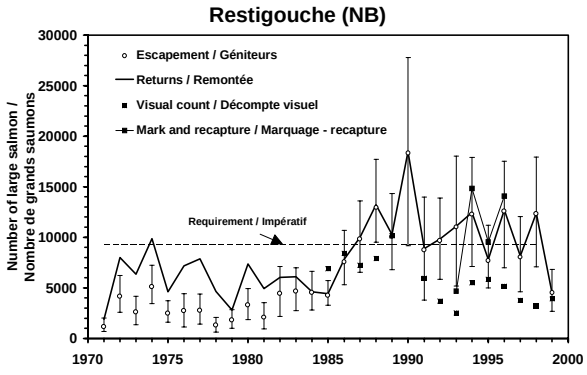
Returns to the **Restigouche (NB)** were estimated from visual spawner counts of adult salmon in early October in the four main tributaries and a redd survey in late October of the main stem of the Restigouche River. Additionally, the catch rates in the angling fishery during 1971 to 1998 were estimated from a model relating young-of-the-year (fry) abundance to escapement of large salmon which would have likely produced the observed fry levels. The average catch rate of 1995 to 1998 was applied to the 1999 catches of large salmon to estimate returns. Small salmon returns were estimated from an adjusted catch rate which historically has been about 1.68 times that of large salmon.

Spawner counts provided minimum spawner estimates of 3,900 large salmon and about 3,000 small salmon. Removals of large salmon in 1999 of about 250 fish are small compared to the uncertainty in the spawner estimates. Small salmon returns were estimated at 4,900 fish.

Restigouche (NB)					
	Small salmon		Large salmon		
	Visual	by CR[1]	Visual	by CR[1]	CR[1]
1994	8100	10800	5500	12300	0.24
1995	3300	3100	5800	7200	0.26
1996	5000	7300	5100	11000	0.25
1997	4100	6500	3800	7100	0.26
1998	5700	7500	3200	9800	0.12
1999	4900	6000	3900	4500	0.26

[1] CR means catch rate (angling catch as proportion of total returns) as modelled from fry abundance

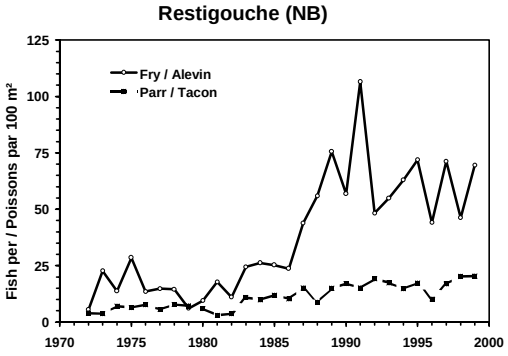
Catch rates in the Restigouche (NB) portion of the river have declined to about 0.25 in recent years. The estimated catch rate in 1998, based on fry abundance in 1999, was among the lowest of record at 0.12. Large salmon returns in 1999 were estimated at about 4,500 fish. Returns of small salmon were estimated at about 6,000 fish. The catch rates in 1999 are likely lower than those of the previous years because of low water conditions and warm water temperatures. Spawning escapement of large salmon in 1999 was the lowest since 1985 but remained above the spawning escapements during 1971 to 1985.



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 4,500 spawners in 1999 represents less than 50% of the requirement. Point estimates of the escapements since 1984 indicate conservation requirements were met in nine of the last 16 years. New Brunswick fall spawner estimates have been lower than those from other methods and are inconsistent with the observed juvenile densities.

Use of the Matapédia egg deposition requirement (1.68 eggs per m^2) for the Restigouche (NB) would indicate that the conservation requirement (6,500 large salmon) was met or exceeded every year since 1986, except for 1999.

Densities of both fry (young-of-the-year) and small and large parr from index sites sampled annually since 1972 remain at greatly improved levels relative to the 1970s and early 1980s. Annual variations in densities represent variations in egg depositions, survival rates, and water conditions at time of sampling.



There is no estimate available of the returns to the **Jacquet River** barrier in 1999 because of a major fence washout on September 18. Counts to date were 135 small salmon and 129 large salmon. A fence washout in October 1998 may also have resulted in an underestimation of the returns in that year. Conservation requirements of

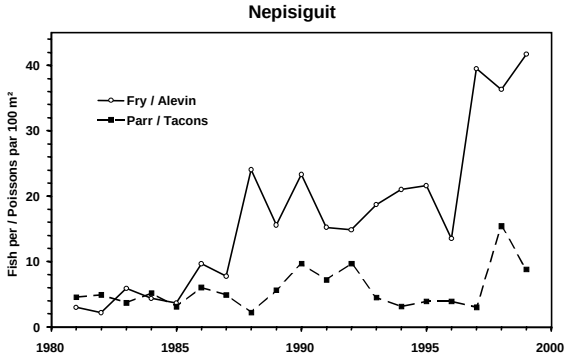
3.8 million eggs would be obtained from 571 large salmon. Conservation requirements were achieved in 1994 and 1995 but not in the subsequent three years.

Jacquet River (- means not available)

	Returns		Egg deposition	
Year	Small salmon	Large salmon	% 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	402	298	55	95
1999	-	-	-	-

The conservation requirement for the **Nepisiguit River** of 9.5 million eggs would be attained from 1,600 large salmon. 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 2,100 redds observed in 1999 were estimated to have resulted from an escapement of 1,200 large salmon. Proposed adjustments to account for water levels and visibility in 1999 and for the unsurveyed portions of the habitat suggest that spawning escapement in 1999 probably approached 1,600 large salmon. 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.



There is an enhancement program on the Nepisiguit River. The contribution of hatchery-stocked fish is difficult to determine since the majority of the fish are stocked at early, unmarked stages.

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 2000.

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

No changes in returns from the previous five years are expected for the **Nepisiguit River**, at about conservation level.

Management Considerations

Large salmon returning to the **Restigouche River (NB)** in 1999 were estimated to have fallen short of the conservation requirement. Catch rates in 1999 may be lower than those assumed as was the case in 1998. The in-river fisheries losses (harvests and catch-and-release mortalities) of large salmon in

Restigouche (NB) are less than 5% of 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 harvests by Listiguij First Nation are not reported. The assessments of the Restigouche (NB) and Matapédia River stocks are exclusive of the estuary fisheries. Since 1985 the spawning escapements to the Restigouche (NB) and Matapédia River have varied close to or above the conservation requirement.

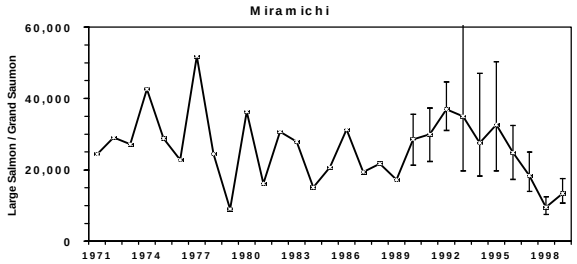
Small salmon returning to SFA 15 rivers are predominantly male and contribute minimally to egg depositions. Harvests of small salmon in recent years have not jeopardized achievement of a 1:1 male to female sex ratio.

Miramichi and Southeast Gulf New Brunswick (SFA 16)

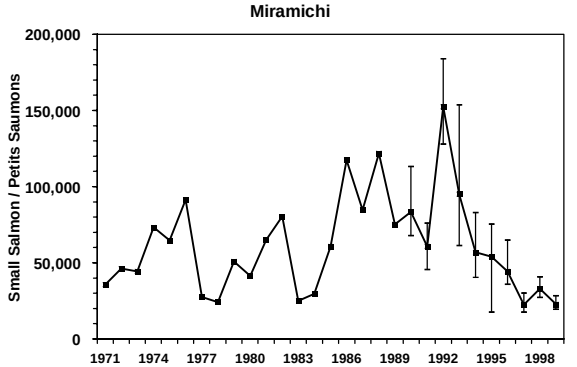
SFA 16 includes the Miramichi River, the largest salmon producing river of eastern Canada, and numerous small coastal rivers along the Northumberland Strait shore of New Brunswick. The Northwest and Southwest branches of the Miramichi River are assessed separately. Other rivers assessed in 1999 include the Buctouche and Tabusintac rivers. The Buctouche River is used as an index river for New Brunswick Northumberland Strait rivers.

Status

The estimated return of 13,600 large salmon (10,700 - 17,900) to the **Miramichi River** in 1999 was among the lowest of record. About 6,800 large salmon (5,000 - 9,800) returned to the **Southwest Miramichi** and 6,700 large salmon (5,300 - 8,700) returned to the **Northwest Miramichi**, which is similar to 1998 for the Southwest Miramichi but a doubling from 1998 for the Northwest Miramichi. The low but improved abundance of large salmon in 1999 was expected given the low but improved returns of small salmon in 1998 relative to 1997. The low abundance in 1998 and 1999 was primarily the result of a low return of fish during the fall.



Small salmon returns in 1999 were 23,000 fish (19,700 - 27,300), down 30% from 1998 and similar to the low return in 1997. A total of 11,200 small salmon (9,200 - 14,200) returned to the Southwest Miramichi and 11,600 small salmon (9,900 - 13,600) returned to the Northwest Miramichi. The early-run of small salmon in 1999 was proportionally stronger than in previous years.



In the **Tabusintac** River, the returns in 1999 were estimated at 817 small and 900 large salmon. Periodic assessments in other years (1993 to 1998) indicated returns ranging from 599 to 1,800 small and 799 to 1,414 large salmon.

In the **Buctouche** River, returns of large salmon ranged from 95 to 244 fish between 1993 and 1999, with the current year the highest. Small salmon returns have generally been about 100 fish annually with the 1999 returns the second highest since 1993. The proportion 2SW salmon in the large salmon returns rebounded to 79% from a low of 33% in 1998.

