REPORT ON THE STATUS OF ATLANTIC SALMON STOCKS IN EASTERN CANADA IN 1994

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Glossary

Terms and definitions related to salmon biology

Fry: see parr (below).

Large salmon: For recreational fisheries, large salmon refers to any salmon with a fork length greater than or equal to 63 cm. This size group contains mostly MSW maiden salmon as well as previous spawner 1SW and MSW salmon. These fish are frequently referred to as salmon by anglers. In the accounting of the commercial fisheries catches, large salmon are any fish weighing 2.7 kg whole weight and up.

Maiden spawner: can refer to 1SW and MSW salmon if they are returning to the rivers to spawn for the very first time in their life cycle. Other terms used to refer to these fish are virgin 1SW or virgin MSW salmon.

Multi-sea-winter (MSW) salmon: refers to salmon which have spent at least two full years at sea before returning to the river to spawn. In contrast to one-sea-winter salmon which mature after having spent one year in the ocean. MSW salmon take at least two years for maturing. MSW is reserved for describing the age of first maturation.

One-sea-winter (1SW) salmon: refers to salmon which have spent one full year at sea before returning to the river to spawn. Because they pass one winter in the ocean between the spring in which they migrate to sea as smolts and the following spring to fall when they return to the rivers to spawn, they are referred to as one-sea-winter fish. The term refers to the age of first maturation.

Parr: juvenile salmon found in the freshwater environment. Parr less than one year old, having hatched and emerged from the gravel bed in the spring are often referred to as fry.

Previous spawner: refers to 1SW and MSW salmon which have spawned previously, returned to sea after spawning, survived and are returning to the rivers for a second or more spawning. For example, previous 1SW salmon are salmon which originally spawned as 1SW maiden fish but are returning to spawn again. The proportion of previous spawners in the returns to a river varies immensely.

Small salmon: For recreational fisheries, small salmon refers to any salmon with a fork length (straight line from the tip of the snout to the edge of the fork in the tail) less than 63 cm. This size group contains mostly 1SW maiden salmon but in some areas of Canada (Bay of Fundy, Newfoundland) it is also comprised of 1SW previous spawners. There are generally very few MSW maiden salmon in this size group. These fish are frequently referred to as grilse by anglers. In the accounting of the commercial fisheries catches, small and large salmon are based on weight categories, small salmon weighing less than 2.7 kg whole weight.

Smolt: intermediate stage in the life cycle of the Atlantic salmon. Refers to juvenile salmon which undertake the migration and transition from freshwater to marine conditions.

Assessment methods and terminology

Counting fence: Barrier placed in the river which guides fish through narrow and easily monitored points during their migration upstream or downstream. Counting fences are usually portable, installed and removed every year and provide a total count of fish moving either upstream and downstream.

CPUE: Abbreviation for Catch-Per-Unit-Effort. This is the amount of fish caught divided by the amount of effort invested to catch it. CPUE data can be useful to indicate the changes occurring in fish population size. If you spend more time to catch fewer fish than in previous years, and other factors have not changed, then it probably indicates that your population is dropping. However, CPUE's are sensitive to changes in things like catch efficiency. If fishermen get better at fishing or come up with a gear which catches more fish for the same amount of time spent fishing, then CPUE values may not drop even when population size is falling.

Density : Number of something per unit area. For example, number of salmon parr per 100 square meters of stream area.

Escapees: fish stocked in sea-cages or shore-based facilities by the aquaculture industry which escape the facilities as a result of damage by storms, floods, predators, etc. These escapees usually show up in rivers and are frequently identified on the basis of fin erosion, body form or scale characteristics.

Escapement: the returns minus the fish removed by fisheries, by broodstock collections, etc. Escapement is the number of fish which are left to spawn in the river.

Exploitation rate : The fraction (percentage) of the fish in a population that are caught and killed by a fishery. The rates of exploitation that can be tolerated vary greatly among species.

Fishway: a structure constructed in a river which can be used by fish to ascend an otherwise impassable section of river. Fishways are located at major waterfalls, at hydro dams, and other such barriers to migration. Generally, a total count of fish using the fishway can be obtained by installing a holding trap at the top of the fishway and releasing fish after they have been counted.

Fluvial habitat: refers to habitat in a river as opposed to lakes or ponds or estuaries.

Lacustrine habitat: refers to habitat in lakes or ponds (generally standing water).

Mark and recapture: experimental technique used to estimate the total population size from a partial count. Fish are captured, marked with an easily identifiable tag and released back to the water. Fish are collected farther upriver or at a later date and the number of fish which have tags versus the number of fish which do not have tags is used to estimate the proportion of the population which has been marked. Because we know how many fish were marked originally, the total population size can be estimated.

pH: A measure of the acidity (hydrogen ion concentration) of the water. The scale runs from 0 - 14, with 0 being pure-acid, 7 being neutral, and 14 being extremely basic (lye). Salmonids are believed to be suffering the impacts of acid rain in some areas where pH is driven below 5 at certain times of year. These levels of acidity kill eggs and juveniles.

Returns: the number of salmon returning to the river from the sea. Generally, the returns are the fish remaining after high seas and coastal fisheries. For some rivers, the proportion of the population which was removed in coastal and high seas fisheries is estimated and the number of fish which would have returned to the river in the absence of these fisheries is reported.

Stock: The part of a fish population which is being considered for harvesting by fishermen. More formally refers to groupings of individuals within a species which do not normally mate with other groups. For Atlantic salmon, each river is assumed to contain at least one stock because of their high degree of homing ability to individual rivers and even tributaries of larger rivers.

Stock-recruit curves : These curves show the relationship between the number of adults spawning and the number of offspring they produce.

Year-class : The fish hatched in a given year.

1.0 Introduction

This report presents the results of the Atlantic salmon stock assessments for eastern Canada for 1994. There are approximately 550 Atlantic salmon rivers in eastern Canada, each of which could contain at least one stock. 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 assessments provide the following information:

1. an accounting of the harvests,
2. an estimation of the total returns,
3. an estimation of the spawning escapement, which is the difference between the returns (2) and the harvests (1),
4. a comparison of the spawning escapement to the conservation target, and
5. an interpretation of the status of the resource in both the short and long terms with regards to the potential exploitation levels.

Preliminary analyses were presented at meetings during which input from industry, user groups, First Peoples and provincial governments was received and incorporated. The assessment documents were then written by the team leaders and peer reviewed regionally; the composition of the peer review teams varied by region but included representatives from universities, other DFO (Dept. of Fisheries and Oceans) scientists, representatives of First Nations and of angling associations. Regional summaries have been prepared and detailed research documents on individual stocks or geographical areas are publicly available from the Atlantic Stock Assessment Secretariat (Dept. of Fisheries and Oceans, P.O. Box 1006, Dartmouth, Nova Scotia, Canada, B2Y 4A2).

Section 2.0 provides an overview of the status of Atlantic salmon in 1994 for the Atlantic zone while Section 3.0 provides regional overviews for each assessment region of Atlantic Canada: Scotia-Fundy, Gulf, Quebec, and Newfoundland. The Province of Quebec information is included with concurrence of representatives of the Ministère de l'Environnement et de la Faune.

Many of the assessments were made possible through the collaboration between DFO, provincial government biologists, recreational fisheries associations, development associations, and First Peoples. Recreational fisheries associations were funded through cooperative recreational fisheries development agreements while many First Peoples initiatives were funded through the Aboriginal Fisheries Strategy.

Any comments on the present document should be addressed to the Regional Science Director

