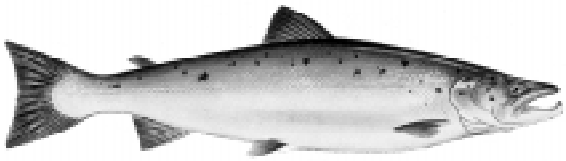


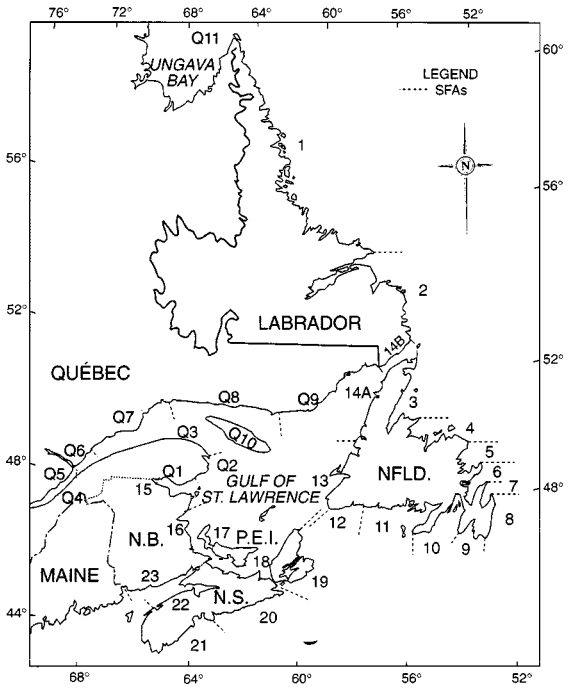
Atlantic Salmon Eastern Canada Overview for 1997

Background

There are approximately 550 Atlantic salmon rivers in eastern Canada. Each river is assumed to consist of at least one stock with the larger rivers containing several stocks. There is a diverse life history structure including variations in 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 are predominantly maiden fish (never spawned before) which have spent one year at sea before returning to spawn (one-sea-winter salmon). The large salmon component contains a mixture of maiden fish which have spent two and occasionally three years at sea before spawning and previous spawners which are returning for a second or subsequent spawning. The majority of the large salmon spawners are female whereas small salmon spawners comprise varying proportions of male and female fish depending upon the geographic area. The relative proportions of the size groups in the returns also vary geographically.

Conservation for Atlantic salmon is considered to be a threshold reference point. Conservation requirements for Atlantic salmon define the level of egg deposition below which the consequences are likely to be deleterious. The conservation requirements are established for most individual rivers based on 2.4 eggs per m^2 of river habitat with an additional egg requirement for the lacustrine habitat in Newfoundland and Labrador. 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.

Assessments are prepared for a limited number of specific rivers, mostly on the basis of the size of the Atlantic salmon resource within the river, the demands by user groups, and as a result of requests for biological advice from fisheries management.



The Fishery

DFO directly manages the salmon fisheries in 23 Salmon Fishing Areas (SFA); for Québec, the management is delegated to the Ministère de l'Environnement et de la Faune and the fishing areas are designated by Q1 through Q11. Harvest (fish which are killed and retained) and catches (including fish caught and released in recreational fisheries) are categorized in two size groups: small and large. Small salmon in the recreational fisheries refer to salmon less than 63 cm fork length, whereas in commercial fisheries, it refers to salmon less than approximately 2.7 kg whole weight. Large salmon in recreational fisheries are greater than or equal to 63 cm fork length and in commercial fisheries refer to salmon greater than or equal to about 2.7 kg whole weight.

Three user groups exploited salmon in Canada in 1997: Native peoples, commercial fishers, and recreational fishers.

The following management measures were in effect in 1997.

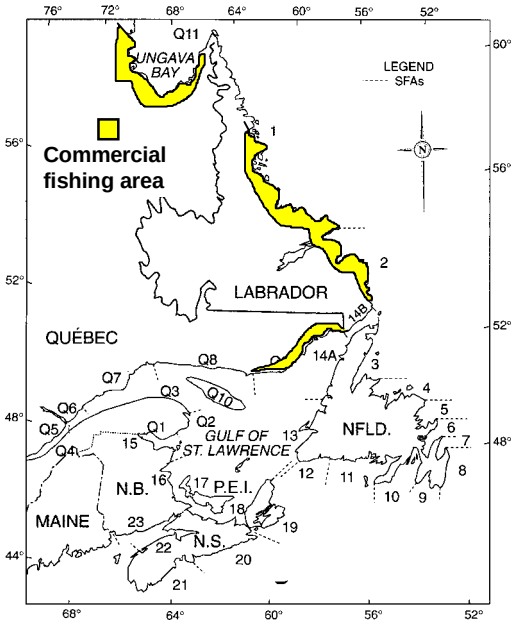
Native peoples' fisheries: Most Native peoples' food fisheries took place subject to agreements or through permits issued to the bands. The permits generally describe gear and fishing effort and catch limits. Harvests which occurred both within and outside agreements were obtained directly from the Native peoples. Harvest by Native peoples with recreational or commercial licenses are reported under the recreational and commercial harvest categories.

Commercial fisheries: The five-year moratorium which was placed on the commercial fishery in insular Newfoundland in 1992 was extended in 1997. In Labrador, commercial fishing quotas assigned by SFA were reduced further from 1996. The commercial fishery in SFA 14B was closed in 1997, which reduced the number of licensed fishers in Labrador from 218 to 205.

	Labrador (SFA 1,2, 14B)		Québec (Q7 to Q9)	
	Licensed effort	Quota (t)	Licensed effort	Quota (number)
1990	570	340	165	29,605
1991	570	295	152	28,359
1992	495	273	147	23,400
1993	288	178	94	15,325
1994	218	92	90	15,175
1995	218	73.5	90	15,175
1996	218	55	87	12,068
1997	205	50	87	12,068

In SFAs 1 and 2, the commercial fishery opened June 20, similar to 1996. In 1995, the fishery opening had been delayed to July 3. Previously, the Labrador commercial fishery opened on June 5. The season was to close on October 15 or when the quota was caught.

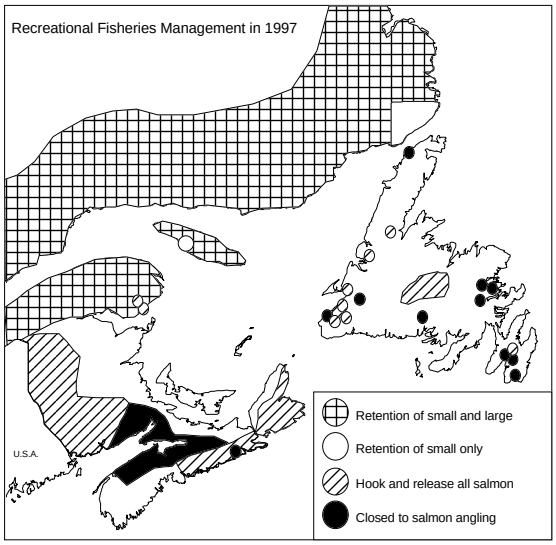
Commercial fisheries in Québec in 1997 occurred in Zone Q9 (July 1 to August 23) and in Ungava Bay (Zone Q11 by Native peoples). The quota for Q9 in 1997 was similar to 1996 and reduced by 20% from 1995.



Recreational fisheries: Recreational fisheries management in 1997 consisted of four main strategies: 1) retention fisheries for small and large salmon, 2) retention fisheries for small salmon with mandatory catch-and-release for large salmon, 3) catch-and-release of all salmon regardless of size reflecting reduced stock levels, and 4) complete closure reflecting depressed stock levels.