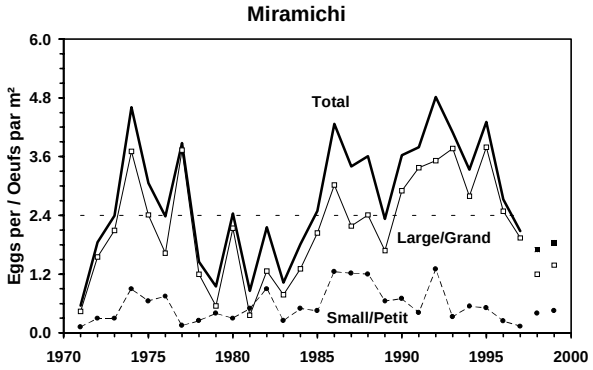
Returns (number of fish) of small and large salmon

	1995	1996	1997	1998	1999
Tabusintac River					
Small	Unk	615	Unk	> 900	817
Large	Unk	920	Unk	> 700	900
Buctouche River					
Small	98	127	97	92	115
Large	154	134	200	102	244

Conservation requirement for the Miramichi River of 132 million eggs would be contributed on average by 23,600 large salmon. Removals data for 1998 and 1999 are incomplete. Egg depositions by all salmon returning to the **Miramichi River** (before any removals) would have equalled 76% of the conservation requirement (57 - 107%). Egg depositions by large salmon alone would have equalled 57% of requirements. In **the Southwest Miramichi**, egg depositions at most would have equalled 55% (38 - 81%) of the conservation requirement of 88 million eggs whereas in the **Northwest Miramichi**, egg depositions would have been 128% (97 to 171%) of the 41 million conservation egg 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		Miramichi	
	Ret.	Esc.	Ret.	Esc.	Ret.	Esc.
1995	280	269	150	139	190	179
1996	150	134	125	114	125	114
1997	120	104	83	78	95	87
1998	57		70		68	
1999	128		57		76	



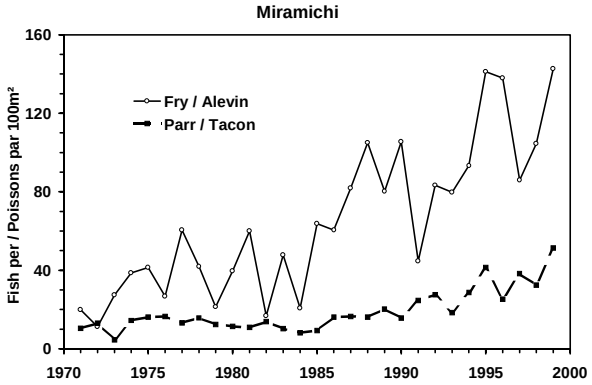
Small salmon could potentially have contributed 30% of the total eggs in the Northwest Miramichi and 20% of the total in the Southwest Miramichi. Egg depositions in 1999, even before accounting for removals, were the second lowest since 1984.

The conservation requirement for the **Tabusintac** River has been exceeded in the five years the stock was assessed between 1993 and 1999.

Egg deposition from large and small salmon in the **Buctouche** River in 1999 was estimated at 102% of the conservation requirement and is the first instance in seven assessed years when the requirement appears to have been met.

Egg deposition relative to conservation requirement		
Year	**Tabusintac River**	**Buctouche River**
1993	200%	35%
1994	404%	72%
1995	Unk	58%
1996	245%	46%
1997	Unk	70%
1998	> 100%	33%
1999	250%	102%

Juvenile densities of both fry (young-of-the-year) and small and large parr estimated annually at index sites in the **Miramichi** River remain at higher levels than those of the 1970s and early 1980s. Annual variations in densities represent variations in egg depositions, survival rates, and water conditions at the time of sampling.



Average fry densities (84.8 fry per 100 m²) in the **Tabusintac** River in 1999 were improved from levels measured in 1994 and above the Elson norm. The average parr density (30.8 parr per 100 m²) measured at 25 sites in 1999 was below the norm but improved from 1994 levels. Spawning in 1998 in the Tabusintac River, as inferred from fry densities, had occurred throughout the watershed.

Fry and parr densities in the **Buctouche** River remain comparatively low and below the Elson norm. Quality spawning and rearing habitat on the Buctouche River appears to be limited. Juveniles are generally found throughout the river with the highest concentrations in the South Branch but abundance is low compared to levels in the Miramichi River. Egg-to-summer fry survival is low suggesting there may be a habitat constraint at that life stage. Age-0+ to age-1+ parr survival, as inferred from stocking of fall fingerlings, does not appear to be a constraint. Juvenile abundance in **four other southeastern New Brunswick** rivers (Cocagne, Richibucto, Coal Branch, and Kouchibouguac) was, with the exception of the Kouchibouguac, low compared to Miramichi levels and suggested that spawning success in recent years has been variable, asynchronous, and generally low.

Outlook

For the **Miramichi River**, juvenile abundance levels have remained high since 1990. The outlook for 2000 based on the previous five-year large salmon return may be overly optimistic considering the downward trend in recent years. The ratios of small salmon to large salmon the following year suggests a decrease in the large salmon returns in 2000. Based on the range of ratios observed in the last five years, large salmon returns in 2000 are expected to be between 9,300 and 13,200. This level of large salmon return is unlikely (near zero chance) to be sufficient to meet conservation requirements.

With the expected return of small salmon, based on the previous five-year average return (35,400 fish), there is no chance that eggs from the returns of small and large salmon combined will meet or exceed the egg requirement. The expected egg contribution by small salmon is 27% (9% - 41%).

For the **Southwest Miramichi**, the return of large salmon in 2000 is expected to be between 3,300 and 5,700 fish. This level of large salmon has no chance of meeting conservation requirements. The average small salmon return in the previous five years has been 22,200 fish. Egg deposition from the returns of small and large salmon have a near zero probability of meeting conservation requirement. Small salmon may account for 9% to 30% of the eggs from the total returns.

For the **Northwest Miramichi**, the return of large salmon in 2000 is expected to be between 2,600 and 9,000 fish. The average small salmon return in the previous five years has been 14,300 fish. There is a 37% chance that eggs from the returns of small and large salmon will meet/exceed the conservation requirement. Small salmon may account for up to 30% of the eggs from the total returns.

For the **Tabusintac River**, the conservation requirement has been exceeded for the five years the stock was assessed. The expectation is for this stock to continue meeting or exceeding the conservation requirement.

The conservation requirement for the **Buctouche River** was probably met in 1999 for the first time in seven assessed years (1993-99). Based on the average returns of all years there is a 3% chance of meeting the egg conservation requirement in 2000.

Management Considerations

Even if there is no fisheries-related mortality on salmon in the **Miramichi** River in 2000, there is no chance that the eggs from the returns of small and large salmon will meet the requirement. In 1998 and 1999, the fall run of large salmon was weak compared to previous years.

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

The aboriginal fisheries in 1999 removed small and large salmon bearing about 6% of the eggs in the total returns to the Miramichi. Between 1992 and 1997, the aboriginal fisheries removals were 1.7% of the total eggs in the returns whereas recreational fisheries removed 5% of the total eggs in the returns.

For the **Tabusintac River,** current fisheries exploitation levels are not a conservation concern.

The **Buctouche River** is used as an index river for New Brunswick Northumberland Strait rivers. The conservation requirement may have been met for the first time in seven assessed years on the Buctouche in 1999, but conservation requirements are unlikely to be met in 2000. Small salmon have contributed an average of 2% (0-6%) of total egg deposition from all salmon.

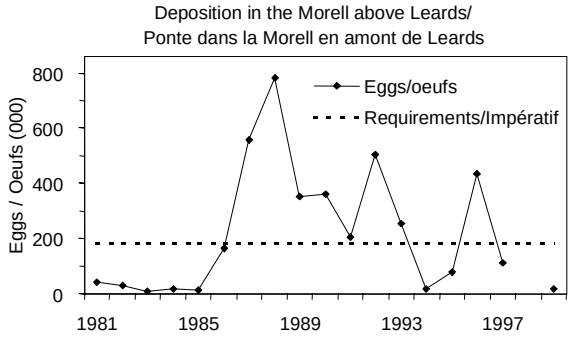
Prince Edward Island (SFA 17)

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 stocking 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

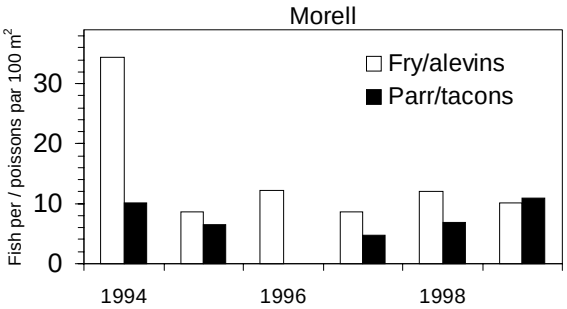
the province's salmon angling catch in most recent years. A small amount of natural production occurs in the **Morell** and other stocked rivers. Small runs of late-returning salmon persist in several unstocked rivers.

Status

Egg deposition in the upper West Branch of the **Morell River** can be estimated from fishway counts at Leards Pond. However, true deposition may be higher than that calculated because of trap inefficiency. Calculated egg deposition was lower than conservation requirements in 1999, and also in four of the last five years for which data are available. Most (87%) returning fish were of hatchery origin in 1999.



Mean total densities of juvenile salmon (0+ fry, 1+ and 2+ parr) on the **Morell** were 18.3 fish per 100 m^2 in 1994-1999 and 21.0 fish per 100 m^2 in 1999.



Salmon returns to stocked PEI **rivers other than the Morell** are far below conservation requirements. Much of the juvenile production in the **Valleyfield River** in 1999 was destroyed in a pesticide-induced fish kill.

Outlook

Based on recent years' experience, returns in 2000 to the Morell will probably not meet conservation requirements, but broodstock needs for the stocking program (about 50 fish) will be met. Egg depositions have little influence on future returns because most returns are of hatchery origin. Returns in 2000 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

Atlantic salmon production in PEI streams is severely constrained by streambed sedimentation which is caused by agriculture and other land use activities. Potato pesticides were implicated in eight fish kills in 1999. Cultivation techniques which reduce erosion and pesticide run-off have become more widely used in recent years, but potato acreage has also increased markedly. Substantial self-sustaining salmon runs cannot be re-established in PEI streams until these inputs are severely reduced.

No change is recommended to current management for hatchery-reared fish, which comprise most of PEI's salmon runs.

PEI rivers which are stocked with Atlantic salmon, and some rivers which are unstocked, produce small numbers of wild-reared fish. To protect wild fish it is recommended that retention of wild-reared salmon (as indicated by an intact adipose

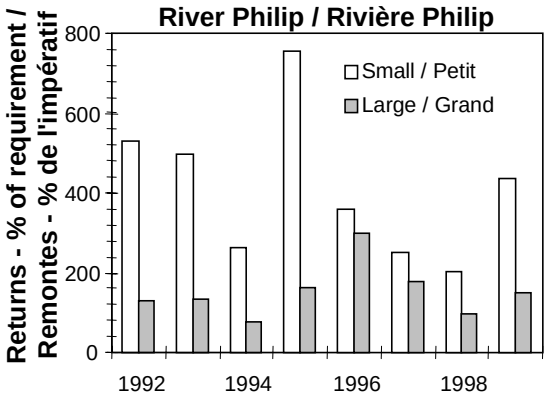
fin) be prohibited. Habitat factors are considered to be a greater threat than fisheries to small runs in unstocked rivers.

Northumberland Strait Nova Scotia (part of SFA 18)

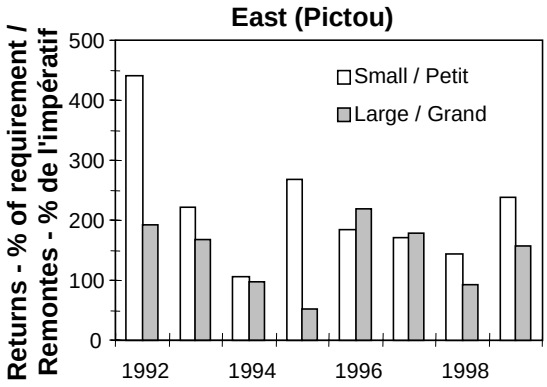
Fifteen rivers on the Northumberland Strait shore of Nova Scotia support Atlantic salmon stocks. Stock status information for 1999 is provided for eight of these stocks. The Atlantic salmon stocks of the Northumberland Strait area typically enter rivers in late autumn, usually after September 15.