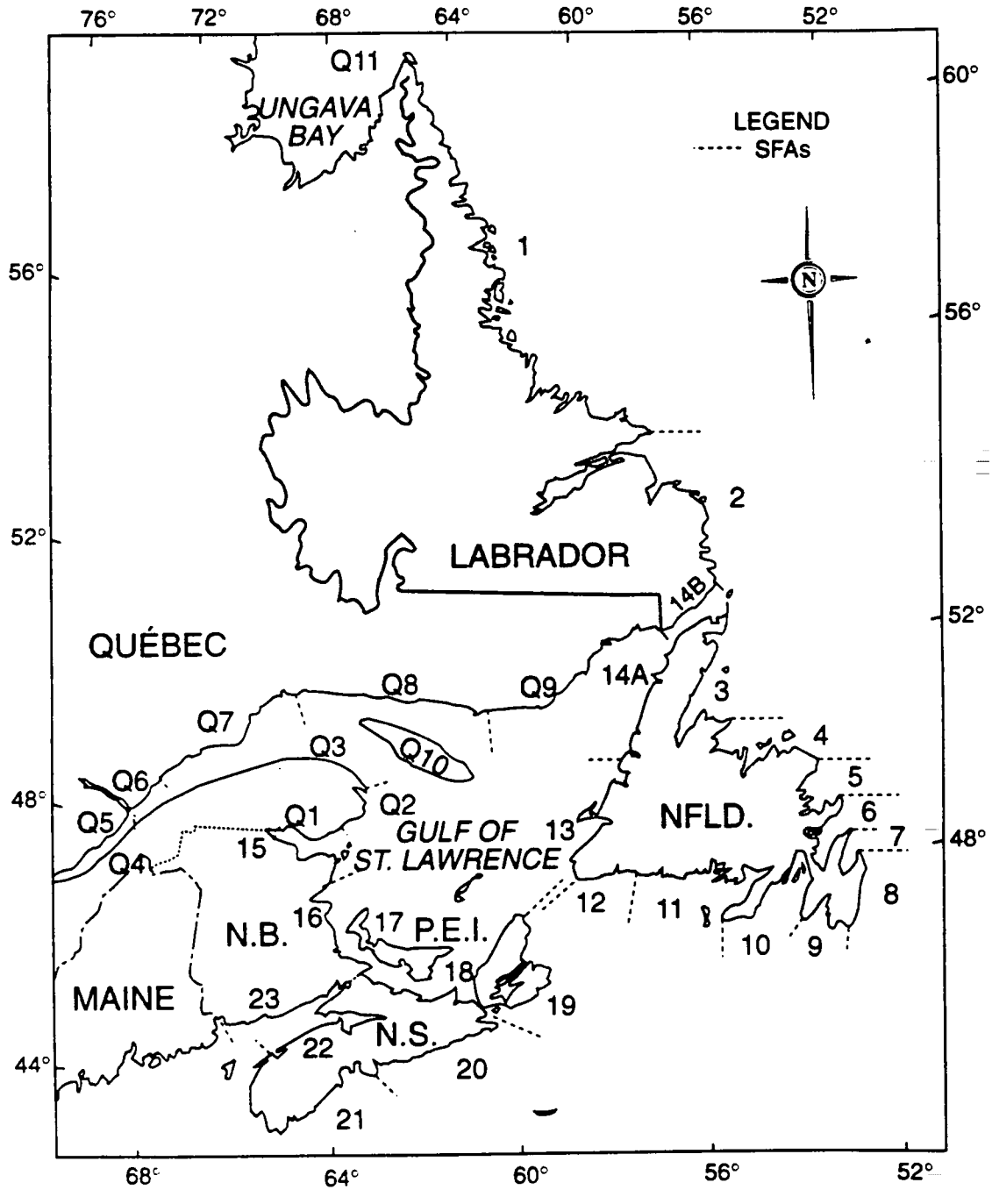

Fig. 2.1. Atlantic Salmon Fishing Areas.

in your Region:

for Nova Scotia, New Brunswick and P.E.I.:
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or to:
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Ottawa, Ontario
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2.0 OVERVIEW OF ATLANTIC SALMON STOCKS

Several sources of information are used to assess the status of Atlantic salmon of which the most important are derived from complete counts at fishways or counting fences, from mark and recapture experiments and finally from the fisheries themselves. Because of the high degree of homing ability, Atlantic salmon within a river are considered to comprise a stock (see Glossary). It is not possible to assess all stocks because sufficient information on the total returns, number of spawners, and the biological characteristics is available from only a small proportion of the rivers. Catch information is generally available from most individual rivers. Accordingly, both information on stock status offered in this document as well as fishery management practices are based primarily on geographic areas having within them several individual rivers. The 23 areas for which DFO manages the salmon fisheries directly are called Salmon Fishing Areas (SFA); for Quebec, the management is delegated to the Ministère de l'Environnement et de la Faune and the fishing areas are designated by Q1 through Q11. These areas are shown in Figure 2.1.

2.1 Definitions

All the terms used to describe Atlantic salmon biology and management are defined in the glossary at the first part of this report. Two important terms used extensively throughout this document are: **Small salmon:** in recreational fisheries refer to salmon less than 63 cm fork length (tip of the snout to the middle of the tail) whereas in commercial fisheries, refers to salmon less than approximately 2.7 kg whole weight.

Large salmon: in recreational fisheries refers to salmon greater than or equal to 63 cm fork length while in commercial fisheries, refers to salmon greater than or equal to about 2.7 kg whole weight.

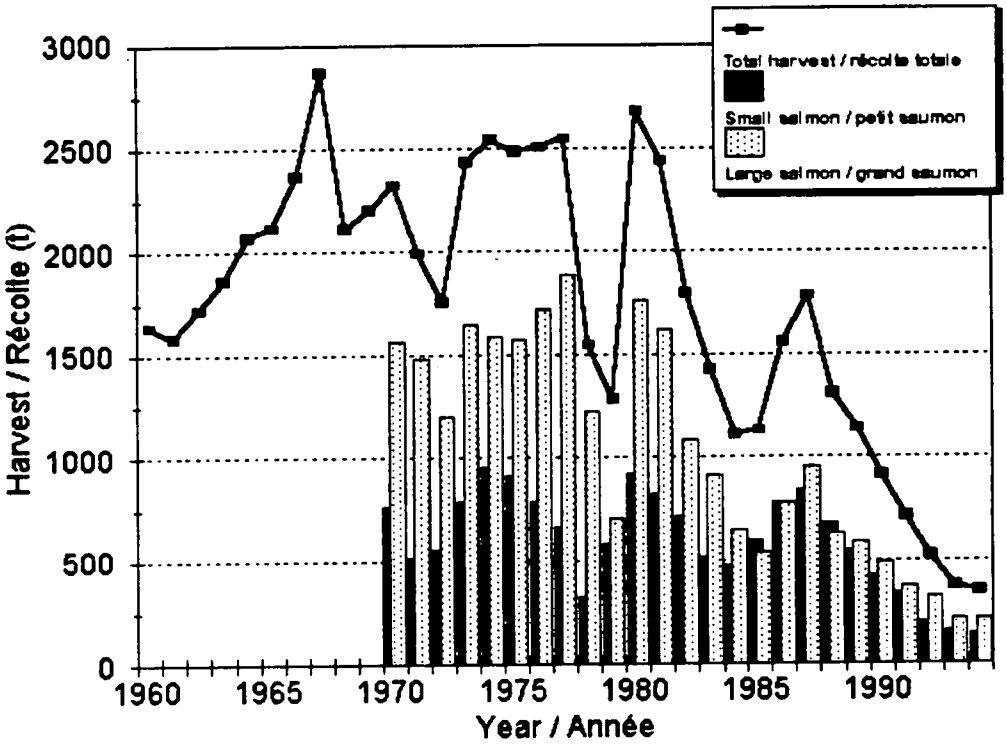
2.2 Description of Fisheries

The five-year moratorium which was placed on the commercial fishery in insular Newfoundland in 1992 continued. In Labrador, commercial fishing quotas and numbers of fishers were decreased. The commercial fishery opened on June 5 and closed on October 15 or when the quota was caught. Quotas were assigned by SFA. Commercial fisheries in Quebec were also reduced in 1994 from 1993; these fisheries were active in two zones, Q9 and Ungava Bay.

Only small salmon could be retained in the recreational fisheries except for Quebec and Labrador. The seasonal bag limits in the recreational fishery remained at eight small salmon in New Brunswick and Nova Scotia with a daily limit of two retained. In PEI, the season and daily bag limits were 7 and 1 respectively. For insular Newfoundland, the seasonal bag limit in 1994 was reduced from eight to 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, hook-and-release fishing only was permitted. In Labrador, there was no seasonal division of the bag limit but the limit for large salmon was reduced from four to two with a daily limit of one fish. In Quebec, season and bag limits varied by zone: for Q1 to Q7 and Q10, the season limit was 7 fish of any size. For rivers in Q7 east of Franquelin and in zones Q8, Q9 and Q11, the season limit was 10 fish. 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. Daily limits in some zones of Q7 were two fish, in Q8 and Q9 it was three and in Q11 it was four fish.

Throughout this report, harvests in fisheries refers to fish which are caught and killed. In the recreational fisheries, reference is also made to catches which include both fish which are retained and fish which are released back to the water alive. This distinction is important for all the years after 1983, when mandatory hook and release regulations for large salmon in the recreational fishery were introduced in many parts of eastern Canada.

The provisional harvest of salmon in 1994 by all users was 351 t representing about 77,000 small salmon and 42,000 large salmon.



The dramatic decline in harvested tonnage since 1988 is mostly the result of the large reductions in commercial fisheries effort and, since 1992, the closure of the insular Newfoundland commercial fishery.

Salmon were exploited by three user groups in eastern Canada in 1994: First Peoples, recreational fishers and commercial fishers. The 1994 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. Newfoundland reported the largest proportion of the total harvest of small salmon and Quebec reported the greatest share of the large salmon harvest. Recreational fisheries exploited the greatest number of small salmon in all the provinces.