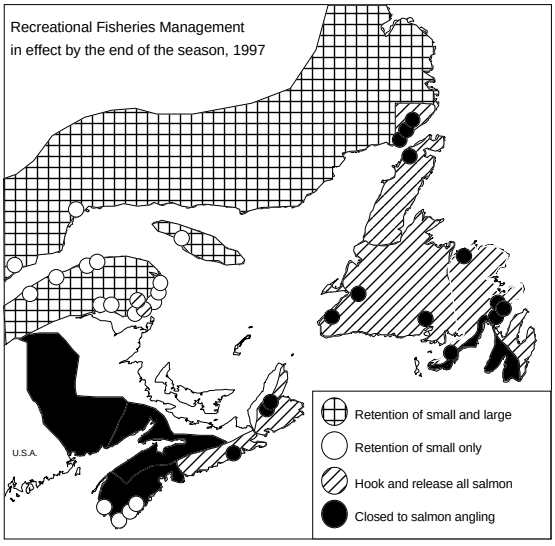
Except in Québec and SFAs 1 and 2 (Labrador), only small salmon could be killed and retained in the recreational fisheries. Within Québec, many rivers or sections of rivers had retention fisheries for small salmon only for a part of the season or when the individual river quotas for large salmon were attained. A new permit allowing catch-and-

release only (no retention of salmon of any size) was introduced in Québec in 1997.



The seasonal bag limits in the recreational fishery remained at eight small salmon in New Brunswick (SFA 15, 16) and in SFA 18 of Nova Scotia. In Nova Scotia SFA 21, the daily limit was set at one small salmon retained. In SFA 17 (PEI), the season and daily bag limits were 7 and 1 respectively. Catch-and-release fishing for all sizes of Atlantic salmon was in effect in SFAs 19 and 20 of Nova Scotia and SFA 23 of New Brunswick. SFA 22 was closed to salmon angling. For insular Newfoundland (SFA 3 to 14A) the seasonal bag limit was similar to the 1994 to 1996 period: six fish of which three small salmon could be retained prior to July 31 and three small salmon after that date. After the bag limit of three was reached in each time period, catch-and-release fishing only was permitted. In some rivers of insular Newfoundland, river-specific quotas were in effect. For southern Labrador (SFA 14B), the management plan was similar to insular Newfoundland. In the northern SFAs of Labrador (SFA 1, 2), there was no seasonal division of the bag limit but the season limit of six fish could contain no more than one large salmon, as in 1995 and 1996, with a daily limit of two fish. In Québec, season and bag limits varied by zone: for Q1 to Q8 and Q10, the season limit was 7 fish of any size. For rivers in zone Q9 and Q11, the season limit was 10 fish with daily limits of two fish in Q8, three fish in Q9 and four fish in Q11. In most rivers of zones Q1 to Q7 and Q10, fishing for the day would end if the first fish kept was a large salmon. If the first fish kept was a small salmon, then fishing could continue until a second fish was caught, regardless of the size of the second fish.

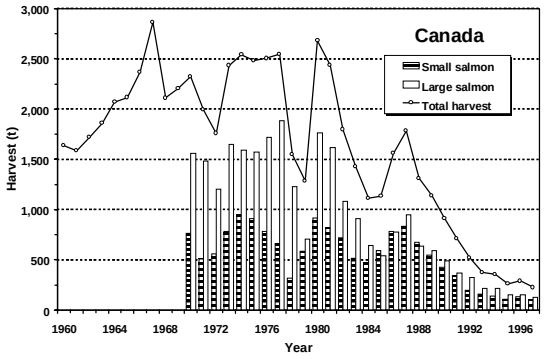
Throughout eastern Canada in 1997, retention of salmon regardless of size and in some cases, complete closure, was imposed following river-specific inseason reviews of returns. In insular Newfoundland (SFAs 3 to 14B), retention angling seasons were shortened as a result of low returns and complete closures of fisheries occurred on many rivers due to low water conditions and warm water temperatures.



The **provisional harvest** of salmon in 1997 by all users was 225 t, a decrease of 22% by weight from the 1996 harvest of 290 t.

The 1997 harvest represented about 57,143 small salmon and 26,530 large salmon, a decrease from the 1996 harvests of 30% and

16% for small salmon and large salmon, respectively. The dramatic decline in harvested tonnage since 1988 is large part the result of the large reductions in commercial fisheries effort and, since 1992, the closure of the insular Newfoundland commercial fishery and reductions in Québec. These reductions were introduced as a result of declining abundance of salmon.



The 1997 harvest of small and large salmon, by number, was divided among the three user groups in different proportions depending on the province and the size group exploited.

	% of Provincial Harvest			% of eastern	Number
	Native peoples'	Recreational	Commercial	Canada	of fish
Small salmon					
Newfoundland / Labrador	1.7	64.4	34.0	53.6	30,651
Québec	1.5	58.9	39.7	15.6	8,902
New Brunswick	10.8	89.2	0.0	28.0	15,997
P.E.I.	0.3	99.7	0.0	0.7	375
Nova Scotia	13.3	86.7	0.0	2.1	1,218
Large salmon					
Newfoundland / Labrador	0.0	3.1	96.9	24.5	6,488
Québec	26.9	34.8	38.3	70.9	18.798
New Brunswick	100.0	0.0	0.0	3.9	1,028
P.E.I.	0.0	0.0	0.0	0.0	0
Nova Scotia	100.0	0.0	0.0	0.8	216

Eastern Canada	% by user group			
Small salmon	4.4	71.2	24.4	57,143
Large salmon	23.7	25.4	50.9	26,530

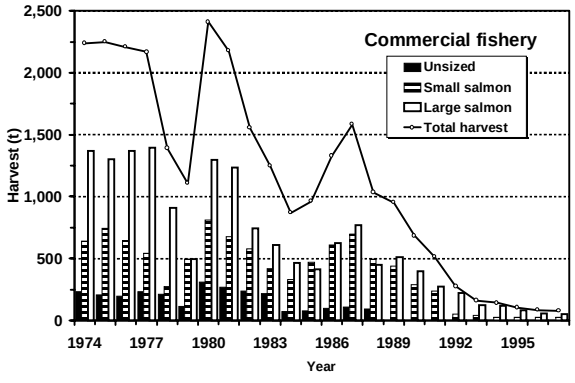
Newfoundland reported the largest proportion of the total harvest of small salmon and Québec reported the greatest share of the large salmon harvest. Recreational fisheries exploited the greatest number of small salmon in all the provinces and overall in Canada (71.2%). Commercial fishers took the largest share of large salmon (50.9% by number).

Native peoples' harvested 4.4% (by number) of the total small salmon and 23.71% of the total large salmon in eastern Canada. In many cases, **Native peoples' food fisheries** harvests in 1997 were less than the allocations. Harvests in 1997 (by weight) were down 14% from 1996 but 3% above the previous 5-year average harvest. The proportion of the harvest composed of large salmon increased to 90% by weight, 71% by number in 1997.

Native peoples' fisheries

		% large	
Year	Harvest (t)	by weight	by number
1990	31.9	78%	
1991	29.1	87%	
1992	34.2	83%	
1993	42.6	83%	
1994	41.7	83%	58%
1995	32.8	82%	56%
1996	47.9	87%	65%
1997	41.0	90%	71%

The **commercial harvest** in 1997 declined to 78.5 t from a peak of more than 2,400 t in 1980.



Commercial harvest in Labrador and Québec was the lowest ever. The harvest and the percent large salmon by number continued to decline in 1997, as a result of license retirements and reduced quotas.

Commercial fisheries harvests

	Weight (t)	Number	% large (by number)
Labrador (SFA 1,2, and 14B)			
1992	204	56,590	57%
1993	112	34,170	50%
1994	93	24,017	64%
1995	55	19,156	59%
1996	48	15,121	48%
1997	47	16,696	38%
Québec (Q7 to Q9)			
1992	63	19,363	80%
1993	46	14,657	75%
1994	43	13,800	72%
1995	42	13,653	71%
1996	32	11,718	61%
1997	30	10,437	66%

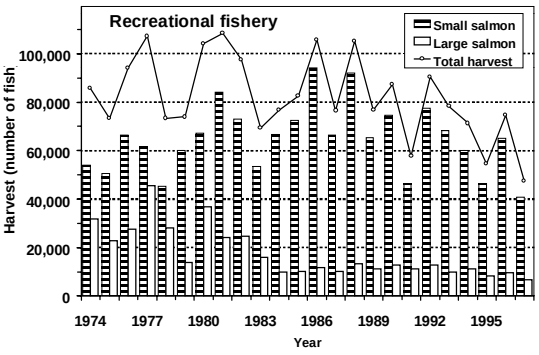
The commercial fishery in Zone Q11 (Ungava Bay) has harvested between one and three tons of salmon since 1990, representing between 212 and 485 fish, sizes combined. The commercial harvest in 1997 was estimated at 1.7 t, 296 small and large salmon combined.