Status

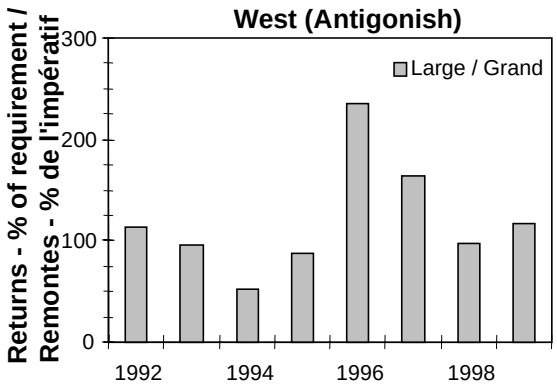
The estimated return of salmon to **River Philip** in 1999 was 538 large and 326 small fish. Escapements were 506 large (447 - 1,855) and 209 small salmon which were 150% and 435% of the respective conservation requirements of 358 large and 75 small fish. The escapement of large fish in 1999 increased relative to 1998. Escapements have approximately met or exceeded requirements for the fifth consecutive year in 1999.



Returns to **East River (Pictou)** of 425 large salmon and 135 small salmon also exceeded the conservation requirements of 271 large and 57 small fish. Escapements were estimated at 375 large and 100 small salmon.

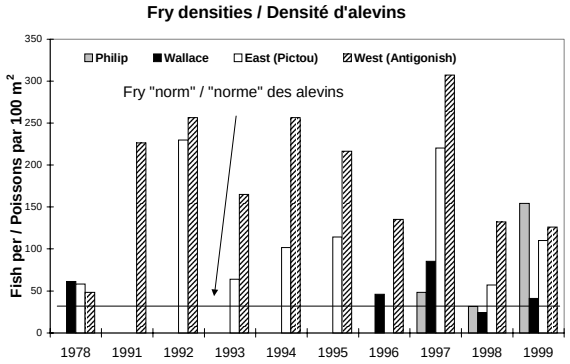


West River (Antigonish) salmon returns have exceeded or approximately met the conservation requirements of 353 large and one small salmon for the fourth consecutive year. The escapement of large salmon in 1999 was estimated to be 113% of the requirement.

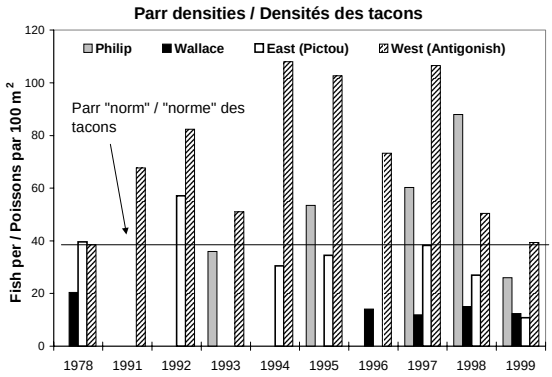


Returns and escapements to the **Sutherlands River** and **West River (Pictou)** also exceeded conservation requirements. In contrast, large salmon returns to **River John**, the **Wallace River** and the **Waugh** were not sufficient to meet conservation levels.

Fry densities on most rivers in this area have remained above the Elson norm. Wallace River fry populations have been lower than on neighboring rivers.



Parr densities in most rivers have, until 1999, remained consistently at or above the Elson norm. Similar to fry densities, parr numbers in the Wallace River have been consistently lower than in other rivers and below the Elson norm.



Outlook

Forecasts of returns to four rivers in the area, **East River (Pictou)**, **River Philip**, **West River (Antigonish),** and **Sutherlands River**, are based on five-year averages for both large and small salmon.

Average returns to **East River (Pictou)** were 378 (205-551) large salmon or 139% of the conservation requirement. The forecast grilse return of 114 (86-142) fish is 200% of the requirement.

On **River Philip**, the mean number of returns during the past five years for large salmon was about 635 (379-891) fish or 177% of the conservation level. Similarly, small salmon returns are expected to exceed requirements; the five-year average is 301 (145-447) fish (401% of requirement).

Large salmon returns over the past five years, average 494 fish for **West River (Antigonish)**, about 130% (57 - 197%) of the conservation requirement. The number of small salmon spawners which could be surplus, if consistent with the five-year average, would be about 260 (105 - 409) fish.

Return estimates for the year 2000 on **Sutherlands River** are expected to exceed 34 large salmon and 20 small salmon, 138% and 400% of the respective conservation requirements.

Management Considerations

Based on indicator rivers, it is expected that returns to most rivers will meet or exceed conservation requirements in 2000. The level of directed fisheries exploitation in recent years generally has not been of concern to conservation. Directed fisheries for large salmon should be avoided on River John and Wallace River until it has been determined that returns to those rivers will provide a surplus.

Small salmon in these rivers are predominantly male (95% or more). Returns and spawning escapements of small salmon in recent years have exceeded the conservation requirements and returns in excess of requirements are anticipated in 2000.

The smaller rivers in the area, the **Afton**, **Tracadie (Monastery)**, and **Sutherlands**, require less than 50 large salmon spawners to meet conservation requirements, and are

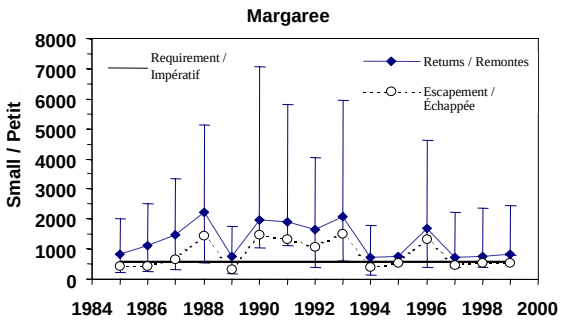
more vulnerable to over-exploitation. Accordingly, these rivers should be managed independent of the larger rivers in the area.

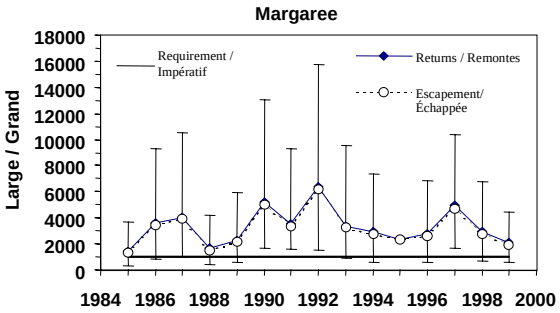
Cape Breton (SFA 19 and part of SFA 18)

Salmon stocks of Cape Breton Island include those of the Margaree, 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.

Status

Estimates of salmon returning to the **Margaree** in 1999 were 820 (20 - 1,610) small and 2,060 (1,440 - 2,400) large salmon. Small salmon returns are similar to those of four of the last five years. Large salmon were down 30% from 1998, the lowest estimate since 1988. Escapements numbered 550 small and 1,901 large salmon. Hatchery stocked fish may have comprised 5-10% of the run.

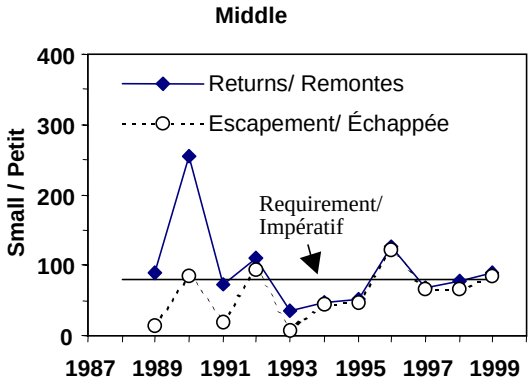


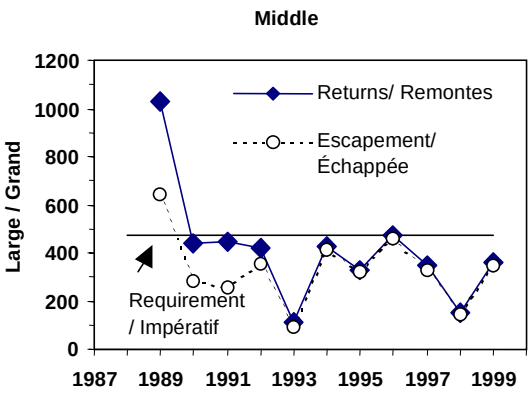


Conservation requirements are 1,036 large salmon and 582 small salmon. In 1999, small salmon escapement was about 95% of requirement and large salmon was about 185%. Egg requirements have been exceeded in every year since 1985.

Mean juvenile densities in 1999, not unlike those of recent record, were 132 fry and 90 age-1^+ and older parr per 100 m^2 and are 4.6 and 2.5 times the Elson norms of 29 fry and 38 parr per 100 m^2. These densities are consistent with escapements of two to six times the conservation requirement.

Returns to **Middle River** were estimated at about 450 fish, (range 140 - 640) comprised of 90 small and 360 large salmon. Estimates of large salmon returns and escapement rose to the mid-1990s level.

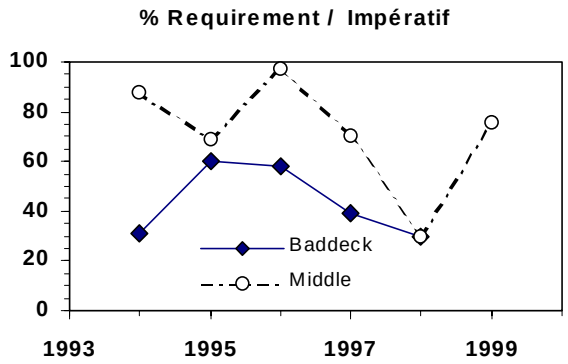




Conservation requirements for the Middle River of 2.07 million eggs have been expected from 470 large and 80 small salmon. Small salmon escapement (84 fish) was about 105% of requirement, large salmon (347) were about 75% of requirement.

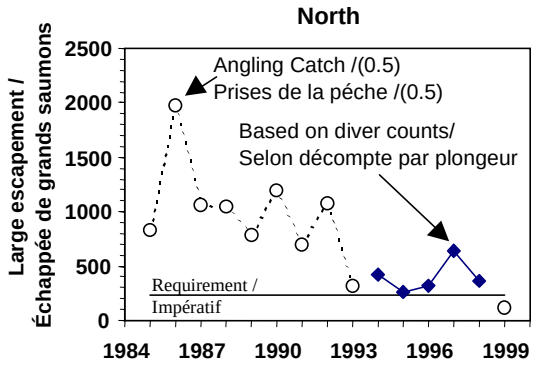
Mean juvenile densities of 41 fry and 38 parr per 100 m^2 for two mainstem sites on Middle River in 1999 were 1.4 and 1.0 times the Elson norms. Monitoring since 1995 found densities to be at or slightly above norms and suggests uncertainty in the egg requirements or measures of returns and spawners, both of which are being investigated.

Egg conservation requirement for the **Baddeck River** is 2.0 million, expected from 450 large and 80 small salmon. High river discharges precluded the usual October diver counts of salmon on the Baddeck River in 1999. Estimates of large salmon escapement in 1999 were based on the assumption that they track those of the Middle River. Accordingly, it is unlikely that the egg conservation requirement was achieved.