	% of provincial harvest			% of eastern Canada	Number of fish
	First Peoples	Recreational	Commercial		
Small salmon					
Newfoundland	0.0[1]	78.8	21.2	52.3	40,124
Quebec	3.1	63.7	33.2	15.2	11,620
New Brunswick	15.1	84.9	0.0	30.7	23,565
P.E.I.	0.0	100.0	0.0	0.1	40
Nova Scotia	13.9	86.1	0.0	1.8	1,348
Large salmon					
Newfoundland	0.0[1]	3.0	97.0	37.0	15,687
Quebec	18.1	41.5	40.3	60.7	25,771
New Brunswick	100.0	0.0	0.0	1.7	705
P.E.I.	-	-	-	0.0	0
Nova Scotia	100.0	0.0	0.0	0.6	261

[1] First Peoples in Conne River Newfoundland (SFA 11) did not fish in 1994 because of low returns.

First Peoples Fisheries

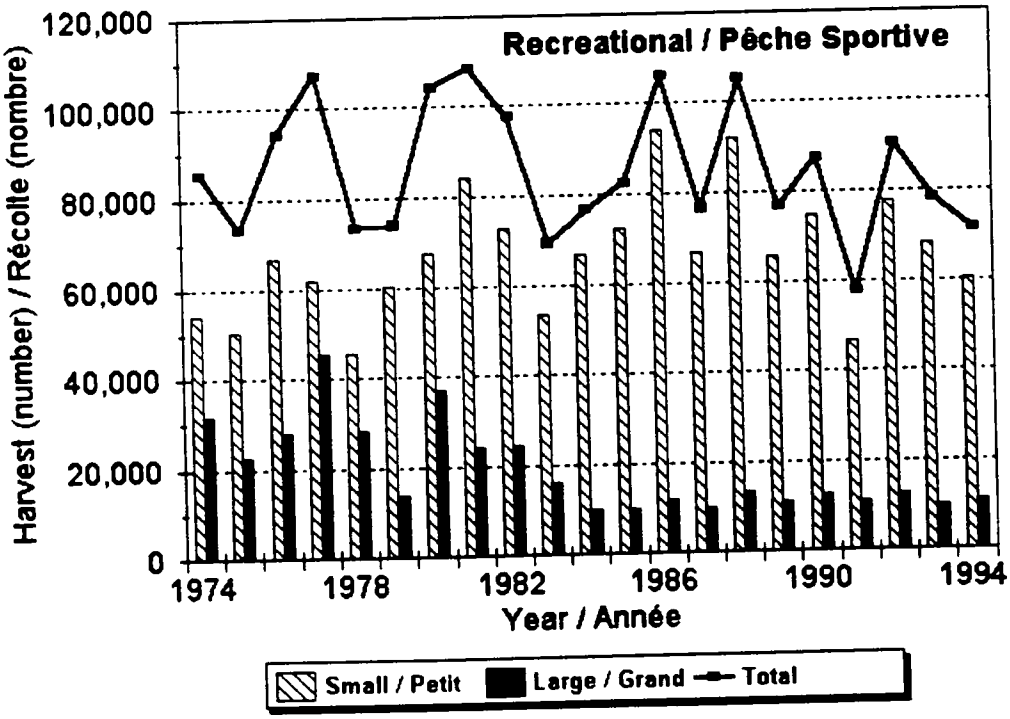
In Quebec, First Peoples' food fisheries took place subject to agreements or through permits issued to the bands. There are nine bands with food fisheries in addition to the fishing activities of the Inuit in Ungava. The permits generally describe gear and fishing effort limits but not catch limits. In the Maritimes and Newfoundland, food fishery harvest agreements were signed with several First Peoples in 1994. The signed agreements included allocations of small and large salmon. In many cases, harvests were less than the allocations. Harvests which occurred both within and outside agreements were reported by the First Peoples. The Conne River (SFA 11) food fishery did not occur in 1994 because the expected returns were below the conservation target for the river. Harvest by First Peoples with recreational or commercial licenses are reported under the recreational and commercial harvest categories.

First Peoples catches in 1994 (by weight) were 93% of the previous year's catch but were 18% above the previous 5-year average catch. The proportion of the catch which was large salmon was unchanged relative to previous years, except for 1993.

	Year					
Harvests	1989	1990	1991	1992	1993	1994
Weight (t)	30.4	31.9	29.1	34.2	42.6	39.7
% Large by weight	85%	78%	87%	83%	91%	83%

Recreational Fisheries

Harvest in recreational fisheries has varied, but without a trend, at about 80,000 fish of which small salmon make up on average 85% of the catch since 1984.

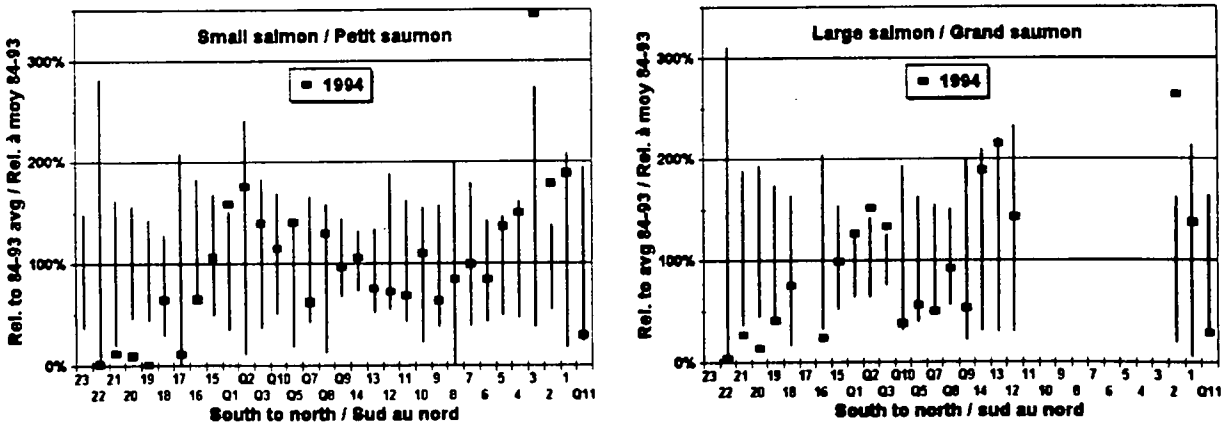


Reported harvests in all regions represent a small fraction of the potential harvests if all recreational license holders had caught the maximum allowed.

Province	Number of licenses	# of tags[1]	Size	Potential Harvests	Reported Harvests	% of Potential
New Brunswick	30,500	8	Small	216,000	20,013	9%
Nova Scotia	4700	8	Small	38,000	1,161	3%
Prince Edward Island	N/A	7	Small	N/A	40	N/A
Newfoundland & Labrador	23,000	6	Small & Large	138,000	32,090	23%
Quebec	<15,000	7	Small & Large	102,000	18,111	18%

[1] # of tags issued with a full-season recreational license. Fewer tags are issued for different classes of non-resident licenses.

Recreational catches in 1994 by fishing area were variable and generally less than the catches reported in most of the previous ten years. Small salmon catches were generally above the previous ten-year average catches in Labrador, the northeast coast of Newfoundland and Quebec but were below in all other areas including the Gulf of St. Lawrence, with exception to the Restigouche River (SFA 15). SFA 3 small salmon catch was the highest since 1984. Large salmon catches were above previous ten-year average catches in Labrador, the west coast of Newfoundland, and the Gaspé coast of Quebec but were among the lowest recorded in all the other areas of eastern Canada.