The **Greenland fishery** took an estimated 92 t in 1996 of which 42% was estimated to have been of North American origin (12,900 fish). These fish would have returned to North America in 1997. Of these, 12,357 fish (96%) were 1SW salmon.

The small marine commercial and recreational net fisheries **in St. Pierre and Miquelon (France)** recorded preliminary landings of 1.5 t for 1997, the same as reported for 1996. The majority if not all of

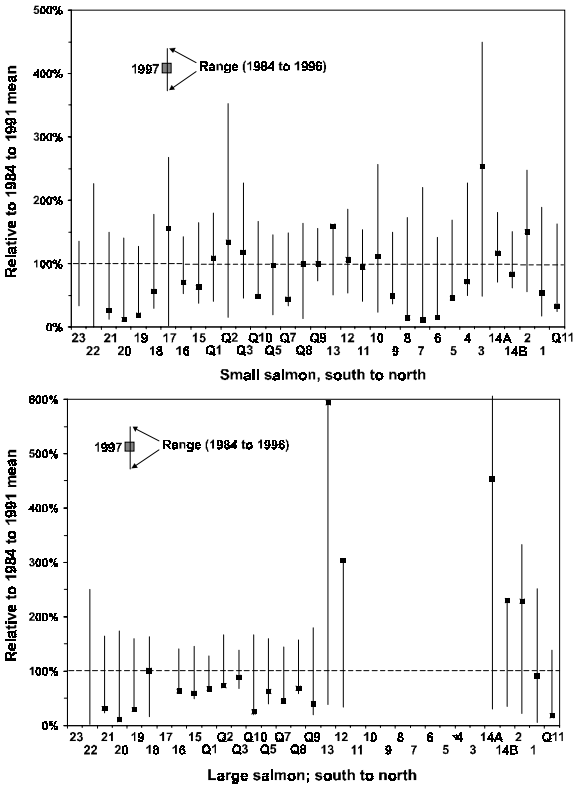
the harvested salmon are expected to be of Canadian origin.

Harvest in **recreational fisheries** in 1997 totalled 47,419 small and large salmon, 33% below the previous five-year average and 36% below the 1996 harvest level.



The harvest of 40,673 small salmon was a decrease of 32% from the previous five-year mean. The harvest of 6,746 large salmon was a 37% decline from the previous five-year mean. Harvests of small salmon were down 38% and harvests of large salmon were down 21% from 1996. Small salmon have contributed 86% on average of the total harvests since the imposition of catch-and-release for large salmon in the recreational fisheries in SFAs 3 to 14A and 15 to 23 in 1984.

Recreational catches (including retained and released fish) of small salmon in 1997 were similar or above the 1984 to 1991 mean in most fishing areas of Québec, and SFAs 3, 13 and 14A. Catches of small salmon were among the lowest observed in the majority of the Maritimes and in the northeast and south coasts of Newfoundland (SFAs 3 to 12). Catches of large salmon were well below the average throughout most of eastern Canada with the exception of the rivers of SFA 18 in Nova Scotia and SFAs 12, 13, 14, and 2 in Newfoundland and Labrador. Catches in SFA 17 (PEI) were above average but more than 90% of the returns originate from smolt stocking programs.



Changes in the management of the recreational fisheries since 1984 have compromised the use of angling catches as indices of abundance. Therefore, the interpretation of trends in abundance relies mostly on rivers where returns have been estimated or completely enumerated. Caught-and-released fish are not considered equivalent to retained fish and their inclusion in catch statistics further compromises the reliability of interpretation of trends. In addition, numerous areas in the Maritimes Region in 1997 were closed to all retention of salmon, regardless of size.

Unreported removals are defined as harvests which are caught and retained, but

do not enter into the reported harvest statistics; such harvests could be both legal and illegal, but would not include catch-and-release mortalities whether they arise from nets or angling gear. Such estimates would not include fish retained by public or private agencies for broodstock purposes.

These removals are difficult to quantify. To develop such estimates, regional fisheries officials were asked to provide their best estimates, based on enforcement knowledge, of the magnitude of the unreported harvest in their areas. Because of the reduced commercial fishery landings, the unreported removals now make up a large proportion of the reported harvest although the magnitude of the unreported removals has decreased. In spite of the salmon and cod commercial fishing moratoria, salmon are still encountering fishing gear throughout the Newfoundland coastal areas, based on the incidence of net-marked salmon observed at counting facilities. These fish are the survivors of encounters with fishing gear and depending upon the retention rate and the short-term mortality rate from such encounters, this could infer a substantial loss of fish if either or both of these rates are high. Salmon could be encountering fishing gear which has been legally set for other species, such as herring, capelin, and mackerel throughout eastern Canada.

Reported and unreported removals for eastern Canada

Year	Unreported removals (t)	Reported harvest (t)	Unreported as % of reported
1986	315	1559	20
1986	315	1559	20
1987	234	1784	13
1988	161	1311	12
1989	174	1139	15
1990	111	911	12
1991	127	711	18
1992	136	522	26
1993	161	373	43
1994	105	355	30
1995	98	260	38
1996	156	290	54
1997	89	225	40

Commercial **aquaculture of Atlantic salmon** first occurred in 1980 in the Bay of Fundy with the reported production of 11 t. Commercial operations in the Bay of Fundy account for over 90% of the total eastern Canadian production.

Atlantic salmon commercial aquaculture production (t) in eastern Canada

Year	Eastern Canada	Québec[1] Q1	NB SFA 23	NS SFA 19-21	NFLD SFA 11
1988	3,315	5	3,273	27	10
1989	4,760	10	4,500	250	0
1990	7,810	10	7,500	300	0
1991	9,395	50	9,000	320	31
1992	10,380	30	10,000	300	75
1993	11,115	20	10,145	850	100
1994	12,441	15	11,836	544	46
1995	12,805	30	12,000	630	145
1996	17,715	0	16,380	1,125	210
1997[2]	20,198	0	18,585	1,125	488

[1] All land-based facilities, [2] 1997 values are preliminary

Other salmonid species cultured commercially in eastern Canada include Arctic charr and rainbow (steelhead) trout. The Arctic charr production occurs in Newfoundland, all in shore-based facilities. Rainbow trout are cultured in the Bay of Fundy (all land-based), Bras d'Or Lakes (SFA 19), and in Bay d'Espoir (SFA 11). In 1997, production of rainbow trout was 386 t from Nova Scotia (similar to 1996) and 1,556 t from Newfoundland (compared with 1,101 t in 1996). Escapees of Atlantic salmon, Arctic charr and steelhead trout have been recorded in many rivers in proximity to these production facilities.

Resource Status

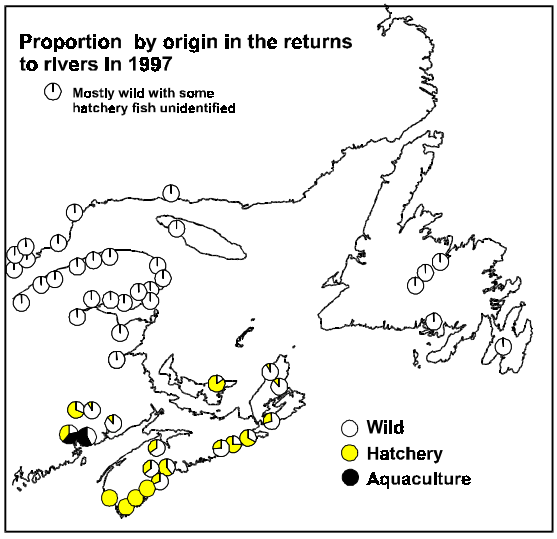
The returns represent the size of the population before any in-river removals. Spawning escapement is determined by subtracting all the known removals, including food fisheries, recreational harvests, an allowance for hook-and-release mortality, broodstock collections, and scientific samples from the total returns.