Mean juvenile densities of 95 fry and 33 parr per 100 m^2 for three mainstem sites on Baddeck River in 1999 were 3.2 and 0.8 times the Elson norms. Monitoring since 1996 indicates that densities of fry fluctuate above while densities of parr fluctuate around the Elson norms. This, like the Middle River, raises uncertainty with respect to estimates of egg requirement, returns and spawners.

High river discharges also precluded October diver counts of salmon on the **North River** in 1999. Estimated returns of 58 small and 120 large salmon were based on angling data. Diver count estimates have consistently exceeded those based on angling.



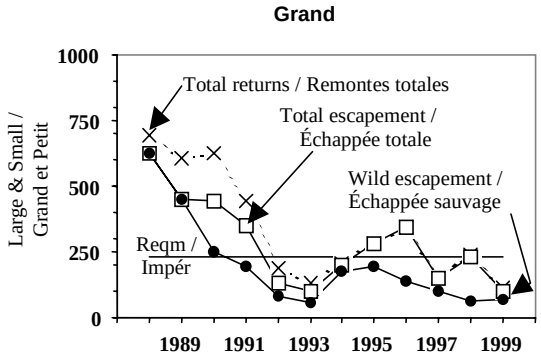
Conservation requirements for the North River are 0.85 million eggs expected from 200 large and 30 small salmon. Comparison of escapement estimates based on diver

counts and angling data, 1994 to 1998, suggests that escapement in 1999 may have met the egg requirement.

Mean juvenile densities of 42 fry and 42 parr per 100 m^2 for four mainstem sites on North River in 1999 were 1.4 and 1.1 times 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 to contribute to returns in 2000.

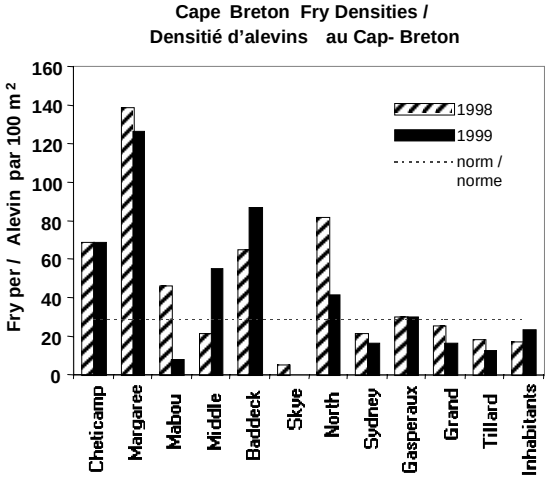
The count of salmon in 1999 was 42 small and 2 large fish; the estimate of returns is about 110 salmon, 34% of hatchery origin. Total returns and escapement numbered about one-half of those in 1998; wild returns and escapement were similar.

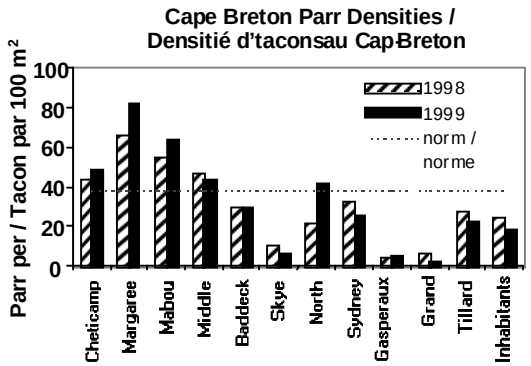


Conservation requirement upstream of the fishway is 234 salmon (475,000 eggs). In 1999, escapement of wild and hatchery salmon upstream of the fishway was 47% of fish requirement, the second lowest of the 12- year data set. As in 1998, wild fish met only 30% of the conservation requirement.

Juvenile densities at four sites on the main stem averaged 16 fry and 2 parr per 100 m^2, 0.6 and 0.05 times the Elson fry and parr norms and are consistent with the estimated decrease in egg depositions since 1996.

In 1999, juvenile salmon surveys were again conducted on the **Cheticamp** and **Mabou** rivers in SFA 18 and **Skye**, **Sydney**, **Gaspereaux**, **Tillard** and **Inhabitants** rivers in SFA 19. Densities of fry and parr relative to Elson norms suggest: (1) most stocks of SFA 18, Gulf Cape Breton, may be meeting or exceeding egg conservation requirements, (some uncertainty about the reason for low fry levels on the Mabou) (2) the Skye River of Bras d'Or Lakes has not been meeting the egg conservation requirement, and (3) that Atlantic coast rivers are unlikely to be meeting egg conservation requirements.





Outlook

The following prognoses are based on the average returns of the previous five years.

Escapement to the **Margaree River** has exceeded the egg conservation requirement in each of the last 14 years. The forecast of returns in 2000 is about 3,000 (1,200 - 4,860) large fish with a greater than 96% probability that the conservation requirement of 1,036 large salmon will be met. Returns of small salmon may number 950 fish (300 - 1,630) and the probability of meeting the 582 fish conservation requirements is about 80%.

For the **Middle River**, the forecast of small and large salmon returns in 2000 is about 415 fish (200 - 630). The probability of returns exceeding the 550 fish requirement is about 15%.

For the **Baddeck River**, the forecast return in 2000 is 335 fish (130 - 540) and the probability of exceeding requirements of 530 salmon is less than 7%.

Projected returns of small and large salmon to **North River** in 2000 are 476 fish (145 - 825). The probability of exceeding the conservation requirement of 230 fish is 88%.

Projected returns to the area upstream of **Grand River** Falls are 113 fish (35 - 200), mostly wild small salmon. There is only about a 1% probability that the conservation requirement of 234 fish will be met upstream of Grand River Falls.

Management Considerations

Conservation requirements are expected to be exceeded in 2000 in the **Margaree** (as in previous years) and probably other west coast Cape Breton rivers. Exploitation levels on large salmon, both realized and allocated for the Margaree River**,** have not been a conservation concern. Small salmon are predominantly male, usually are less abundant than large salmon, and generally are not constraining to stock conservation.

Conservation requirements have generally not been achieved in recent years on the **Middle** and **Baddeck** rivers and perhaps other tributaries of Bras d'Or Lakes. Expectations are that returns will not meet requirements in 2000.

Expectations for the **North River**, based on the five-year mean, are that returns in 2000 will be sufficient to meet conservation requirements of 230 salmon (probability of 88%). Because of the low estimated escapement in 1999, an in-season review of stock status should be considered prior to harvesting of large salmon.

The **Grand River** did not meet the conservation requirement upriver of the fishway in 1999. Returns in 2000 are now dependent totally on wild production, which has not met requirements since 1990. There is <1% probability that conservation requirements will be met in 2000.

Parr densities in other rivers along the Atlantic coast are relatively low (e.g., **Sydney, Tillard, Inhabitants, Gaspereaux**) and indicate a need for caution and river-specific assessments.

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

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 rivers are areas of limestone rich soils (drumlins) that provide local areas of less acidified water.

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 which are **partially acid-impacted** where main river annual mean pH is between 4.7 and 5.0.

Fourteen rivers have **lost** their population of Atlantic salmon and fisheries are supported on four of these by stocking with hatchery-reared smolts.

There is evidence that water quality in rivers has deteriorated since 1986. Some of these rivers are also impacted by hydroelectric or impoundment for domestic water use.

Status

Low- or non-acidified rivers

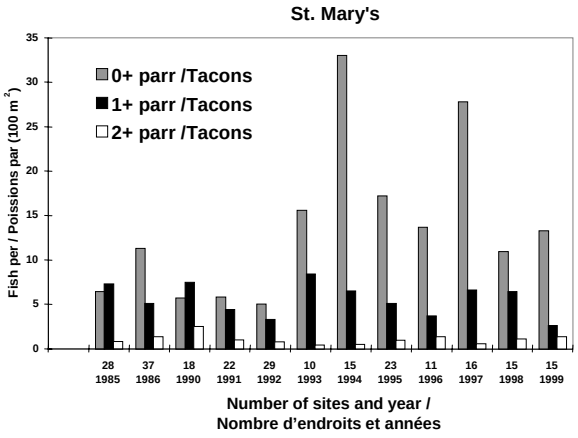
Conservation requirements have been assigned for two low acidified rivers, LaHave and St. Mary's. These requirements are 1.9 million eggs equivalent to 1,320 fish for the LaHave above Morgans Falls and 7.4 million eggs or the equivalent of 3,155 fish for the entire St. Mary's River.

The estimated escapement to the **West River St. Mary's**, in 1999, was 390 fish (256 – 915). Based on the proportion of habitat sampled, total escapement to **St. Mary's River** in 1999 was estimated to be 700 fish or 22% of the fish conservation requirement and 30% of the egg requirement.

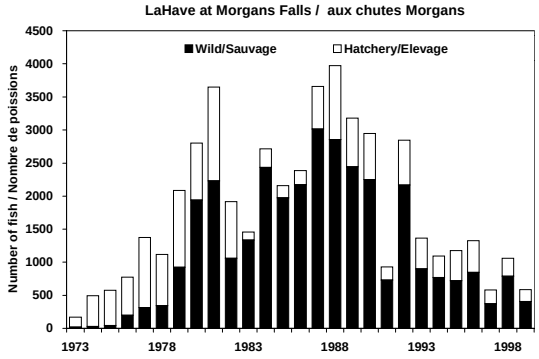
Salmon escapement estimate – St. Mary's River

Year	Small	Large	% Conservation
1995	2,038	437	92
1996	1,535	590	93
1997	709	110	28
1998	1,926	74	55
1999	559	150	30

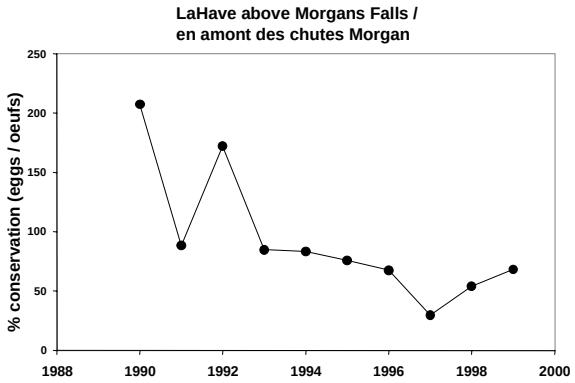
Age-1^+ and age-2^+ parr densities remain low while age-0^+ parr (fry) are higher since 1993.



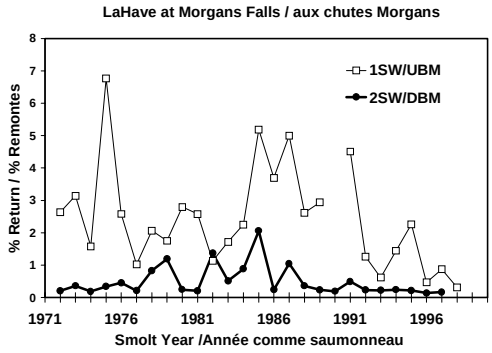
Counts at Morgans Falls fishway on the **LaHave River** were 585 fish, which indicated a return of 48% of the fish conservation requirement and 68% of the egg requirement in 1999. After broodstock removals, egg deposition was 55% of the requirement. Hatchery fish contributed 33% of the potential egg deposition.