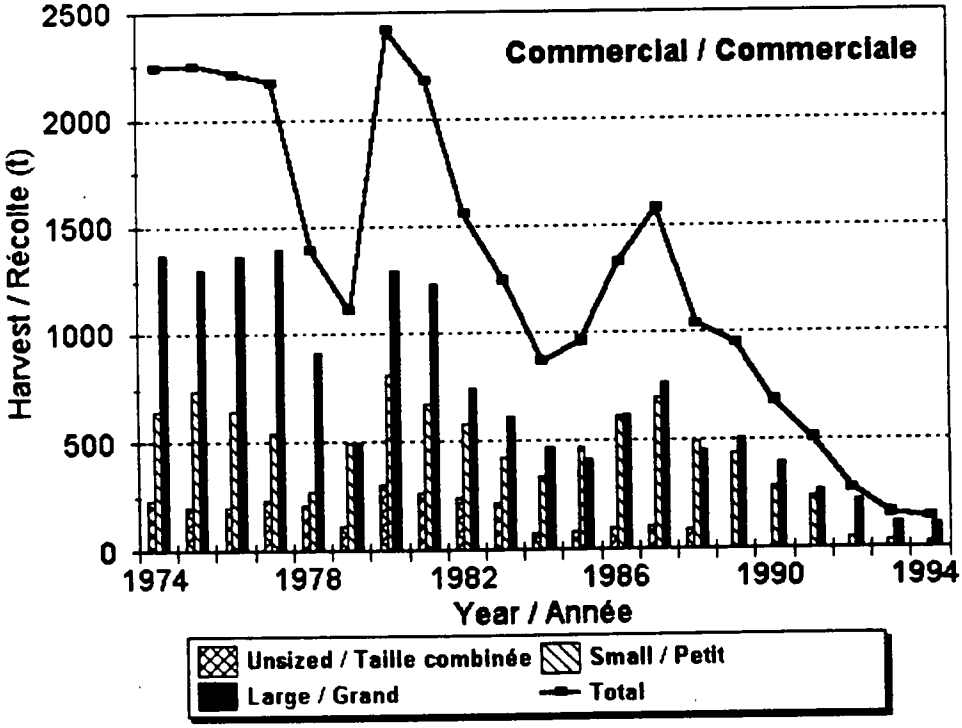
Angling catches by management area in 1994 relative to the previous ten-year average. Annual values are expressed as a percent of the average catch between 1984 and 1993. The vertical lines represent the minimum to maximum range. The black square is the 1994 catch expressed as a percent of the mean. A value of 100% for 1994 indicates that the 1994 catch was similar to the mean whereas a 1994 value of 300% indicates that the 1994 catch was three times as high as the previous ten-year average catch.

Because of the changes which occurred in the management of the recreational fisheries since 1984, the use of angling catches as indices of abundance has been seriously compromised. Therefore, the interpretation of trends in abundance relies mostly on rivers where returns have been estimated or completely enumerated. As well, in 1994, rivers in several SFA were closed to angling for part or the entire season as a result of low stock abundance or low water and high temperatures (see regional summaries).

Commercial Fisheries

The commercial fisheries moratorium for insular Newfoundland established in 1992 remained in effect in 1994. Commercial fisheries occurred in Labrador and along the Quebec north shore of the Gulf of St. Lawrence but they were reduced in terms of licensed effort and allocations from previous years.

The commercial harvest in 1994 declined to less than 150 t from more than 2,400 t in 1980.



Commercial fisheries in 1994 accounted for 61% of the total recreational and commercial harvest of small salmon in Labrador in contrast to the 1986 to 1991 period when commercial fisheries harvested a much greater share of the small salmon. There was no change in the percent of the large salmon harvests taken by the commercial fisheries in 1994 compared to the levels of 1986-91. For Quebec, there was a slight decrease in the proportion of the total large salmon harvests from Q7 to Q9 taken by the commercial fishery relative to the 1986-1991 levels. Small salmon proportion increased in 1994.

	1989	1990	1991	1992	1993	1994
Labrador						
Licensed effort	610	570	570	495	288	216
Quota (t)	N/A	340	295	273	178	92
Harvest (t)	330	202	120	204	112	92
Quebec (Q7 to Q9)						
Licensed effort	185	165	152	147	94	90
Quota (number)	33.125	29.605	28.359	23.400	15.325	15.175
Harvest (number)	20.790	19.517	19.653	19.700	14.869	14.240

					Commercial as % of total recreational and commercial	
Harvest (number of fish)		1992	1993	1994	1994	1986-1991
Labrador	Small	24.249	17.074	8.508	61%	94%
	Large	32.341	17.096	15.213	95%	98%
Quebec (Q7 to Q9)	Small	3.849	3.627	3.858	60%	53%
	Large	15.514	11.030	9.897	77%	82%

Unreported removals

Unreported removals are defined as harvests which are caught and retained, but do not enter into the reported catch 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 catch although the magnitude of the unreported removals has decreased. In 1994, net-marked fish were noted at several counting facilities in Newfoundland and Labrador: 5% of salmon sampled at Sandhill River (SFA 2), 16% of fish sampled at Gander River (SFA 4), 6% of samples at Campbellton River (SFA 4) and 19% of salmon sampled at Conne River (SFA 11). The values for Gander (June to August) and Conne (June) rivers were obtained from fish sampled at index traps. 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. In spite of the salmon and cod commercial fishing moratoria, salmon are still encountering fishing gear throughout the Newfoundland coastal areas. Salmon could be encountering fishing gear which has been legally set for other species, such as herring and capelin. In 1994, capelin trapnets were fishing throughout insular Newfoundland waters and there was no maximum mesh size restrictions on either the leaders or traps.

The estimates for Canada since 1986 are:

Year	Unreported removals (t)	Reported catch (t)	Unreported as % of reported catch
1986	315	1559	20
1987	234	1784	13
1988	161	1310	12
1989	174	1139	15
1990	111	911	12
1991	127	679	19
1992	136	470	29
1993	161	364	44
1994	105	352	30

2.3 Aquaculture Production in Eastern Canada

Commercial aquaculture of Atlantic salmon first occurred in 1980 in the Bay of Fundy with the reported production of 11 t. Production increased exponentially during 1984 to 1992 when more than 10,000 t of annual production was reported. In 1993 and 1994, commercial operations in the Bay of Fundy accounted for over 90% of the total Canadian production.

Atlantic salmon commercial aquaculture production (t) in eastern Canada

Year	Atlantic Canada	Québec Q1	New Brunswick SFA 23	Nova Scotia SFA 19-21	Newfoundland SFA 11
1980	11		11		
1981	21		21		
1982	38		38		
1983	68		68		
1984	227		223	5	
1985	360		350	10	
1986	673		636	36	1
1987	1.357		1.318	37	2
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[1]	12.464	15	12.000	403	46

[1] 1994 values are preliminary

Other 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, Bras d'Or Lakes (SFA 19), and in Bay d'Espoir Newfoundland (SFA 11). In 1994, production of rainbow trout was 400 t from the Bay of Fundy, 300 t from the Bras d'Or Lakes and over 300 t from Bay d'Espoir. Escapees of both Arctic charr and steelhead trout have been recorded in many rivers in proximity to these production facilities.

2.4 Definition of Conservation and Derivation of Targets

Conservation for salmon is defined as follows:

> "That aspect of renewable resource management which ensures that utilization is sustainable and which safeguards ecological processes and genetic diversity for the maintenance of the resource concerned. Conservation ensures that the fullest sustainable advantage is derived from the resource base and that facilities are so located and conducted that the resource base is maintained." (CAFSAC Adv. Doc. 91/15).

The operational translation of conservation for eastern Canada is based on an egg deposition rate of 2.4 eggs/m^2 of fluvial rearing habitat (see glossary) and in addition for insular Newfoundland, 368 eggs/hectare of lacustrine habitat (ponds and lakes) (CAFSAC Adv. Doc. 91/15). For the northern peninsula of Newfoundland (SFA 3 and 14) and for Labrador, 105 eggs/hectare of lacustrine habitat is used (O'Connell et al. MS1991). The conservation target for a river is therefore the product of the fluvial habitat area and 2.4 eggs, plus for insular Newfoundland and Labrador, the surface area of lacustrine habitat times the appropriate egg per lacustrine area value. Targets for rivers are defined in terms of eggs and can be translated into the number of salmon required to meet the target using values of the average biological characteristics of the stock, including percent female and eggs per female.

References

CAFSAC 1992. Definition of Conservation for Atlantic Salmon. CAFSAC Ad. Doc. 91/15 in Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) Annual Report Vol. 14, 1991 pp. 147-150.

O'Connell, M.F., J.B. Dempson, and R.J. Gibson, 1991. Atlantic salmon (salmo salar L.) smolt production parameter values for fluvial and lacustrine habitat in Insular Newfoundland. CAFSAC Res. Doc. 91/19, pp 11.

2.5 Status of Stocks - Returns and Spawning Escapements

A total of 63 rivers were assessed in 1994 (Figure 2.2). Estimates of total returns of small and large salmon were obtained using various techniques; 36 were derived from counts at fishways and counting fences, 7 were obtained using mark and recapture experiments, 3 using visual counts and mark/recapture combinations, 12 from visual counts of spawners, and 5 from angling and food fishery catches. 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 catches, broodstock collections, and scientific samples from the total returns.