A total of 108 rivers were assessed in eastern Canada in 1997. Estimates of total returns of small and large salmon were obtained using various techniques: 48 were derived from counts at fishways and counting fences; 7 were obtained using mark and recapture experiments; 39 using visual counts by snorkeling or from shore; 1 from an acoustic system; and 13 from angling catches or catch rate indices.

Origin of returns

Salmon returning to rivers of eastern Canada were either of wild origin, hatchery origin, or aquaculture escapees. Fish designated as being of wild origin are defined as the progeny of fish where mate selection occurred naturally (eggs not stripped and fertilized artificially) and whose life cycle is completed in the natural environment. Hatchery origin fish, designated as fish introduced into the rivers regardless of life stage, were identified on the basis of a clipped adipose fin, from fin deformations, and/or from scale characteristics. Stocking of early life stages often precludes their later identification as hatchery origin fish. Aquaculture escapees were identified from hatchery fish on the basis of fin erosion (especially of the tail) and from scale characteristics.

The returns to the majority of the rivers in Newfoundland and to most rivers of the Gulf of St. Lawrence and Québec were comprised exclusively of wild salmon. Hatchery origin salmon made up varying proportions of the total returns and were most abundant in the rivers of the Bay of Fundy and the Atlantic coast of Nova Scotia.



Rainbow trout and Atlantic salmon smolt escapees from the Bay d'Espoir aquaculture industry, were observed at Conne River (SFA 11) in 1997. Aquaculture escapees were sampled from the returns to two rivers

of the Bay of Fundy (St. Croix, Magaguadavic). No aquaculture escapees were identified in the returns to the Saint John River and its tributaries in 1997.

In 1994, escapes of Atlantic salmon in the Bay of Fundy area were estimated at 20,000 to 40,000 salmon, an amount greater than the total returns of wild and hatchery origin salmon (both small and large) (13,000 to 21,000 fish) to the entire Bay of Fundy and Atlantic coast of Nova Scotia (SFA 19 to 23) in the same year. The level of escapes in 1993 was similar to that of 1994. Estimates of escapes for 1995 to 1997 are low.

Aquaculture escaped fish have increased in abundance in the Magaguadavic River (SFA 23) which is in close proximity to the centre of the aquaculture production area. Escaped fish were not observed between 1983 and 1988. Since 1992, escaped fish have comprised between 33% and 90% of the total counts at the fishway.

Magaguadavic River (SFA 23)

Year	1SW	%. Aqua	MSW	% Aqua	Total	% Aqua
1983	303	-	637	-	940	-
1984	249	-	534	-	783	-
1985	169	-	466	-	635	-
1988	291	-	398	-	689	-
1992	238	35%	201	31%	439	33%
1993	208	46%	177	29%	385	38%
1994	1064	94%	228	73%	1292	90%
1995	540	90%	198	85%	738	89%
1996	195	89%	68	29%	263	74%
1997	94	63%	47	49%	141	33%

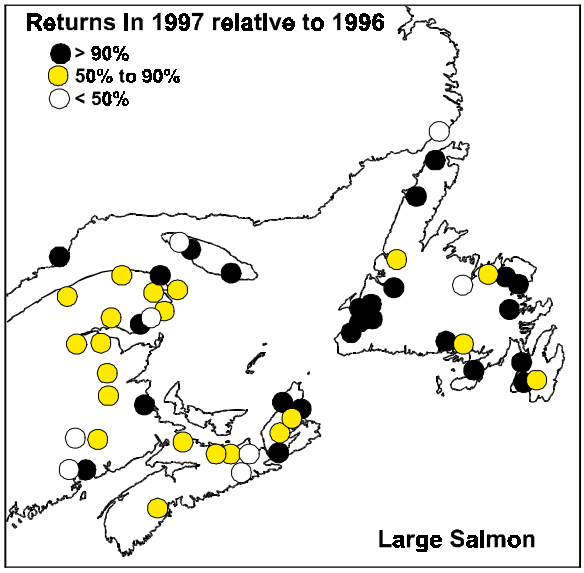
Aquaculture escapees comprised 54%, 22%, 13%, and 39% of the total run of salmon to the St. Croix River during 1994 to 1997, respectively.

Returns and Escapements in 1997

Of the 108 stocks for which returns of salmon were determined in 1997, comparable data were collected on 83 of these in 1996. Returns were estimated for small salmon and large salmon size groups seperately on 54 rivers in both years.

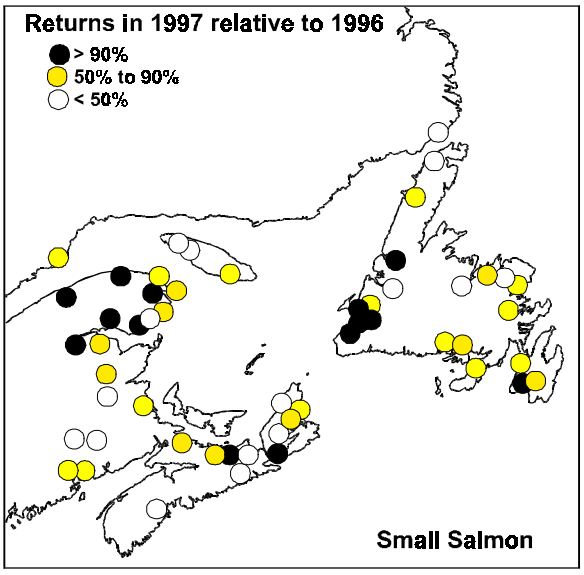
For both size groups combined, returns in 1997 were less than 50% of the 1996 returns in 19 of the 83 rivers assessed (23%), between 50% and 90% of 1996 returns in 49% of the rivers and were 90% or greater than 1996 returns in 28% of the rivers.

Returns of large salmon in 1997 decreased from 1996 in rivers throughout the Maritime provinces and Québec but were similar or improved in Newfoundland. In most of the rivers of Newfoundland, except for rivers of the southwest coast (SFA 13), large salmon are mostly repeat spawning 1SW fish.

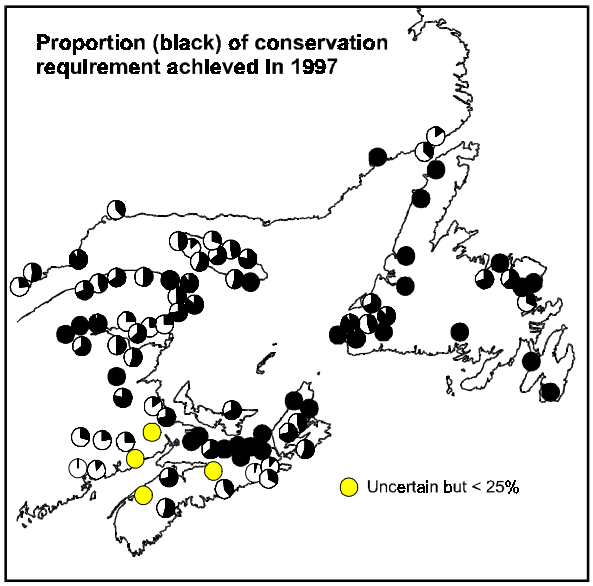


Returns of small salmon in 1997 relative to 1996 were lower throughout eastern Canada. In 30% of the rivers, the returns of small salmon in 1997 were less than 50% of the

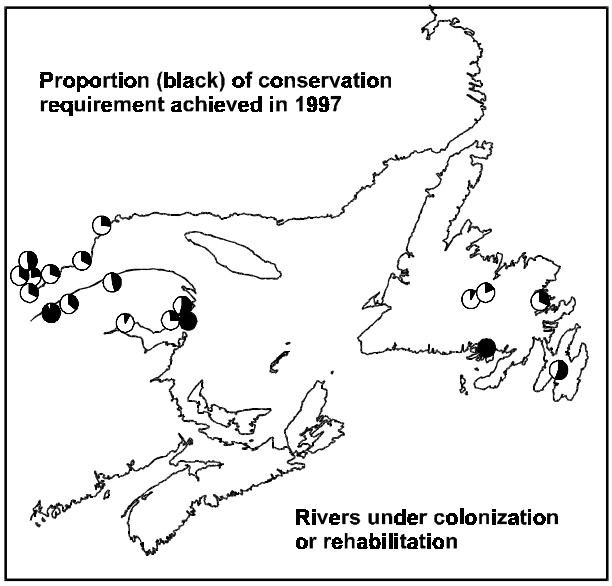
1996 returns. Returns were similar to or improved in only 26% of the assessed rivers. The southwest coast of Newfoundland rivers (SFA 13) showed the most consistent improvement in returns.