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



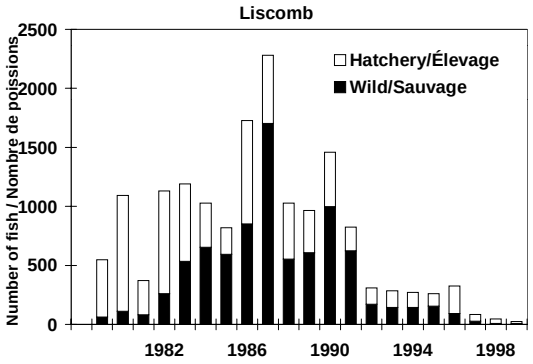
The return rate of hatchery smolts to Morgans Falls, LaHave River has declined since 1984. Return rate of 1998 hatchery smolts as 1SW fish in 1999 decreased to 0.3% from 0.9% the previous year, the lowest in the time series. Returns of 2SW hatchery salmon in 1999 (1997 smolt class) remained below 0.2%.



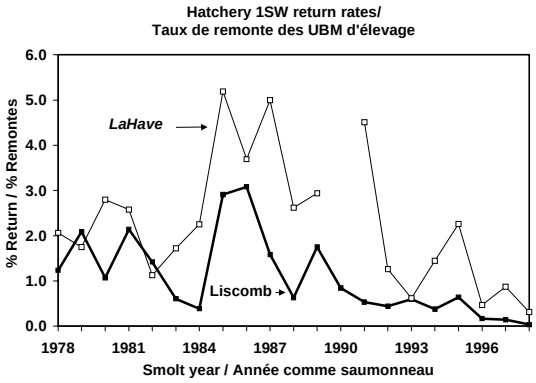
Status for all low-acidified rivers in SFAs 20 and 21, which are still capable of producing wild Atlantic salmon, is expected to be similar or worse than the index rivers. Dissimilarities in the status of salmon stocks among rivers of these SFAs may be attributed to the levels of acidification and to supplementation with hatchery produced smolts.

Partially-acidified rivers

Returns to the **Liscomb River** fishway numbered only 25 fish in 1999. Wild salmon have almost disappeared and survival of hatchery-origin salmon has declined severely.



Mortality of stocked smolts attributed to low pH (i.e., increased acidity) may account for the decrease in the hatchery smolt return rate to these rivers. Therefore, hatchery supplementation as a mitigation technique for acidification is now less effective than when the stocking programs originally began. This can be seen in the consistantly higher returns of 1SW salmon for hatchery smolts stocked in LaHave River, a low acid-impacted river, compared to those stocked in the Liscomb River, a partially acidified river, since the early 1980s.



Acid-impacted rivers

Some rivers can no longer support the production of salmon because of inadequate fish passage, flooding of habitat and acidification. The **East River Sheet Harbour, Mersey, Clyde** and **Jordan** rivers receive hatchery smolts.

Outlook

Low- or non-acidified rivers

Based on the average estimated return to **St. Mary's River** from 1995 to 1999 of 1,280 small salmon (340 - 2,310) and 340 large salmon (65 - 675), there is less than a 5% chance that the returns in the year 2000 will exceed the conservation requirement of 2,415 small and 713 large salmon.

For **LaHave River** above Morgans Falls, cohort and smolt origin forecast models suggest a 35% chance that year 2000 returns will be greater than the conservation requirement. Also, about a third of the forecast return is expected to originate from 46,000 hatchery smolts stocked above Morgans Falls in 1999. However, hatchery returns may be overestimated considering that return rates for hatchery smolts have declined in the past three years and the forecast is based on a five-year average.

Based on the number of wild smolts emigrating from above Morgans Falls in 1998 and 1999 there is less than a 10% chance that returns of wild small and large salmon to Morgans Falls in year 2000 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 bode well for the recovery of salmon stocks in SFA 20 and 21.

Hatchery smolts stocked in other low- or non-acidified rivers are expected to return to those rivers at rates similar to that observed at Morgans Falls. Stocking in these other rivers in 1999 was not as extensive as that above Morgans Falls.

River	Origin of stock	Number of smolt
La Have	LaHave	45,600
Mushamush	LaHave	9,500
Petite	LaHave	10,800
Musquodoboit	Musquodoboit	18,900

Partially-acidified rivers

Deteriorating water quality, declining wild salmon returns and low smolt-to adult return rates indicate that wild returns will be inadequate to meet conservation requirements in 2000. Declining survival rates of hatchery smolts stocked in Liscomb River suggests that hatchery returns in the year 2000 will provide insufficient augmentation to meet conservation levels in partially-acidified rivers receiving hatchery stocking.

River	Origin of stock	Number of smolt
Sackville	Sackville	20,500
Tusket	Tusket	45,400
Gold	Gold	16,400
Medway	Medway	41,600
Salmon (Digby)	Salmon (Digby)	7,000
Liscomb	Liscomb	56,000

Acid-impacted rivers

The numbers of smolts stocked in the four acid-impacted rivers in 1999 were similar to 1998 and returns in 2000 are expected to be similar to those of 1999.

River	Origin of stock	Number of smolt
Clyde	LaHave	11,500
Jordan	LaHave	4,900
Mersey	LaHave	9,900
East R. Sh. Hbr.	East River	22,000

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 the year 2000. Return rates of hatchery smolts have declined to levels that even rivers that have been stocked with hatchery smolts are not likely to meet conservation requirements in year 2000. Any salmon fisheries in SFA 20 or 21 should be contingent on the results of the LaHave River in-season assessments.

Egg depositions in these rivers are contributed equally by small and large salmon. Therefore, the harvest of small salmon has the potential to significantly affect stock conservation.

Returns to the **Liscomb River**, representative of the partially acidified rivers, have shown an almost total loss of wild salmon and severe decline in the survival of stocked hatchery salmon. In-depth monitoring is recommended to assess the risk of extirpation of these stocks.

Returns of adipose fin clipped hatchery smolts to the **East River Sheet Harbour, Mersey, Clyde and Jordan rivers** (all acid impacted) will again be available for harvest in 2000. Hatchery returns to the latter three of these rivers have been dependant upon broodstock collected from the LaHave River. Because returns to the LaHave River have been and are again forecast to be less than that required for stock conservation, other options for broodstock collections need to be considered.

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

Salmon of the inner Bay of Fundy may have occupied about twenty-one rivers of SFA 22 in Nova Scotia and about six rivers in SFA 23, New Brunswick. Rivers in these areas have a variety of habitats and are well suited to the production of salmon. In general, habitat is minimally impacted by forest harvesting and agriculture practices and not susceptible to acidification. Some rivers have lost their salmon production because of barriers to migration e.g. Petiticodiac, Shepody, and Avon rivers. The Petiticodiac River represents about 28% 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 wide-spread degradation of freshwater habitat is known to have occurred.

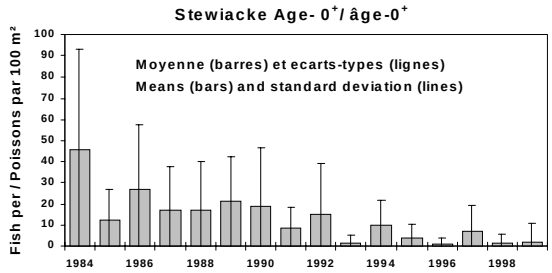
Salmon usually enter these rivers in the fall of the year, have a high proportion that return to spawn after one winter at sea, are not generally known to migrate to the north Atlantic Ocean, and have a high survival between consecutive spawning years.

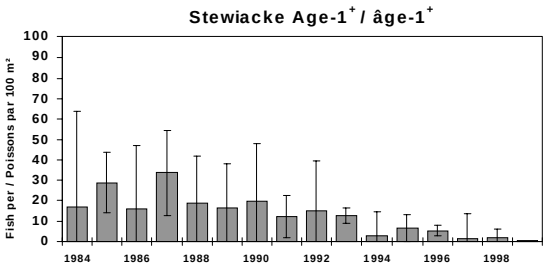
The inner Bay of Fundy historic catches averaged 1,061 fish in the commercial fishery (1970-1984), and 1,462 small salmon and 597 large salmon (1970 - 1990), in the recreational fishery. Two rivers, the Big Salmon River, New Brunswick, and Stewiacke River, Nova Scotia, accounted for more than half of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

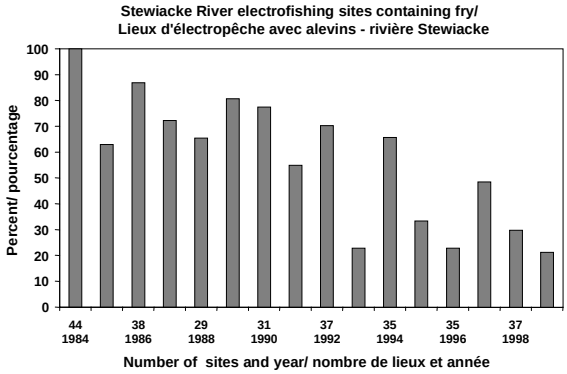
Status

These rivers were assessed through electrofishing of juvenile and adult salmon as well as stream side observation in the clearer more visible rivers. No quantitative or qualitative observations indicated that salmon returns increased in 1999.

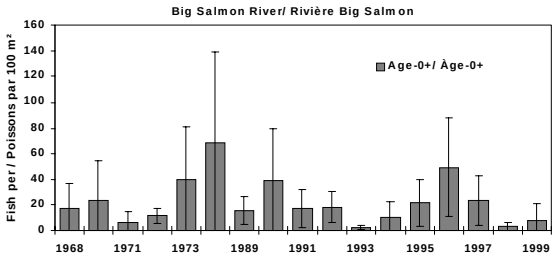
Electrofishing for juvenile salmon at 32 sites in the **Stewiacke River** in 1999 indicated a continued decline of juvenile salmon. The incidence of electrofishing locations that are void of age-0^+ parr increased from zero in 1984 to 79% in 1999.

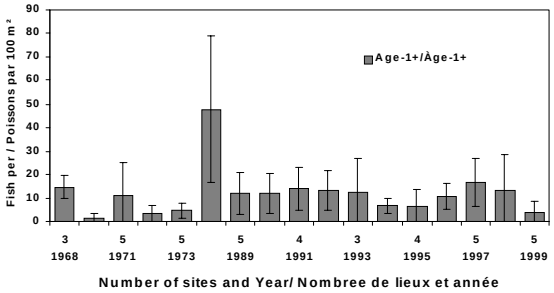






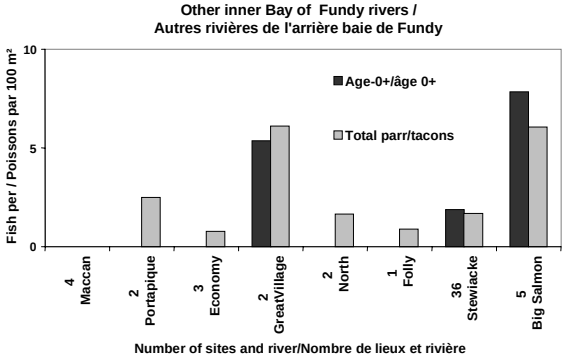
The population of Atlantic salmon in the Big Salmon River was enhanced through captive rearing. Hatchery-reared smolts of wild stock were grown in sea-cages and released to spawn in the Big Salmon River in 1994 and 1995. Electrofishing at five sites in the Big Salmon River in 1999 indicates that parr densities have now declined in this river.