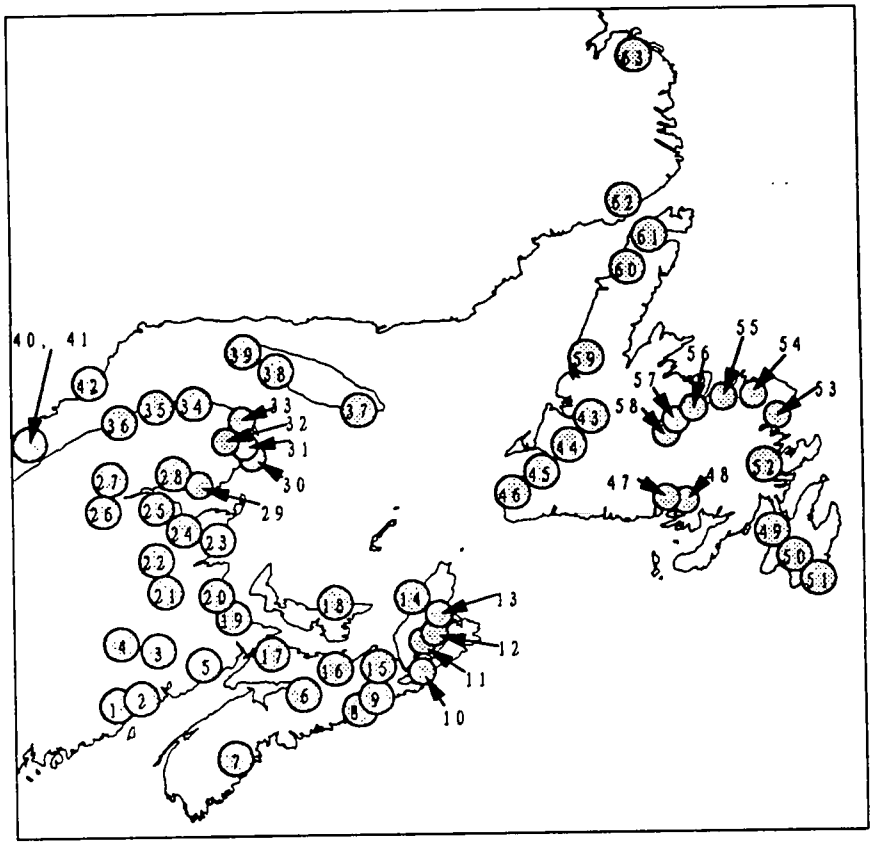


Fig. 2.2. Location of rivers in eastern Canada for which the status of Atlantic salmon was assessed in 1994.

Number	River	Number	River	Number	River
1	Ste. Croix	21	Southwest Miramichi	41	Ste. Marguerite (principale)
2	Magaguadavic	22	Northwest Miramichi	42	de la Trinité
3	Nashwaak	23	Tabusintac	43	Humber
4	Saint John (Mactaquac)	24	Nepisiguit	44	Pinchgut
5	Big Salmon	25	Jacquet	45	Flat Bay
6	Stewiacke	26	Restigouche	46	Highlands
7	La Have (Morgan Falls)	27	Matapédia	47	Conne
8	Liscomb	28	Cascapédia	48	Little
9	St. Marys	29	Bonaventure	49	Northeast
10	Grand	30	Grande Rivière	50	Rocky
11	Middle	31	St. Jean	51	Biscay Bay
12	Baddeck	32	York	52	Terra Nova
13	North	33	Dartmouth	53	Middle
14	Margaree	34	Madeleine	54	Gander
15	West (Antigonish)	35	Ste. Anne	55	Campbellton
16	East (Pictou)	36	Matane	56	Lower Exploits
17	Philip	37	de la Chaloupe	57	Middle Exploits
18	Morell	38	Jupiter	58	Upper Exploits
19	Bouctouche	39	Bec-Scie	59	Lomond
20	Richibucto	40	Ste. Margeurite (nord-est)	60	Torrent
61	Western Arm Brook	62	Forteau	63	Sandhill

Total returns in 1994

Of the 63 stocks for which returns of salmon were determined in 1994, comparable data were collected in 1993 for 54 of these. Large salmon returns in 1994 were higher than in 1993 in the Gulf of St. Lawrence but lower in the Bay of Fundy/Atlantic coast of Nova Scotia and in Newfoundland. Small salmon returns were lower in 1994 in the Gulf of St. Lawrence and Newfoundland and either up or down in rivers of the Bay of Fundy/Atlantic coast of Nova Scotia.

	Number of rivers in each category			
		Returns in 1994 relative to returns in 1993		
Size group	Total	<90%	90% to 110%	> 110%
Bay of Fundy, Atlantic coast of NS				
Small + Large	2	1	0	1
Small	7	3	1	3
Large	7	4	0	3
Rivers flowing into the Gulf of St. Lawrence				
Small + Large	16	3	5	8
Small	19	11	3	5
Large	19	7	1	11
South, Northeast Newfoundland and Labrador				
Small	10	8	0	2
Large	9	5	3	1

Fewer rivers, 34 in eastern Canada, have had returns enumerated going back to 1984. For these rivers, the returns in 1994 were generally among the lowest observed in the time series, with a few exceptions. Most of the rivers in the Bay of Fundy-Atlantic coast of Nova Scotia and Gulf of St. Lawrence regions had returns of both small and large salmon which were ranked sixth or less (a rank of 1 means the returns in 1994 were the highest, a rank of 11 means the returns in 1994 were the lowest during 1984 to 1994). Returns to south and northeast Newfoundland and Labrador were improved from the previous ten years with returns to most rivers among the top four in the last 11 years.

Rank of the 1994 returns of individual rivers within the last 11 years and within the last 6 years. A rank of 1 means the return in 1994 was the highest of the time series for that river. A rank of 11 in the eleven year time series means that the 1994 return was the lowest observed in 11 years for that river. The median rank represents the rank of the 1994 returns for which half the rivers were above and half were below. For example, for the 5 rivers assessed in the Bay of Fundy/Atlantic coast of Nova Scotia, the highest rank for the small salmon return in 1994 for any of the five rivers was fourth out of eleven, the lowest rank of one of the rivers was eleven or the lowest observed in the 11 year time series and the median rank was 10 to 11. This means that at least 2 rivers had a rank of 11, a third river had a rank of 10 or 11 and two rivers had ranks which were better than 10.

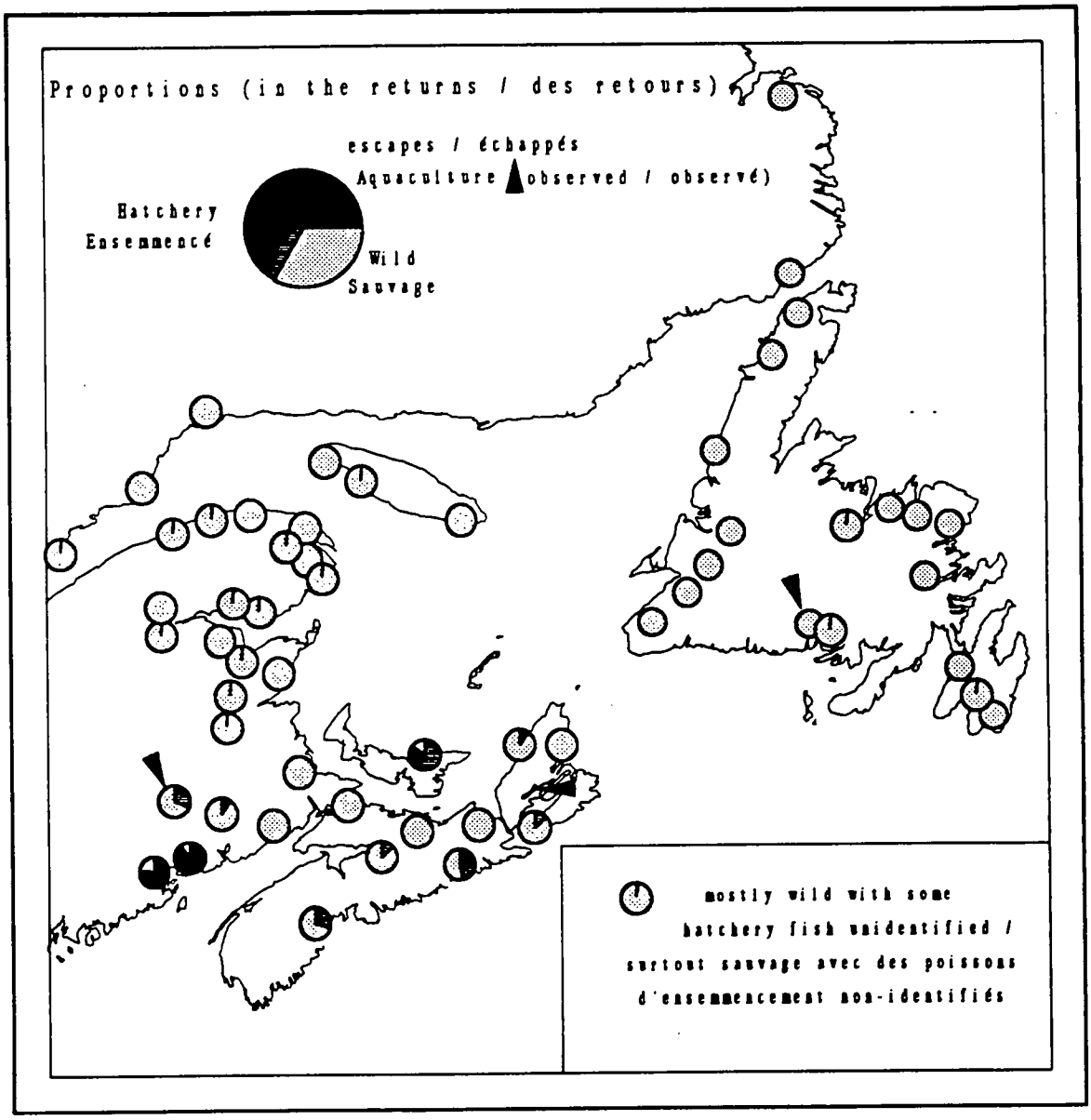
	Rank of 1994 within 1984 to 1994 period				Rank of 1994 within 1989 to 1994 period			
Size group	# of rivers	Highest	Lowest	Median	# of rivers	Highest	Lowest	Median
	Bay of Fundy / Atlantic coast of Nova Scotia							
Small	5	4	11	10-11	5	1	6	5
Large	5	1	11	11	5	2	6	5-6
	Rivers flowing into the Gulf of St. Lawrence							
Small + Large	16	3	11	6	16	1	6	4
Small	9	1	9	6	9	1	6	5
Large	9	1	10	8	10	1	6	6
	South, northeast Newfoundland and Labrador							
Small	4	1	7	2	8	1	4	3
Large	4	2	6	4	9	1	6	3