Egg depositions exceeded or equalled the river specific conservation requirements in 26 of the 89 assessed rivers (29%) and were less than 50% of conservation in 30 other rivers (34%). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 14 of the 19 rivers assessed (74%) had egg depositions which were less than 50% of conservation requirements. In Newfoundland and Labrador, 55% of the rivers assessed met or exceeded the conservation egg requirements. Conne River in Newfoundland SFA 11 exceeded its conservation requirement but fell short of the management target for the river.



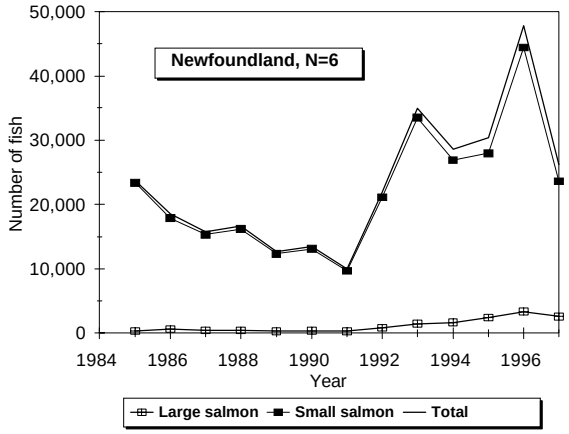
Nineteen rivers in Newfoundland and Québec are under rehabilitation or colonization programs where salmon have gained access in recent years to previously inaccessible habitat or have been enhanced to augment the wild production. Two of these rivers met or exceeded the conservation requirements in 1997. Egg depositions in 74% of these rivers were less than 50% of requirements. Only 33% of these rivers had improved egg depositions relative to 1996.



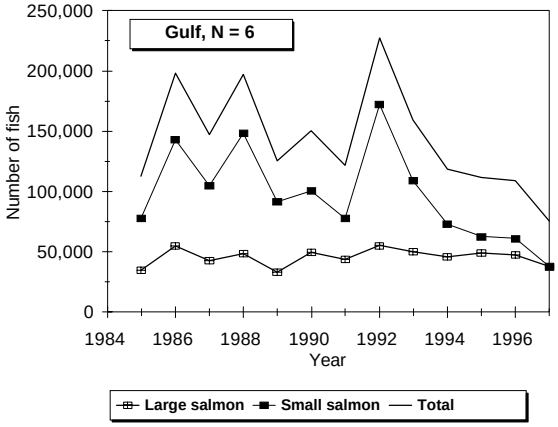
Trends in Returns, Escapement, and Production

Annual returns to the rivers of salmon by size group are available for 25 rivers in eastern Canada since 1985. These returns do not account for commercial fisheries removals in Newfoundland, Labrador, Québec, and Greenland and in some rivers include returns from hatchery stocking. Peak return years differed for regions within eastern Canada. The returns during the Newfoundland commercial fishery moratorium years (1992 to 1997) for all areas except Newfoundland are lower than returns in 1986 to 1988 when there were commercial fisheries in Newfoundland, Labrador and Greenland harvesting mainland Canada origin salmon.

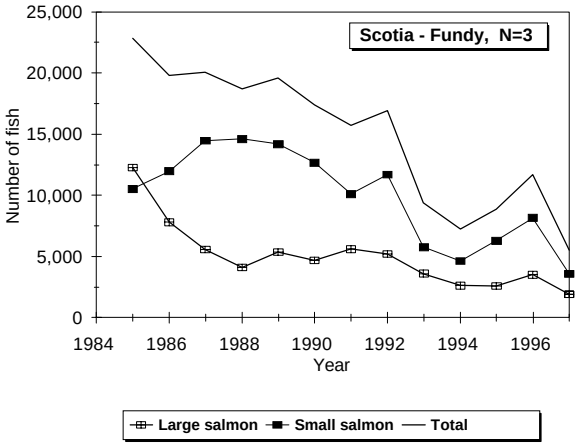
The total returns to six Newfoundland rivers doubled during 1993 to 1996 from the low levels observed during 1989 to 1991. The returns in 1997 were collectively as low as the 1992 returns and just above the returns in the 1980s.



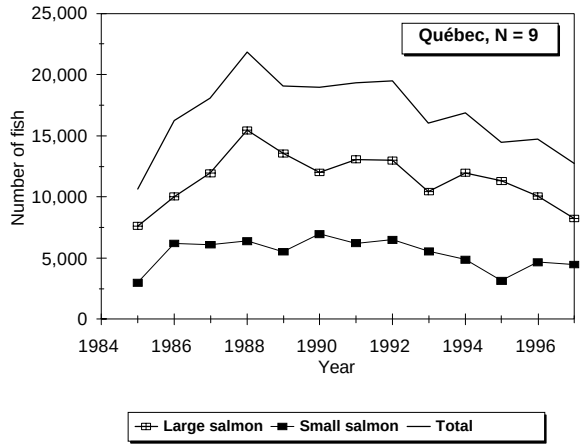
Returns of small salmon to seven Gulf rivers (NB, NS) have fluctuated annually but declined between 1994 and 1997 to the lowest levels since 1985. The returns in 1997 were the lowest of the time series. Returns of large salmon have not fluctuated as greatly as the small salmon returns and have levelled off at about 45,000 fish.

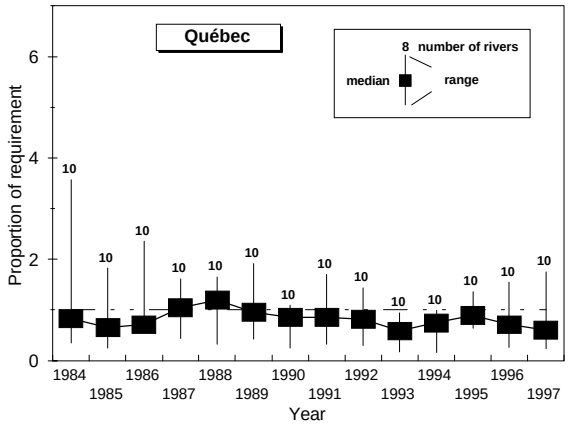


Returns to the rivers of the Atlantic coast of Nova Scotia and Bay of Fundy improved from 1994 to 1996 for both large salmon and small salmon but returns of both size groups remain well below the levels observed in the 1980s.

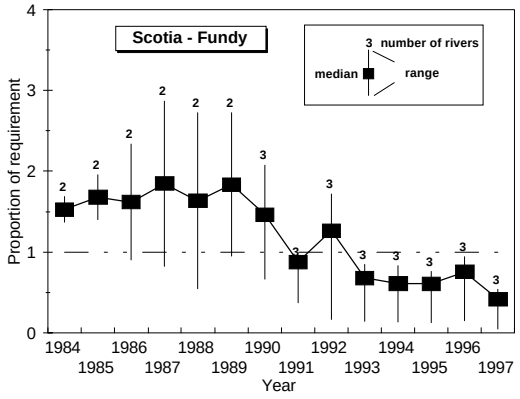


Returns to nine rivers of Québec in 1997 were the second lowest since 1985 with large salmon returns declining from the peak returns of 1988.