The increased densities of parr from 1995 to 1998, a result of the release of captive reared mature salmon, indicates that the decline in parr densities generally noted in other inner Bay of Fundy rivers, was the result of reduced spawning escapements and not a general loss of habitat productivity.

Electrofishing at a total of fourteen locations in six other rivers (**Maccan, Portapique, Economy, Great Village, Folly and North**) indicates that there were few salmon of any age in rivers of the inner Bay of Fundy in 1999.



Salmon of the **Gaspereau River**, Kings County, unlike other inner Bay of Fundy rivers, migrate to the northwest Atlantic and have followed a recruitment and life history pattern similar to other Atlantic coast rivers. A total of 41 fish (13 hatchery and 28 wild), or a potential 24% of the required spawning escapement upstream of the White Rock Dam fishway, was counted in 1999. A total of 16 fish was removed for broodstock. Egg deposition in 1999 was 15% of the conservation requirement.

		Year		
Origin	Size	1997	1998	1999
Wild	Large	5	2	1
	Small	30	14	11
Hatchery	Large	2	4	0
	Small	22	60	13
Broodstock	Large	12	5	2
	Small	31	27	14
Conservation	(%)	71	56	15

The status of salmon in **Annapolis River**, an outer Bay of Fundy stock, may be implied from failed broodstock collection attempts in 1999. Only five hatchery returns were observed at the Martyn Mills fishway on the Nictaux River.

Outlook

Atlantic salmon spawners and juveniles of the **inner Bay of Fundy** are critically low. No salmon surplus to conservation will be available until three generations of recovery have been documented.

Salmon of the **Gaspereau** and **Annapolis** rivers have received hatchery supplementation, did not meet conservation requirements in 1999 and are not expected to do so in 2000.

Management Considerations

Inner Bay of Fundy salmon stocks (e.g., **Stewiacke, Big Salmon**) are critically low. Surveys of juveniles and adults, conducted in 1999, indicate that there are few Atlantic salmon of any age remaining in these 22 rivers. Smolt production is very low and therefore all recruitment is required for spawning. If in the near future marine survival were to increase to previously documented levels, recovery of the inner Bay of Fundy salmon stock would take at least three generations or twelve years.

Special measures are required to prevent extirpation of inner Bay of Fundy salmon. An action plan is urgently required.

Outer Bay of Fundy (western part of SFA 23)

Stocks in this area generally have not met conservation requirements during the last decade. Saint John River stocks originating upriver of Mactaquac face a multitude of constraints including hydroelectric dams (with upriver passage facilities) mostly devoid of safe downstream passage, artificial flow regimes, headponds and additional communities of potentially effective predators on juveniles and smolts.

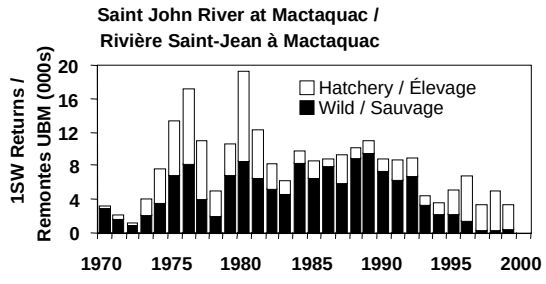
Saint John tributaries downstream of Mactaquac are not obstructed. Stocks of other outer Fundy rivers such as the Magaguadavic and St. Croix face similar perils to stocks upriver of Mactaquac and additionally, transmission of diseases and

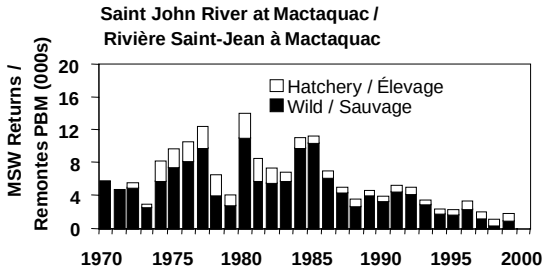
potential genetic swamping by farmed salmon escapees from the nearby Fundy-Isle (NB) and Cobscook Bay (ME) aquaculture industry (1998 production of about 32,000 t).

Status

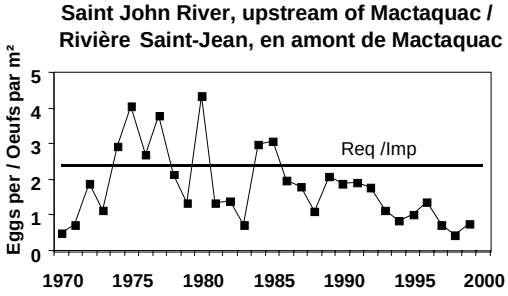
The total count of salmon on the **Saint John River at Mactaquac** dam in 1999 was 5,003 fish. Total returns (including assumed losses downriver of Mactaquac) were estimated to be 3,257 1SW and 1,804 MSW salmon, exclusive of 20 fish which were identified as farm escapees. About 86% of 1SW and 54% of MSW returns were of hatchery origin. Proportionately more of the total returns arrived early at Mactaquac than in any previous year, e.g., among MSW salmon, about 60% of the run was counted by July 1, 1999, whereas the average of the previous 10 years was about 15%. For 1SW fish, respective values were 30% versus about 2%.

Wild 1SW returns were the third lowest of a 30-year record; wild MSW returns were 2.5 times as numerous as those of 1998 but are the second lowest of the 30-year record. Hatchery 1SW returns were fewer than returns estimated since 1994. Hatchery MSW returns were 1.5 times as numerous as in 1998, about the same as those of 1997 and with one exception exceeded estimated returns since 1984.

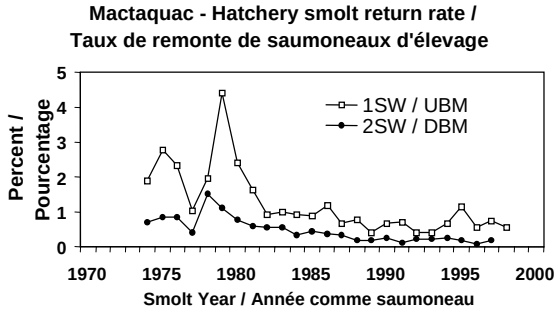




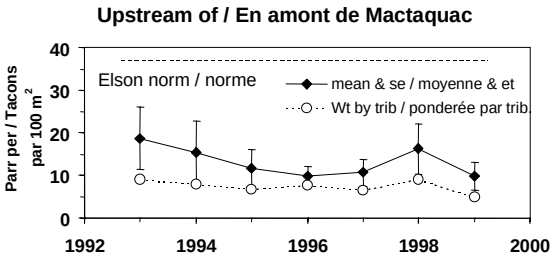
Escapements upriver of Mactaquac numbered an estimated 1,338 MSW (43% wild) and 2,962 1SW (15% wild) salmon. Ninety-five percent of escaping MSW fish were female, 90% of escaping 1SW fish were male. Conservation requirements upriver of Mactaquac are 32.3 million eggs to be provided by 4,900 MSW and 4,900 1SW fish. Only 31% of the conservation egg requirement was met with hatchery-origin fish providing 59% of the total. This is the sixth lowest value in 30 years. A total of 1.9 million eggs, representing 16% of the total eggs arriving at Mactaquac, were retained for hatchery incubation and rearing. Eggs in total returns (12.3 million) would have accounted for 38% of conservation requirement.



Aged returns from reared smolts released via Mactaquac smolt migration channel have been used as an index of marine survival. Preliminary assessment indicates that the return rates remain low. Fallback and recovery at Mactaquac in 1999 of tagged fish placed upriver of Mactaquac Dam suggest that 1SW return rates may be lower than indicated.

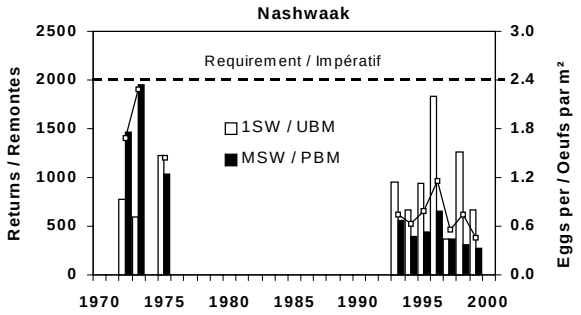


Mean densities of wild parr at 15 sites upriver of Mactaquac, and also weighted according to relative production area of the tributaries in which they are located were 9.8, and 4.8 parr per 100 m^2 , respectively. These values are among the lowest estimated since 1993 but consistent with declining egg depositions.



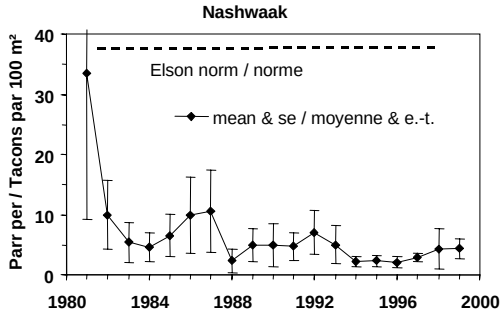
Counts of 305 small and 84 large salmon at the **Nashwaak River** fence and a late-October mark-and-recapture estimate indicated a run of 665 1SW (515 – 1,385) 275 MSW (195 – 1,115) salmon to the fence. Hatchery returns contributed to less than 1% of the total and no farmed escapees were identified.

Returns of 1SW salmon were the third lowest since 1993, and one-half the 1SW returns of 1998. MSW returns were the lowest on record and have been declining since 1996.



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 660 1SW and 270 MSW salmon indicates egg deposition in 1999 to have been only about 19% of requirement. Females among 1SW salmon (46%) contributed to 43% of the estimated egg deposition.

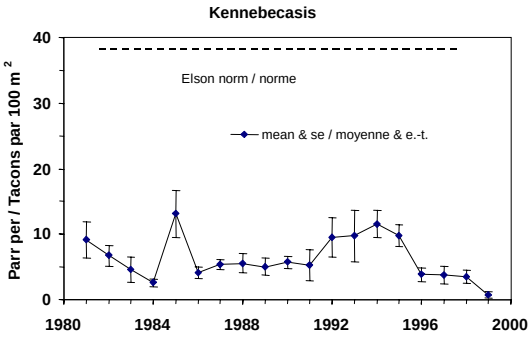
Juvenile densities have been monitored since 1981 at five sites upriver of the Nashwaak River counting fence. The values for age-1+ and older parr, as well as fry, are low with respect to Elson norms and trend downwards since 1981.



Smolts emigrating from upstream of the fence were estimated to number 28,500 (25,300 - 33,200) fish (0.5 smolts per 100 m^2). This estimate is a 25% increase over that of 1998. The increase is consistent, at least for the dominant 2-year smolts, with the estimated increases in: 1) egg depositions, between 1995 and 1996; 2) age

0^+ parr densities, between 1996 and 1997 and 3) age 1^+ and older parr between 1997 and 1998.