Compared to more recent times, 1989 to 1993, the returns in 1994 were most frequently among the lowest in all the areas of eastern Canada. Only a few rivers in each area had returns in 1994 which were the highest of the previous five years.

Origin of returns in 1994

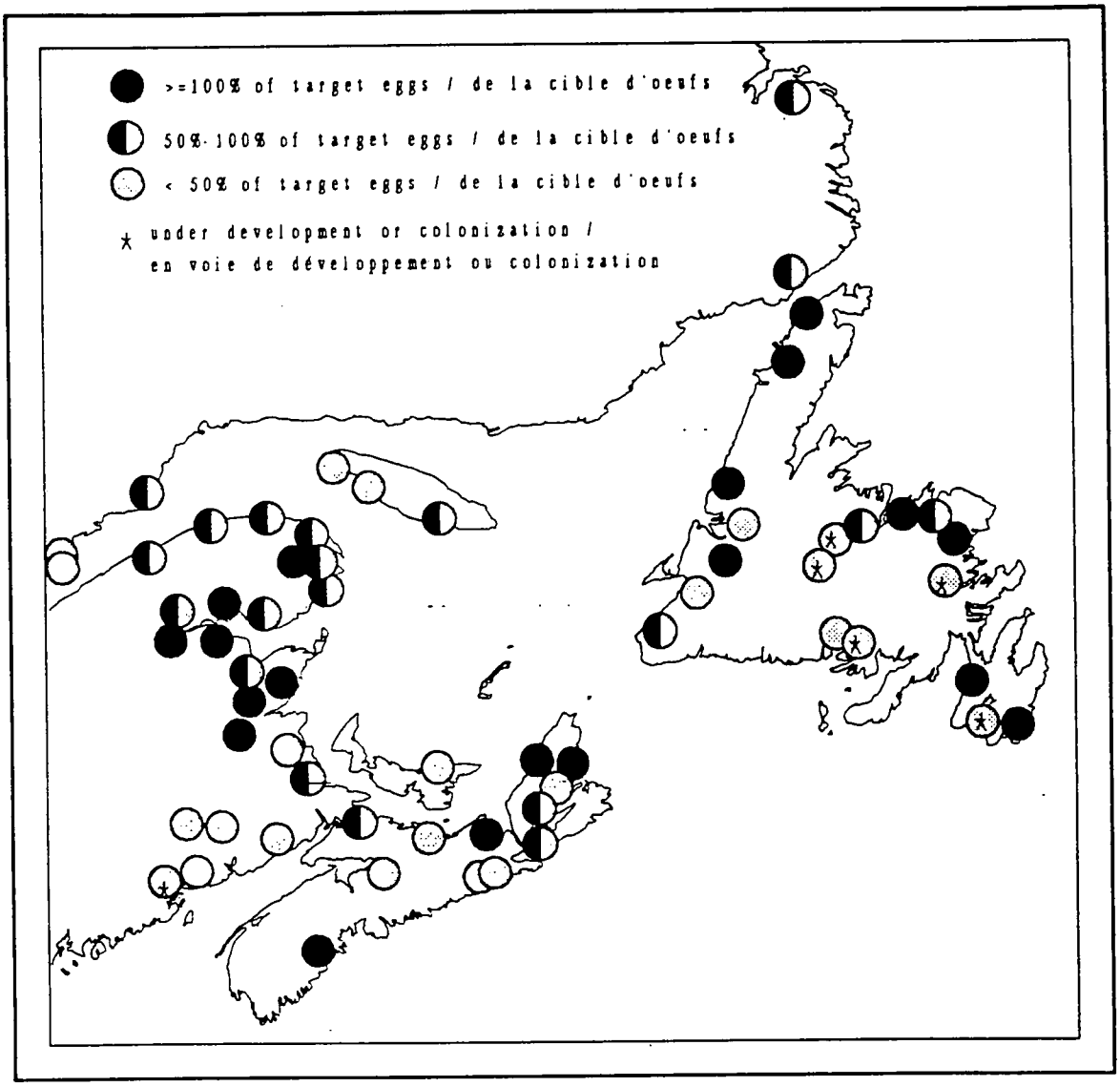
Hatchery origin salmon made up varying proportions of the total returns to rivers in Atlantic Canada. Fish designated as of hatchery origin are defined as those fish originating from eggs spawned in the hatchery followed by rearing of the juveniles to various life stages before being stocked in the rivers. Identification of hatchery origin fish was on the basis of the presence of an adipose-clip, from fin deformations, and/ or from scale characteristics. The returns to the majority of the rivers in Newfoundland were comprised of exclusively wild salmon. Hatchery fish were more abundant in the rivers of the Bay of Fundy and the Atlantic coast of Nova Scotia.

Aquaculture escapees, identified on the basis of fin erosion (especially of the tail) and from scale characteristics, were abundant in the rivers of the outer Bay of Fundy. A few were also noted in Conne River Newfoundland (SFA 11) and in rivers flowing into the Bras d'Or Lakes of Cape Breton Island (SFA 19). Cage-reared Big Salmon River fish (SFA 23) were released into the river in the fall of 1994 to augment the natural spawning; these releases were greater than the estimated returns of wild salmon to the Big Salmon River in 1994.



Escapement and Egg Depositions in 1994

Egg depositions exceeded or equalled the specific river targets in only 19 of the 63 rivers and were less than 50% of target in 24 other rivers. Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 9 of the 13 rivers assessed had egg depositions which were less than 50% of target. Six rivers under colonization received egg depositions which were less than half the target, five of these were in Newfoundland.

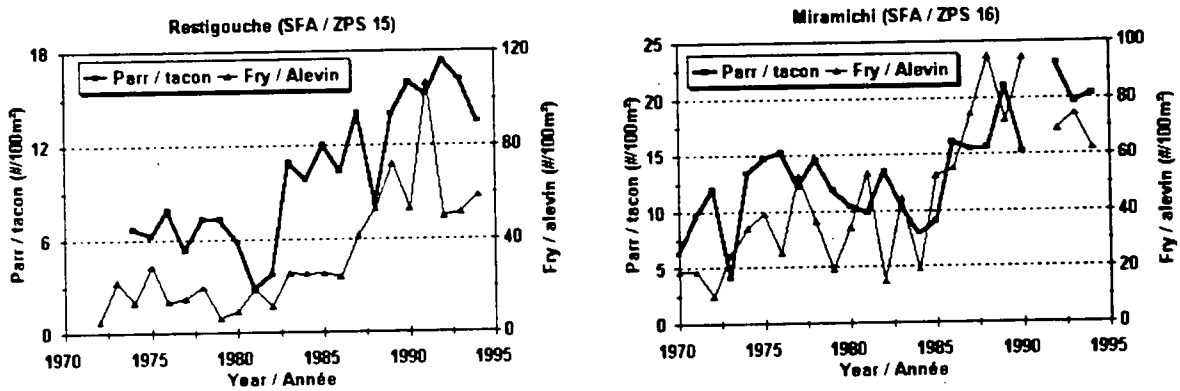


2.6 Production of Atlantic salmon in recent years

The production of Atlantic salmon can be clearly differentiated into two stages--a freshwater phase and a marine phase. Freshwater production relates to the survival of juvenile salmon from the egg to the smolt stage. The marine production relates to the survival and growth from the smolt stage to the maturing adult fish. Both stages impact on the quantity of salmon returning to the rivers to spawn.