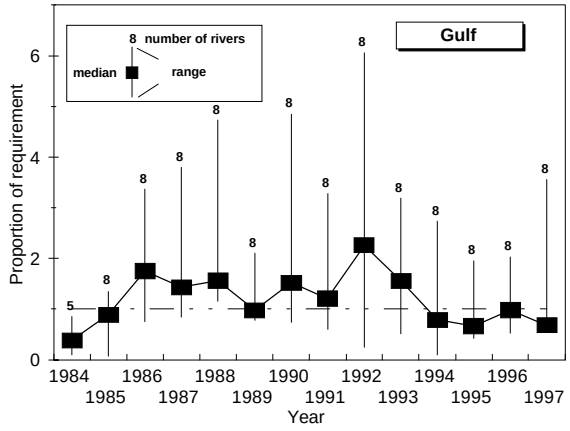


Escapements over time relative to conservation requirements have improved in some areas of eastern Canada but have declined in others. The status of three Bay of Fundy/Atlantic coast of Nova Scotia rivers has severely declined, especially since 1991. The proportion of the conservation requirements achieved were the lowest in all three rivers in 1997.

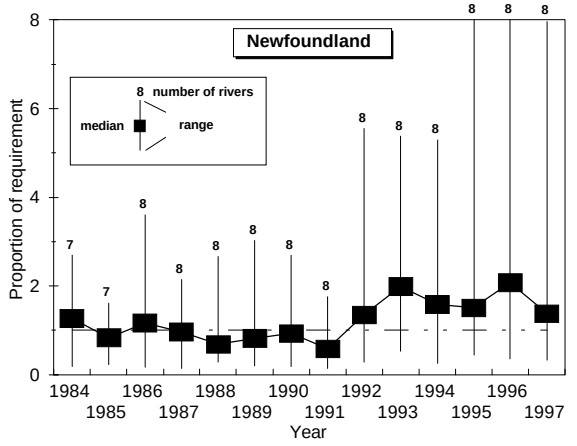


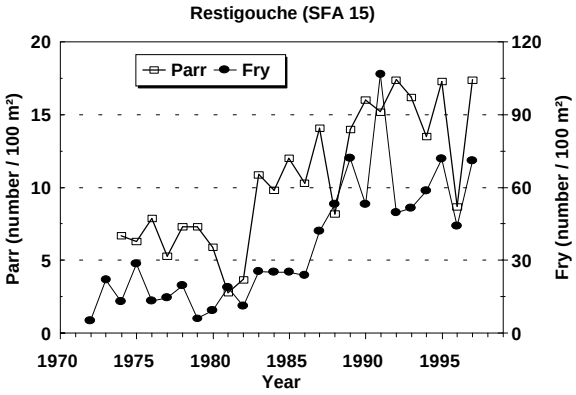
For the Québec rivers, spawning escapements declined continually from a peak median value in 1988 with a slight recovery in 1995. Escapements relative to conservation were among the lowest in the series with a few rivers showing improvements in 1997.

The eight rivers of the southern Gulf have been the most consistent in equalling or exceeding the conservation requirements but the median escapements were below conservation requirements in the last four years with 1997 the lowest since 1984.



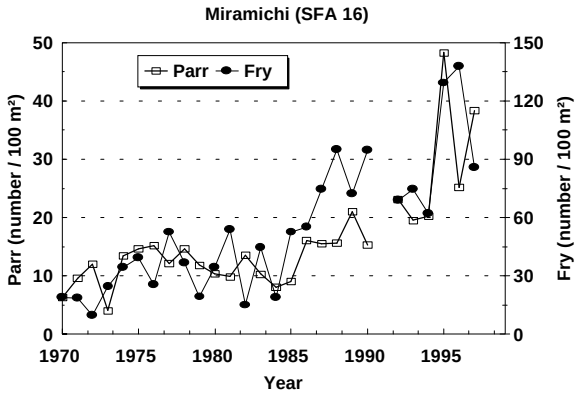
Newfoundland rivers have shown the greatest improvement in the proportion of the spawning requirement achieved as a direct result of the commercial salmon and groundfish moratoria initiated in 1992. There was a decline relative to 1996 but escapements remained above the pre-1992 levels.

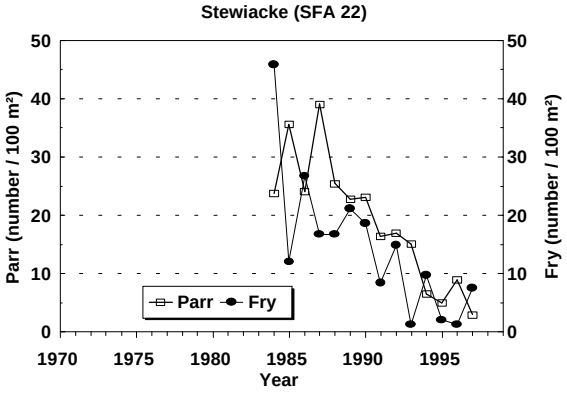




Densities of **juveniles** have been monitored annually since 1971 in the Miramichi (SFA 16) and Restigouche (SFA 15) rivers. In these rivers, juvenile densities of young-of-the-year (fry) and parr (juveniles of one or more years old) increased since 1985 in response to increased spawning escapements. Densities of fry declined in 1997 relative to the last two years but were double the level observed during the previous two decades. Parr densities were improved from 1996 and are at near historical level.

High densities of juveniles have also been reported from Nova Scotia rivers along the Gulf of St. Lawrence (SFA 18) and in several Cape Breton Island streams (SFA 19). This is in contrast to juvenile densities from an inner Bay of Fundy river (Stewiacke River; SFA 22) which have declined since 1984, as a result of reduced spawning escapement. Fry densities in 1997, an index of spawning escapement in 1996, were improved from 1996 but remained well below values observed in the 1980s. Parr densities declined to the lowest in the time series.





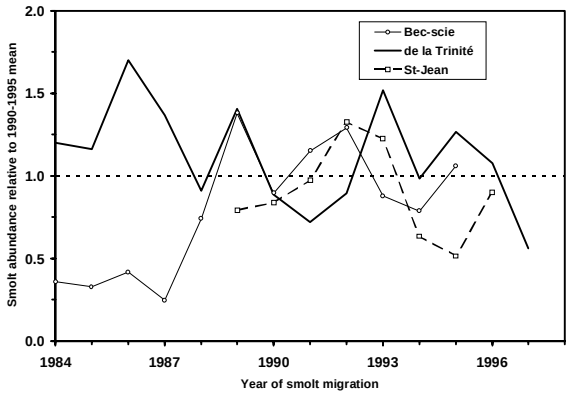
In the Restigouche River, both fry and parr densities improved in 1997 from 1996 and were at or near historical levels.

Counts of **smolts** provide direct measurements of the outputs from the freshwater habitat. There is high variability in the annual smolt output; in tributaries, annual

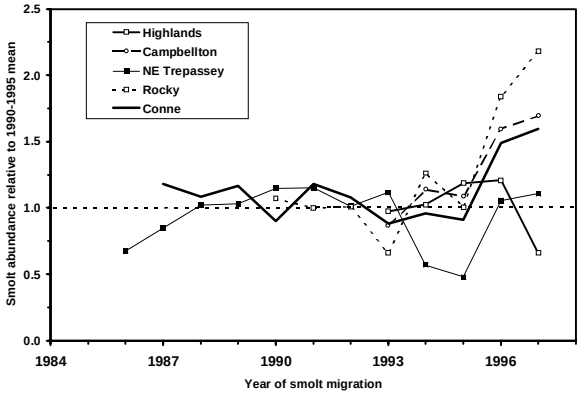
smolt output can vary by five times but in the counts for entire rivers, annual smolt output has generally varied in magnitude by a factor of two.

The number of wild smolts leaving the rivers depends upon the number of eggs deposited adjusted by variable survival rates throughout the juvenile stages. The production among river systems is also not necessarily synchronized and it is not possible to calculate how many smolts in total leave the rivers of Atlantic Canada for any given year.