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. Values for age-1+ and older parr, are low with respect to the Elson norm and trend downwards since 1994.

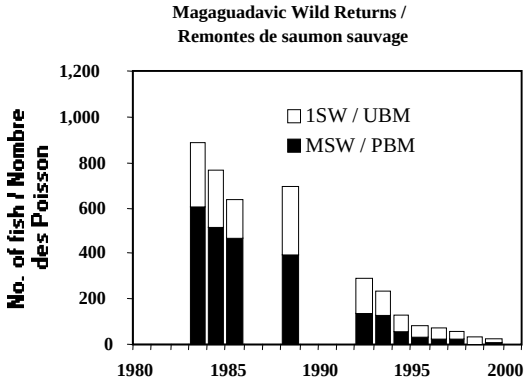


Parr densities track fry densities but at lower levels. Mean densities of fry, albeit with wide error bands between 1991 and 1997, fluctuated about Elson norms.

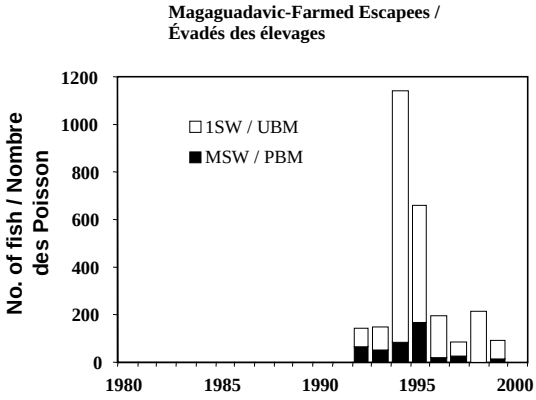
An assessment of adults on the **Hammond River** was not completed in 1999. An assessment of returns in 1998 indicated that about 30% of the total fish conservation requirement (530 MSW and 680 1SW fish) was met. The count of redds in 1999 was double that of 1998 and 134% of the previous five-year mean.

Densities of juvenile salmon (age-1^+ and older parr) at four sites on the Hammond River in 1999 averaged 7 parr per 100 m^2, 41% of those in 1998 and 50% of mean density, 1993-1998. Fry averaged 19 fish per 100 m^2 (4 sites), twice that of the 1998 value and 63% of a 30 fry per 100 m^2 average, 1993 to 1998. Age 1+ and older parr densities have generally been several magnitudes greater than those of either the Nashwaak or Kennebecasis rivers. The influence of hatchery stocking on these densities is believed to be minimal.

Wild returns to the St. George fishway and trap located at the head-of-tide on the **Magaguadavic River** in 1999 numbered only 19 1SW (3 from sreamside rearing) and 5 MSW salmon, the fewest of record.

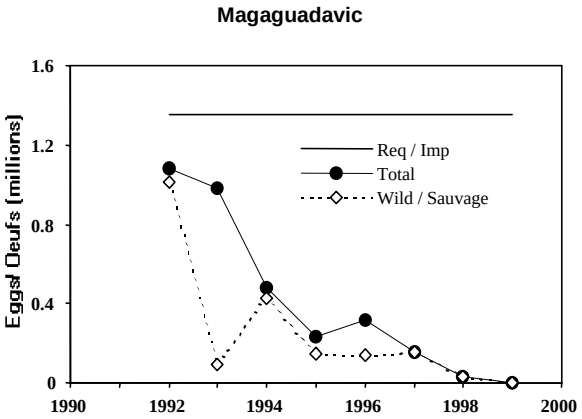


Farmed escapees ascending the fishway through October in 1999 numbered 80 1SW, and 10 MSW salmon.



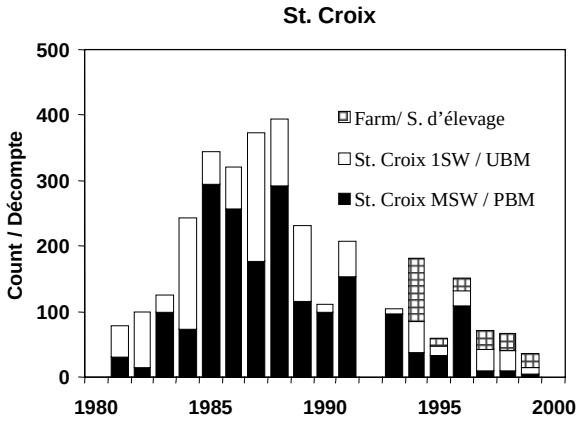
Interim conservation requirements are 1.35 million eggs from 230 MSW and 140 1SW salmon, an objective which in all likelihood was met by returns in the 1980s. In 1999, only four wild 1SW fish were released to the river of which one was a female with a

potential 3,250 eggs. Eleven of 15 broodstock (all testing positive for ISA virus) yielded 30,000 eggs which are being held under quarantine at the NB Research and Productivity Council pending testing for the ISA virus after hatching. As in 1997 and 1998, farmed escapees were not released upriver of the fishway. Four aquaculture escapees also tested positive for ISA virus.



Surveys of juvenile salmon in 1995 and 1997 revealed low fry and highly variable parr densities. Also found were parr escapees from hatcheries supplying the aquaculture industry and as many as 12 juvenile smallmouth bass (*Micropterus dolomieui* Lacépède) per 100 m^2. Nine electrofishing sites were completed in 1999; two sites proximate to the hatcheries contained up to 14 parr per 100 m^2, the sites distant to the hatcheries had 0 to 0.4 fish per 100 m^2.

Counts of salmon at the Milltown fishway, near head-of-tide on the **St Croix River** in 1999 numbered 5 wild and hatchery MSW fish, 8 wild and hatchery 1SW fish and 11 farmed MSW and 12 farmed 1SW fish. All farmed escapees were removed from the trap for disease analysis and found to be negative. Hatchery-origin fish comprised 31% of St. Croix-origin returns.



All 13 hatchery and wild fish were taken as broodstock and yielded 23,600 eggs for hatchery incubation and stocking in the St. Croix as age 0+ parr. Thus no salmon spawned above the Milltown Dam.

Outlook

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

Projected returns for stocks originating on the **Saint John River** at and upriver of **Mactaquac** in 2000 are 4,600 (2,295 - 7,020) 1SW and, at best, 2,060 (720 – 3,430) MSW salmon. The probabilities of attaining conservation requirements of 4,900 of each of 1SW and MSW fish are 43% for 1SW salmon and <1% for the MSW forecast. Low densities of wild parr, apparent increasing reliance on hatchery production and persistently low MSW return rates suggest that MSW returns will not be adequate to achieve egg conservation requirements for at least the next decade.

Predicted returns to the **Nashwaak River** in 2000 are 1,015 1SW fish (235 - 1,945). There is less than a 5% probability that 1SW requirements of 2,040 fish will be met. Forecasts of MSW returns are 410 fish (165 to 655). The probability that conservation requirements of 2,040 MSW fish will be met

is near-zero. 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 at least the next decade.

Low parr densities on the **Kennebecasis River** in 1999 are the result of escapements in 1996 and 1997 which were estimated to have been less than one-half of conservation requirements. Continued low densities, 1996 to the present, suggest that current levels of adult returns will be unlikely to increase in the next several years.

Parr densities on the **Hammond River**, 1997 - 1999, also suggest that current levels of adult returns are unlikely to increase in the next several years.

Wild 1SW and MSW returns to the **Magaguadavic River** in 2000 are projected to be no greater than the few fish returning in 1999. There is a near-zero probability of attaining conservation requirements and without hatchery assistance and a recovery plan, there is a strong possibility that the stock will be extirpated within a few years.

Mean numbers of wild and hatchery returns to the **St. Croix River**, 1995 to 1999, have been 22 1SW and 33 MSW fish. Recent levels of natural spawning indicate that returns of each of 1SW and MSW fish in 2000 or the near future are unlikely to exceed 100 fish. Returns from hatchery stocked St. Croix-origin parr and Penobscot River-origin smolts should provide some additional 1SW returns in 2000. Under any scenario for returns in 2000 there is a near-zero probability of attaining conservation requirements.

Management Considerations

For the **Saint John River** stocks **upriver of Mactaquac**, egg depositions have been less than 50% of requirements for six of the last seven years. There is essentially a zero probability that MSW returns will be adequate to meet conservation requirements. For 1SW salmon there is no more than a 50% probability of attaining the 4,900 1SW salmon requirement.

Generally, 80-90% of the MSW salmon returns to Mactaquac are female. Although females comprise only about 10% of 1SW salmon, their potential contribution towards egg conservation requirements (11% in 1999; 32% in 1998) can be important when MSW salmon escapement is low. Male 1SW salmon are frequently in excess of the 1:1 male:female ratio recommended for conservation requirements.

The **Nashwaak River** stock, met only about 20% of conservation requirement in 1999 and has failed to achieve more than 50% of requirements since 1993. Prospects for attaining the conservation requirement in 2000 is near-zero and based on parr densities, the prospects for increased returns thereafter are low.

1SW salmon are 40 to 50% female and make a significant contribution towards egg conservation requirements (46% in 1999; 54% in 1998). Any losses of 1SW salmon will directly impact on egg depositions required for conservation, particularly now that large salmon returns are inadequate to meet requirements.

The prospects for returns to the **Kennebecasis River** are similar to those of the Nashwaak River. Like fish of the Nashwaak River, female composition of 1SW salmon is high and any losses will directly impact on egg depositions.

Although the number of salmon returning to the **Hammond River** in 1999 is unknown,

patterns of parr densities, (albeit as much as 50% of the Elson norm) and an estimated shortfall to conservation requirements in 1998 suggest that returns to the Hammond River in 2000 are unlikely to meet conservation requirements. Like other assessed tributaries downriver of Mactaquac, the female composition of 1SW is high and any losses will directly impact on egg depositions required for conservation.

Stocks of other outer Bay of Fundy rivers west of the Saint John River have declined dramatically in the last decade. Returns of wild salmon to the **Magaguadavic** and the **St. Croix rivers** in 1999 continued a downward trend. There is no chance that conservation requirements will be met from natural production on these rivers in 2000 or the near future. Action plans to prevent extirpation of salmon stocks of these and other outer Bay of Fundy rivers are critical.