Freshwater production

Densities of juveniles have been monitored annually since 1971 in the Miramichi and Restigouche rivers. In these rivers, juvenile densities of young-of-the-year (fry) and parr (juveniles of one or more years old) have increased since 1985 in response to increased spawning escapements.

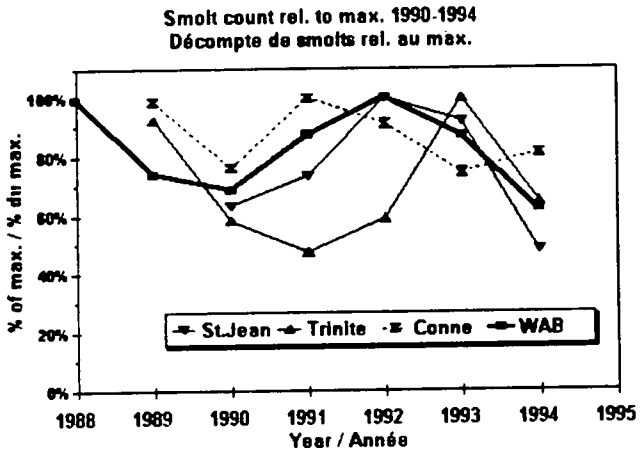


High densities of juveniles have also been reported from Nova Scotia rivers along the Gulf of St. Lawrence. The abundance of parr in the headwater lakes of the Gander River increased in 1993 and 1994 apparently in response to increased spawning escapement. This is in contrast to juvenile densities from an inner Bay of Fundy river (Stewiacke River) which have declined since 1984, in part as a result of reduced spawning escapement. Except for the rivers along the eastern and southern shores of Nova Scotia which have been impacted by acid precipitation, the freshwater production of the monitored rivers in Atlantic Canada has increased or remained constant at high levels since 1985.

Counts of smolts are available from six rivers in Newfoundland, two rivers from Quebec, and three tributaries of rivers in the Maritime Provinces. These provide direct measurements of the outputs from the freshwater habitat. Smolt output can vary by almost five times from one year to the next but in the counts for entire rivers, smolt output has generally varied in magnitude by about a factor of two.

River	Years	Range in smolt (counts) output		
		Minimum	Maximum	Magnitude
Little River (tributary of Stewiacke River SFA 22)				
	1990 - 1994	1500	4000	2.7 X
Lake O'Law Brook (tributary to Margaree River SFA 18)				
	1991 - 1994	631	2541	4.0 X
Catamaran Brook (tributary of the Northwest Miramichi SFA 16)				
	1990 - 1994	515	2429	4.7 X
St. Jean Q2	1989-1994	92575	154906	1.7 X
de la Trinité Q7	1984 - 1994	40695	96469	2.4 X
Highlands SFA 13	1980 - 1982. 1993 - 1994	9986	15839	1.6 X
Conne SFA 11	1987 - 1994	55765	74585	1.3 X
Rocky SFA 9	1990 - 1994	5115	9781	1.9 X
Northeast Trepassey SFA 9	1986 - 1994	944	1911	2.0X
Campbellton SFA 4	1993 - 1994	31577	41633	1.3 X
Western Arm Brook (WAB) SFA 14A	1971 - 1994	5735	20653	3.6 X

Generally, the number of smolts leaving the rivers depends upon the number of eggs deposited. For that reason, among others, smolt output is not constant from year to year. 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. The four rivers which have estimates of the total smolt output in the last five years indicate that in 1994, the number of smolts leaving the rivers was generally down, compared to 1993 and previous years, except for de la Trinité River.

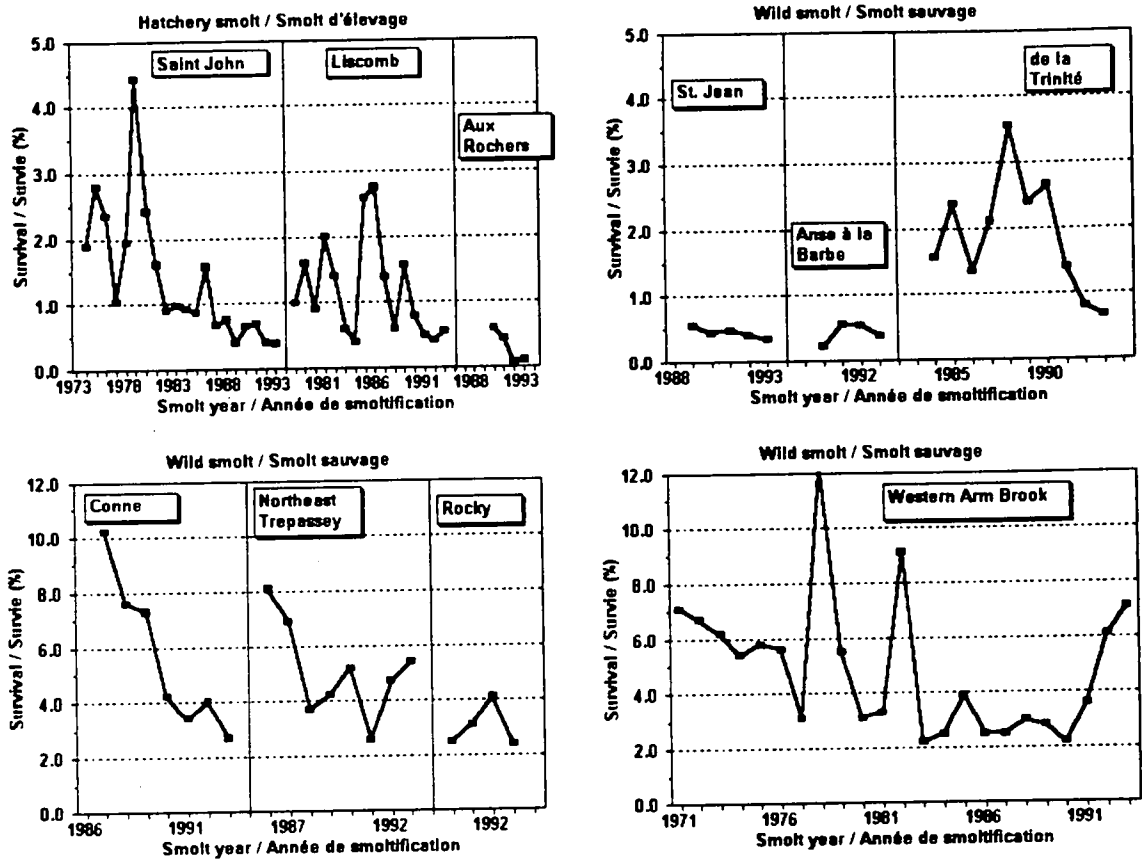


Marine production

The number of smolts entering the sea varies from year to year. Marine production depends in large part on the number of smolts entering the sea and the survival of these smolts to maturity. Sea survival back to the river varies annually, as a result of varying natural and fisheries mortality. Reductions in marine fisheries exploitation would be expected to improve the survival rate back to the river but this can be offset by increases in natural mortality which can be brought about by variable causes, including environmental conditions, predation, and disease transmission.

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 11 rivers in Atlantic Canada with at least four years of smolt counts and corresponding adult counts are available; three are hatchery stocks and 8 are wild populations. Geographically, populations for which data were available ranged from the Saint John River (SFA 23- Bay of Fundy) in the south, Liscomb River (SFA 20) along the Atlantic coast of Nova Scotia, Anse à la Barbe and Saint Jean (Q2) in the Gaspé region, de la Trinité and Aux Rochers (Q7) Quebec north shore, and other populations from southern Newfoundland (SFAs 9 and 11) and the Great Northern Peninsula (Western Arm Brook, SFA 14A).

The following figures illustrate the return rate, or percent survival, from smolt to adult small salmon (to actual 1SW returns for the Saint John River). Smolt year refers to the year of smolt migration and thus the survival corresponds to the return of adult salmon in the following year.



In general, survival of hatchery stocks is lower (avg. by river over all years from 0.30 to 1.38%) than that of wild stocks (avg. over all years of 0.43-8.53%). Similarly, survival of hatchery stocks is more variable (C.V. from 67.5-85.5%) than wild stocks (C.V. from 18.0-51.9%).