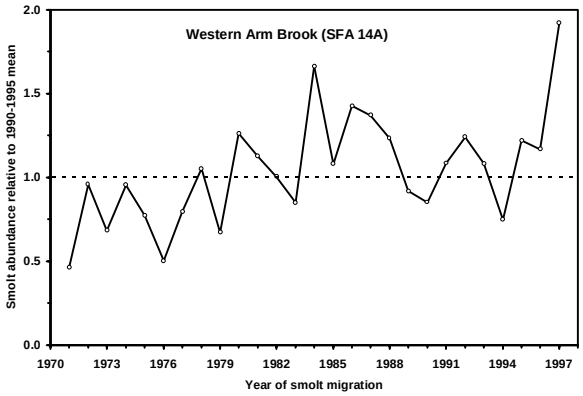
In the Québec rivers, the 1996 smolt production from monitored rivers was similar to the average during 1990 to 1995. A smolt estimate was obtained from only one river in 1997.



In Newfoundland, smolt production increased from 1996 to levels of record in all the rivers of Newfoundland with the exception of the southwest coast river (Highlands) where production was less than half the recent years' values.



The production of smolts from Western Arm Brook (WAB) was the highest of record (1971 to 1997).



Except for the rivers along the eastern and southern shores of Nova Scotia (SFA 20 and 21) which have been impacted by acid precipitation and rivers of the Bay of Fundy (SFA 22 and 23) the freshwater production of the monitored rivers in eastern Canada has increased or remained constant at high levels since 1985.

Counts of smolts and adult salmon returns enable estimates of **marine survival** to be derived. Examination of trends over time provide insight into the impact of changes in management measures or other factors that can influence the production of salmon. Information from 12 rivers in Atlantic Canada with smolt counts and corresponding

adult counts are available; four are hatchery stocks and seven are wild populations. Geographically, populations for which data were available for the 1997 adult returns ranged from the Saint John River (SFA 23 Bay of Fundy) in the south, LaHave River (SFA 21) and Liscomb River (SFA 20) along the Atlantic coast of Nova Scotia, Saint-Jean (Q2) in the Gaspé region, de la Trinité and aux Rochers (Q7) on the Quebec North Shore, and several populations from southern (SFAs 9 and 11), eastern and northern Newfoundland (SFA 4, 14).

In general, survival of hatchery stocks is lower and more variable than that of wild stocks. There was a large decline in the return rates of both hatchery and wild smolts as 1SW salmon in 1997. The decline was generally observed throughout eastern Canada with the exception of the Highlands River population in southwest Newfoundland (SFA 13). The survival of hatchery smolts to 1SW returns in the LaHave and Liscomb rivers was the lowest of record whereas the Saint John hatchery smolt return rate was the fourth lowest in the 23 year time series.

The single hatchery stock from Québec (aux Rochers) had improved survival rates from the previous four years but remained below the 1990 to 1991 return rates.

In 1997, survivals to 1SW salmon were 69% and 39% of the means for the Saint Jean and de la Trinité rivers in Quebec. The survivals of smolts to 2SW salmon were 91% and 41% of the mean. The survival rates declined from the previous year's rates.

Following a brief period of increasing survival of smolts in recent years, return rates to most rivers of Newfoundland exhibited a substantive decline in 1997. Considering that the historical survival rates (prior to 1992) represent survival to the river after commercial fisheries, the recent survival rates and in particular the low rates in 1997 are dismal. Despite major changes to fisheries and corresponding reductions in marine exploitation, marine survival rates are still less than 10% and sea survival of the salmon populations from eastern Canada has not increased in the manner expected.

Environmental Considerations

Rivers along the south and eastern shore of Nova Scotia (SFA 20 and 21) remain vulnerable to acid precipitation. Populations of Atlantic salmon are considered extinct in 14 rivers and remnant populations survive in 19 other rivers as a result of water quality impaired by acidification.

Marine conditions in 1996/97 would have affected the small salmon returning to the rivers in 1997 while conditions in 1995/96 and 1996/97 would have affected the large salmon stocks. Limited surface layer temperature data suggest that the waters in the Labrador Sea, including the Labrador and northern Newfoundland shelves, were generally cold in 1995 but warmer than 1994. Similar cold conditions persisted on the northeastern Scotian Shelf and along the Atlantic coast of Nova Scotia.

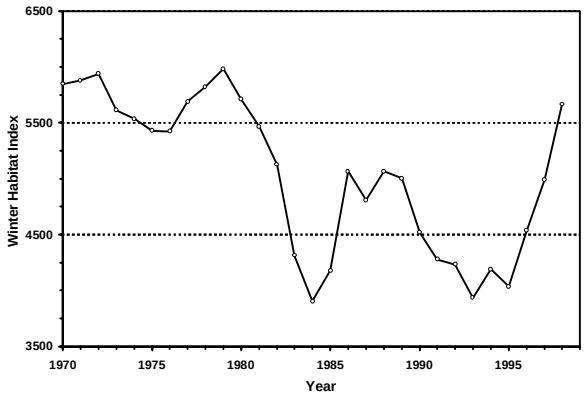
Marine conditions were more temperate in 1996 and 1997 relative to those of the preceding several years (1990 to 1995). Ice coverage in the winter of 1996 was below the median distribution and ice retreat was earlier in the spring of 1996 than in previous

years. Relative to 1996, the air temperatures cooled. Early winter temperatures were warm followed by very cold in the latter half of winter. As a result, ice formed late but spread quickly with ice conditions lasting longer than normal in the Gulf of St. Lawrence and the Scotian Shelf. During spring, air temperature anomalies were generally below normal during 1997. The cooler temperatures observed in 1997 relative to 1996 wre still much warmer than the early 1990s. Much of the offshore North Atlantic and Labrador Sea was warmer than normal for most of the year.

Recent analyses have described a significant correlation between the estimated production of North American 2SW salmon and an index of marine habitat in the northwest Atlantic. It has been used to predict the prefishery abundance at Greenland of non-maturing 1SW salmon destined to return to North America as 2SW spawners in the subsequent year.

Significant correlations between this habitat index and return rates of hatchery smolts to the Saint John River and smolt survival rates to Conne River suggest that colder marine conditions may be having a detrimental effect on the natural survival at1 sea. The habitat index does not correlate with all the Atlantic salmon stocks but appears to be a useful predictor of the potential returns of hatchery smolts to the Saint John River and to rivers of the Atlantic coast of Nova Scotia.

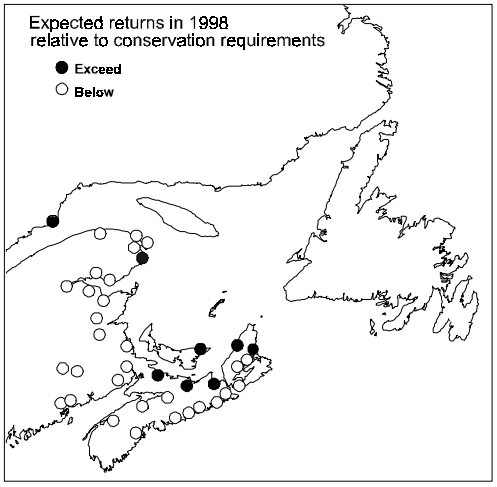
The January to March habitat index has improved through 1996 to 1998 and the 1998 value is as high as the levels of the late 1970s.



Outlook

Short term

Expectations of returns for 1998 are based on a combination of methods: use of the previous 5-year average returns, forecast models based on small salmon returns in the current year to predict large salmon returns in the coming year, stock-and-recruitment relationships, and trends in survival rates of juveniles and smolts from hatchery stocking combined with stocking levels in previous years. The performance of these methods varies. Expectations for 1998 are described in terms of whether the total returns of salmon (small and large) will be below, meet, or exceed the conservation egg requirements for the river.



Returns to the Bay of Fundy and Atlantic coast of Nova Scotia are expected to be deficient in 1998. Returns to Gulf shore of Nova Scotia rivers are expected to equal or exceed the conservation requirements. whereas returns to the rivers of the Gulf shore of New Brunswick are expected to be below the conservation requirements. Returns to rivers of Newfoundland are very uncertain given the lack of an appropriate explanation for the low returns of small salmon in 1997.