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

			Aboriginal Fisheries Removals[1]										Recreational Fisheries Removals[1]									
			Small Salmon					Large Salmon					Small Salmon					Large Salmon				
River	SFA	Index	'95	'96	'97	'98	'99	'95	'96	'97	'98	'99	'95	'96	'97	'98	'99	'95	'96	'97	'98	'99
Restigouche System[2]	15	1&2	21	77	26	26	-	202	213	166	234	-	1620	3475	2982	2984	2598	1164	1361	1002	691	810
Matapédia	15	1	0	0	0	0	0	0	0	0	0	0	337	721	450	653	708	829	922	719	442	588
Restigouche-NB	15	2	21	77	26	26	-	24	37	11	37	-	1283	2754	2532	2331	1890	335	439	283	249	222
Jacquet	15	3	-	-	-	-	-	-	-	-	-	-	61	67	67	-	-	0	2	2	-	-
Nepisiguit	15	4	131	84	85	-	-	44	28	0	-	-	350	450	190	150	300	9	13	9	6	3-
Tabusintac	16	5	106	171	-	18	31	42	187	-	18	19	33	-	74	-	32	1	-	2	-	2
Miramichi	16	6&7	3004	2583	1197	1180	2400	185	372	548	214	700	5533	-	8311	-	-	94	-	152	-	-
NW Miramichi	16	6	1795	1504	871	782	1700	172	317	548	195	650	1705	-	3153	-	-	19	-	46	-	-
SW Miramichi	16	7	1170	1074	326	378	627	13	0	0	0	0	3828	-	5158	-	-	76	-	106	-	-
Buctouche	16	8	15	25	25	Closed	Closed	0	4	5	Closed	Closed	33	21	5	Closed	Closed	0	1	0	Closed	Closed
Morell	17	9	19	17	1	28	0	1	0	0	0	0	449	397	198	237	-	0	0	0	0	-
River Philip	18	10	29	2	0	0	14	37	45	21	7	17	105	165	43	85	103	12	33	5	12	15
Wallace	18	11	2	-	-	-	-	6	-	-	-	-	16	20	13	30	12	1	4	5	3	5
French (Col.)	18	12	-	-	-	-	-	-	-	-	-	-	1	1	0	1	0	0	1	0	0	0
Waugh	18	13	-	-	-	-	-	-	-	-	-	-	14	24		18	13	2	7	1	2	1
River John	18	14	3	-	-	0	-	5	-	-	18	-	10	22	25	21	18	1	6	3	2	3
West (Pictou)	18	15	0	-	-	0	-	3	-	-	12	-	26	57	5	32	42	2	10	1	5	9
East (Pictou)	18	16	2	11	0	3	0	28	49	40	15	12	22	34	23	29	24	2	14	3	6	11
Sutherlands	18	17	-	-	0	0	0	-	-	14	14	14	1	0	0	0	0	0	0	0	0	0
French (Pictou)	18	18	-	-	0	0	0	-	-	13	13	13	0	1	3	0	0	0	0	0	0	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 Listiguj First Nation in the estuary because these data are not available.

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

			Aboriginal Fisheries Removals[1]										Recreational Fisheries Removals[1]									
			Small Salmon					Large Salmon					Small Salmon					Large Salmon				
River	SFA	Index	'95	'96	'97	'98	'99	'95	'96	'97	'98	'99	'95	'96	'97	'98	'99	'95	'96	'97	'98	'99
Barney's	18	19			0	0	0			13	13	13	1	10	0	0	0	0	0	0	0	1
West (Antig.)	18	20	-	-	-	-	-	-	-	-	-	-	50	109	21	67	86	7	24	5	9	12
South	18	21					-					-	1	10	1	3	17	0	1	0	1	2
Margaree	18	22	2	7	20	30	8	4	89	124	120	45	206	306	204	213	253	53	93	105	66	46
Middle [2]	19	23	1	4	3	5	5	7	16	15	9	9	2	5	4	6	1	3	7	4	2	4
Baddeck	19	24	2	2	5	3	3	5	7	13	7	7	10	2	1	2	1	4	8	3	3	2
North	19	25	0	1	0	0	0	0	2	0	0	0	9	9	4	4	1	10	6	7	4	2
Grand	19	26	0	0	0	0	0	0	0	0	0	0	-	5	4	2	1	1	1	1	1	1
St. Mary's	20	27	-	0	0	Closed	Closed	-	0	0	Closed	Closed	421	60	8	Closed	Closed	13	18	3	Closed	Closed
Liscomb	20	28	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
West Sheet Har.	20	29	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
LaHave	21	30	81	220	58	Closed	42	0	0	0	Closed	Closed	565	1131	377	Closed	7	24	33	17	Closed	3
Mersey	21	31	-	-	-	-	-	-	-	-	-	-	0	5	1	3	4	0	0	0	0	0
Jordan	21	32	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-
Clyde	21	33	-	-	-	-	-	-	-	-	-	-	35	37	19	3	7	1	1	-	-	-
Stewiacke	22	34	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Gaspereau	22	35	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Big Salmon	23	36	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
Saint John at / abv Mactaquac	23	37	50	675	361	Closed	154	25	285	265	Closed	76	Closed	50	24	Closed	Closed	Closed	25	15	Closed	Closed
Nashwaak	23	38	Closed	-	-	Closed	Closed	Closed	-	-	Closed	Closed	Closed	14	5	Closed	Closed	Closed	5	3	Closed	Closed
Magaguadavic	23	39	Closed	0	0	Closed	Closed	Closed	0	0	Closed	Closed	Closed	<1	<1	Closed	Closed	Closed	1	<1	Closed	Closed
St. Croix	23	40	Closed	0	0	Closed	Closed	Closed	0	0	Closed	Closed	Closed	<1	<1	Closed	Closed	Closed	<1	<1	Closed	Closed

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

[2] Significant removals of "black" salmon in the winters of 1997-'98, and 1998-'99.

Table 2. Summary of stock status of Atlantic salmon in the Maritime Provinces.

River	SFA	Method	Map Index	Returns in 1999 Small	Returns in 1999 Large	% hatchery origin	Conservation met 1999	Conservation met 1984 - 1999	Qualitative estimate of abundance: Juveniles	Adults: Wild	Adults: Hatchery	Status in 1999 rel. to 1998	Status in 1999 1984 to 1998	Potential Constraints to Production
Restigouche System	15	Ang	1&2	10500	7100	< 1%	No	9 of 16 ⇔		⇔		🡻	🡻	
Matapédia	15	Vi	1	1600	2600	0%	Yes	5 of 16 ⇧		⇧		⇔	⇧	
RestigoucheNB	15	Ang	2	6000	4500	< 1%	No	9 of 16 ⇔	Med ⇧	Med ⇔		🡻	⇔	
Jacquet	15	Fe	3	-	-	0%	-	2 of 5 🡻		🡻				
Nepisiguit	15	RC	4		1600	?	Yes	9 of 13 ⇔	Med ⇧	Med	Low 🡻	⇔	⇔	
Tabusintac	16	MR	5	817	900	0%	Yes	5 of 5				⇧		
Miramichi	16	MR	6&7	23000	13600	< 2%	No	11 of 16 ⇔	High ⇔	Med 🡻	Low ⇔	⇔	🡻	
NW Miramichi	16	MR	6	11600	6700	< 2%	Yes	7 of 8 ⇔	High ⇧	Med 🡻	Low ⇔	⇧	🡻	
SW Miramichi	16	MR	7	11200	6800	< 1%	No	5 of 8 🡻	High ⇔	Med.🡻	Low ⇔	🡻	🡻	
Buctouche	16	CR	8	115	244	< 1%	Yes	1 of 7 ⇔	Low	Low		⇧	⇔	
Morell	17		9			83%		8 of 15	Low ⇔					LU
River Philip	18	ViM	10	326	538	0%	141%	6 of 8 ⇔	Med ⇔	High ⇔		⇔	⇔	
Wallace River	18	CR	11	47	179	0%	75%	1 of 5 ⇔	Med ⇔	Med ⇔		⇧		
Waugh	18	CR	13	43	48	0%	41%	1 of 5 ⇔				🡻		
River John	18	CR	14	47	107	0%	70%	2 of 5 ⇔	Med ⇔			⇧		
West (Pictou)	18	CR	15	178	201	0%	157%	4 of 5 ⇔		High ⇔		⇧		
East (Pictou)	18	CR	16	135	425	0%	138%	5 of 8 ⇔	Med ⇔	High ⇔		⇧	⇔	
Sutherlands	18	Vi	17	25	28	0%	104%	5 of 5 ⇔		High ⇔		⇔	⇔	
West (Ant.)	18	CR	20	398	410	0%	113%	4 of 8 ⇔	High ⇧	High ⇔		⇧	⇔	

Assessment methods: Ang = angling catches and assumed exploitation rates; CR = catch rate index; Fe = counting fence; Fw = fishway; MR = mark and recapture experiment; RC = redd count; 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 (Low, Med & High = qualitative)

Potential constraints to production: Ac = acid impacted rivers; Aq = aquaculutre escapees; 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.

River	SFA	Method	Map Index	Returns in 1999 Small	Returns in 1999 Large	% hatchery origin	Conservation met 1999	Conservation met 1984 - 1999	Qualitative estimate of abundance Juveniles	Adults Wild	Adults Hatchery	Status in 1999 rel. to 1998	Status in 1999 1984 to 1998	Potential Constraints to Production
Margaree	18	Ang	22	820	2060	5 to 10%	Yes	15 of 15	High ⇔	High ⇔	Low ⇔	🡻	🡻	
Middle	19	ViM	23	90	360	0%	No	2 of 11	High ⇔	Low ⇔		⇧	🡻	
Baddeck	19	-	24	-	-	0%	Unlikely	0 of 6	High ⇔	Low⇔				
North	19	Ang	25	58	120	0%	Likely	14 of 15	Med ⇔	Low 🡻		🡻	🡻	
Grand	19	Fw	26	105	5	34%	No	7 of 12	Low ⇔	Low 🡻	Med 🡻	🡻	🡻	Fp,
St. Mary's	20	MR	27	474	235	0%	No	9 of 16🡻	Med ⇔	Low 🡻	Low 🡻	🡻	🡻	
Liscomb	20	Fw	28	24	1	64%	No		Low ⇔	Low 🡻	Low 🡻	⇧	🡻	Ac, Fp
LaHave	21	Fw	30	931	269	31 %	55%	10 of 16 🡻	Med ⇧	Med 🡻	Low ⇔	🡻	🡻	Ac, Fp
Mersey	21		31			~100%								Ac, Fp
Jordan	21		32			~100%								Ac
Clyde	21		33			~100%								Ac
Stewiacke	22	Electro	34	?	?	?	No	0 of 11	Low 🡻	Low 🡻	Low 🡻	🡻	🡻	
Gaspereau	22	Fw	35	74	21	31%	15%	?	?	Low?	Low?	🡻	?	WU, Fp,Aq
Big Salmon	23	Sh+Vi	36	?	?	?	No		Low?	Low?		🡻	🡻	
Saint John at / abv. Mactaquac	23	Fw	37	3257	1804	74%	No	2 of 16 🡻	Low ⇔	Low 🡻	High ⇧	⇧	🡻	Fp, LU, WU
Nashwaak	23	Fe/MR	38	665	275	< 1%	No	0 of 7 ⇔	Low 🡻	Low ⇔	Low ⇔	🡻	🡻	LU, WU
Magaguadavic	23	Fw	39	19	5	0%	No	3 of 11 🡻		Low 🡻		🡻	🡻	Fp, AQ, WU
St. Croix	23	Fw	40	8	5	31%	No	0 of 15 🡻		Low 🡻	Low ⇔	🡻	🡻	Fp, AQ, WU

Assessment methods: Ang = angling catches and assumed exploitation rates; CR = catch rate index; Electro. = Index of abundance, juveniles and adults.
Fe = counting fence; Fw = fishway; MR = mark and recapture experiment
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 (Low, Med & High = qualitative)

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