Long term

The long term prospects for Atlantic salmon stocks of eastern Canada can be categorized geographically. In the southern Gulf of St. Lawrence, the abundance of wild salmon is at best at medium levels relative to historical or expected values. The juvenile abundance in the rivers are at medium to high levels and generally increasing over time. Juvenile abundance is high in these rivers for two reasons: 1) they have a high proportion of large salmon in the returns (produce large quantities of eggs), 2) a large portion of the run returns late in the season and are not as heavily exploited as are early-run fish. High juvenile abundances have not translated into high adult returns to date. The ocean environment appears to be an important factor in the low at-sea survivals of Atlantic salmon in eastern Canada. The returns to rivers of the mainland Canada have not increased markedly following closure of fisheries in Newfoundland and reduced fisheries in Labrador and Greenland suggesting that these stocks were not being exploited intensively in these fisheries in recent years. When sea survivals improve, the abundance of salmon is expected to increase above current levels.

Most Atlantic salmon stocks of the Atlantic coast of Nova Scotia and the Bay of Fundy are not expected to show any important improvements over the next five years. The abundance of wild adult salmon and juveniles is generally low and declining. Sea survival of the salmon from the inner Bay of Fundy stocks is the most important constraint. Returns of wild adult salmon which will meet the conservation requirements are not anticipated in the near future. The populations of salmon in this area are also impacted by numerous industrial activities: acid rain deposition, fish passage constraints (upstream and downstream), water use practices (regulation of discharge asynchronous with seasonal movements of fish) and escapees from aquaculture facilities.

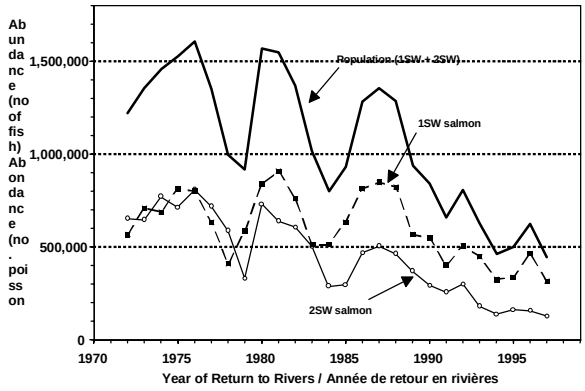
For Newfoundland, the 1997 values although low, are still better than many other years prior to the fishery closure. However, when compared to returns prior to 1992 adjusted for commercial exploitation, 1997 levels were the lowest or among the lowest recorded. Smolt production in insular Newfoundland in 1997 was the highest recorded in four of the six rivers. Positive responses of the commercial salmon fisheries moratorium are being observed in the freshwater environment. The Labrador stock status is poorly known but the best indicators suggest that improved spawning escapements have been achieved in the last three years. Large salmon returns and escapements continue to be below conservation levels and this size group continues to be impacted by the Labrador and Greenland commercial fisheries.

The stocks of the Québec region are generally maintaining themselves although at lower levels than expected. The predominantly large salmon stocks of the Gaspé area and the North Shore continue to be depressed by low marine survival and are

impacted by the local recreational fisheries, Native peoples fisheries, and interceptory fisheries of Greenland and to some extent Labrador. A number of rivers are being rehabilitated and previously inaccessible habitat areas are being modified for fish passage.

While the decline in returns of small salmon in 1997 was dramatic, variations of > 40% from one year to the next are not uncommon. Such fluctuations have occurred on a number of occasions over the past decade. These fluctuations become particularly problematic when the total population size has declined It now stands at its lowest level of recent decades.

The estimated total abundance of North American origin Atlantic salmon (before any exploitation) was calculated from the total returns to rivers of eastern Canada and the US and the harvests in the Canadian and Greenland commercial fisheries. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has oscillated around a generally declining trend since the 1970s, and the abundance recorded in 1993-1997 was the lowest in the time series.



During 1993 to 1997, the total population of 1SW and 2SW Atlantic salmon was about one-half million fish, 45% of the average abundance during 1972 to 1990. The decline has been more severe for the 2SW salmon component than for the small salmon (maturing as 1SW salmon) age group.

Management Considerations

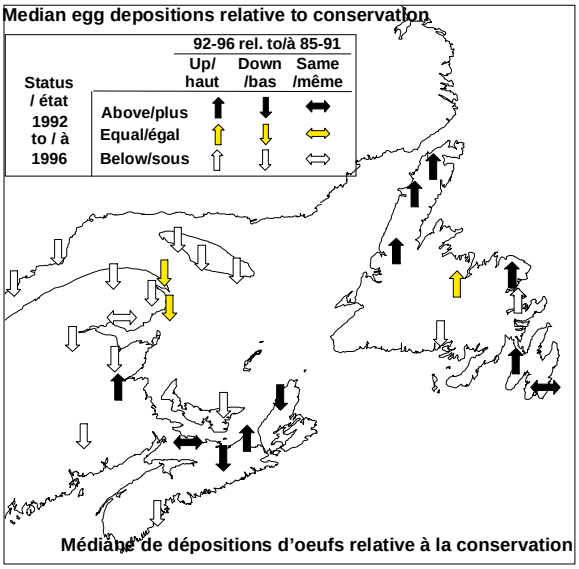
A precautionary management approach is advisable for most of the Atlantic salmon stocks of eastern Canada. The precautionary approach considers the relative uncertainty of the assessment and management practices. Under this approach there should be no increase, and preferably a decrease, in the level of exploitation, thereby minimizing the risk of not achieving the conservation requirement.

The closure of the commercial fisheries in the Maritime Provinces in 1985 and the delayed opening of the Newfoundland and Labrador fisheries resulted in a noticeable increase in returns of small and large salmon to the rivers. The effect of this reduced commercial exploitation and the reduced in-river mortality, as a result of the mandatory catch-and-release in the recreational fishery of large salmon in many areas of eastern Canada, has been increased egg depositions and increased juvenile abundance. In some areas, such as the Bay of Fundy, the increased escapement has not been sustained; returns to these rivers are now lower than they were prior to 1985. Mature aquaculture-origin salmon continue to enter rivers in proximity to production areas. A more thorough assessment of the impact of aquaculture escapees on wild salmon stocks is urgently required in the context of the growing abundance of escapees within rivers and the depressed state of some of the wild stocks.

The commercial fishery moratorium in Newfoundland introduced in 1992 and maintained through 1997 has had the most noticeable impact on the escapement to rivers of Northeast and Northwest coasts of Newfoundland.

Some areas in Newfoundland (SFAs 11 to 13) which showed little or no improvement in escapement to the rivers during the moratorium years have either early run stocks and/or the exploitation on these stocks had already been reduced by the closure of the Port-aux-Basques drift-net fishery in 1971, closure of the SFA 12 fishery in 1984 and the delayed opening of the commercial seasons in 1978 and 1985.

Egg depositions in many rivers of Québec and the Maritimes were higher in the pre-moratoria years (1985 to 1991). The median egg depositions during the moratoria years in Québec rivers are mostly below the conservation requirements and have declined.



Generally, the proportion of large salmon in the returns to the rivers during the moratorium years were higher than in the period 1986 to 1991. While returns of small and large salmon to the rivers showed an overall improvement in the last five years in Newfoundland, higher returns had been observed at several monitoring facilities in years prior to the moratorium. Had the moratorium not been in effect during 1992 to 1997, severe over-exploitation of many Atlantic salmon stocks would have occurred.

Large salmon abundance in Labrador remains low. Consequently, exploitation on Labrador stocks and in particular the large salmon component, which contributes substantially to egg deposition, should be as low as possible.

With few exceptions, for the rivers of the southern Gulf of St. Lawrence, the exploitation rates on the large salmon component are very low. A precautionary management approach is advised for these rivers given the expected low returns of large salmon in 1998.

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References

DFO Sci. Stock Status Rep. Atlantic Salmon Eastern Canada Overview for 1996. D0-01 (1997).

DFO Sci. Stock Status Rep. Atlantic Salmon Abundance Overview for 1997. D0-02 (1998).

Tremblay, S., F. Caron, C. Groleau, et D. Deschamps. 1998. Bilan de l'exploitation du saumon au Québec en 1997. Ministère de l'Environnement et de la Faune, Direction de la faune et des habitats, Service de la faune aquatique. 181 p. (ISBN : 2-550-33078-1)

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