Many of the populations, both wild or hatchery, show a declining trend over time, particularly in recent years. Western Arm Brook (SFA 14A) and Northeast Brook (Trepassey) (SFA 9), however, have shown consistent increases over the past two to three years but still remained below or comparable to pre-salmon moratorium years. On Newfoundland rivers, small salmon returns prior to 1992 would have been affected by the commercial fishery. Since then, survivals would have been expected to have increased as a result of the commercial salmon fishery moratorium.

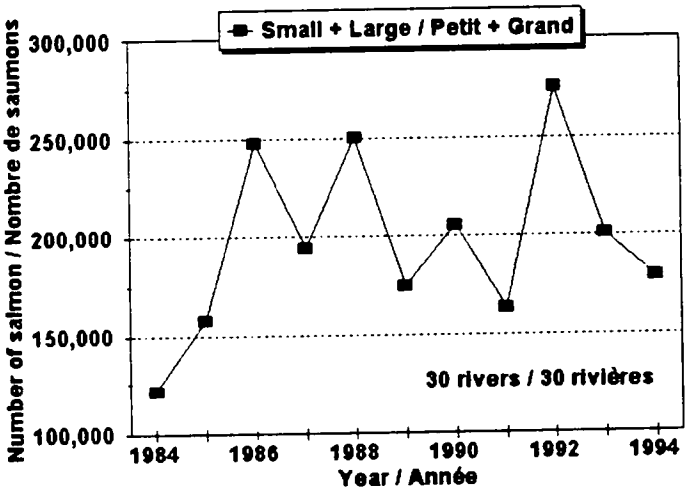
A rank ordering of survival values indicated that:

- 5 of the 11 rivers, had the lowest survival recorded in the 1993 smolt year-class (adult returns in 1994),
- 8 of 11 rivers had the lowest sea survivals during moratorium years (i.e. adult returns in either 1992, 93, or 94),
- 10 of the 11 rivers had either the lowest or second lowest survivals coinciding with the moratorium years.

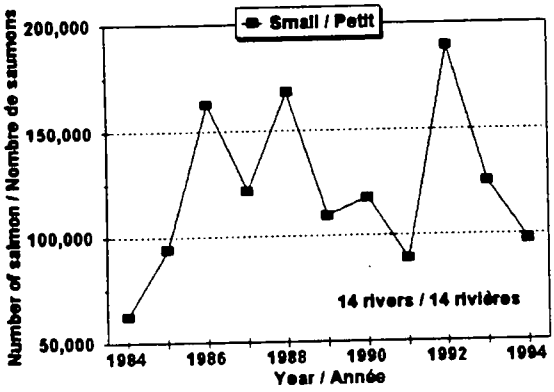
Both hatchery and wild populations displayed similar trends and, for the most part, were consistent over wide geographical areas. Given the large scale reductions in marine exploitation that have occurred over the past several years, sea survival of many salmon populations has not increased in the manner expected.

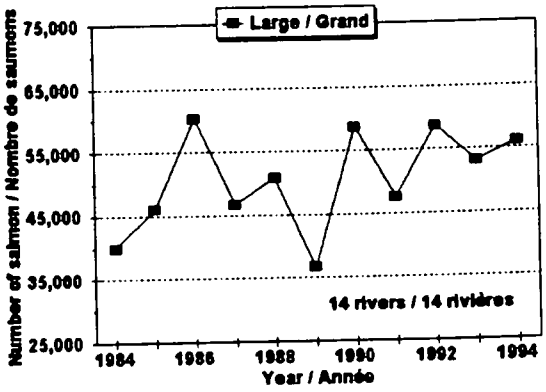
The interaction between aquaculture escapees and wild stocks is a concern being expressed on both sides of the Atlantic. There is speculation that survival of wild fish may be affected while they are in the area of aquaculture operations. In addition to environmental factors that may be affecting sea survival, other possible causes of reduced returns to rivers with continuing low returns should be considered.

Estimates of annual returns of small and large salmon (wild fish only) are available for 30 rivers in Atlantic Canada since 1984. These returns do not account for commercial fisheries removals in Newfoundland, Labrador and Greenland. Returns after commercial fisheries have varied between 125,000 to 275,000 fish. The returns during two of the moratorium years (1993 and 1994) are lower than the returns of 1986 to 1988 when there was a commercial fishery in Newfoundland as well as in Greenland.



The returns of salmon differentiated into small and large size categories have been estimated for 14 rivers. In spite of the substantial reductions in the commercial exploitation, the return of large salmon has shown only a slight improvement from the 1985 to 1989 period.



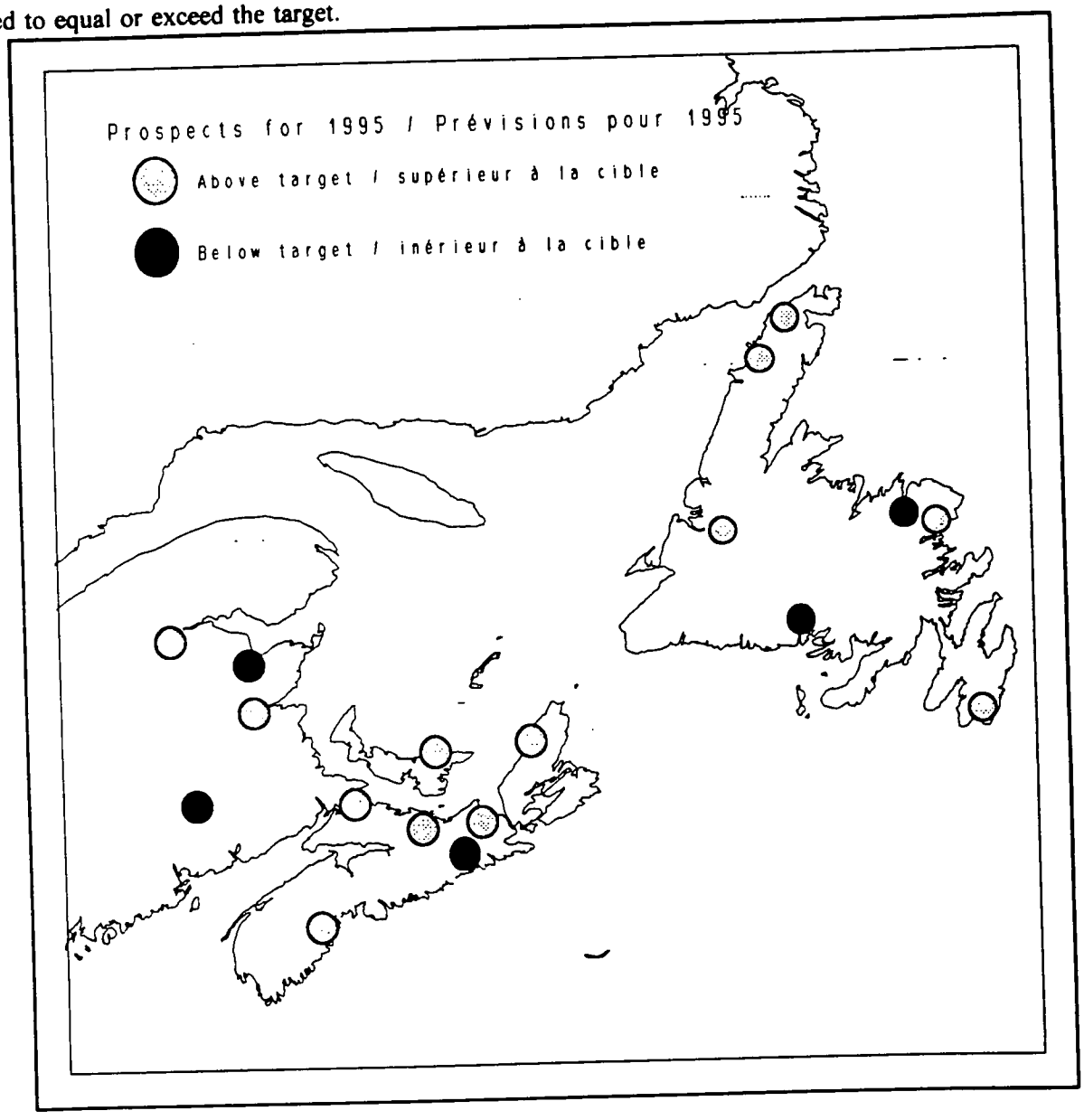


Small salmon returns were higher during 1986 to 1988 when there was a commercial fishery as compared to 1993 and 1994 when the Newfoundland fisheries were closed. The abundance of several stocks of salmon in Newfoundland and Labrador, reconstructed to include catches in commercial fisheries, has declined since 1974 (see regional summaries).

2.7 Prospects

Short term - 1995

Stock to recruitment relationships, trends in sea survivals of hatchery and wild smolts, relationships between small salmon in one year to large salmon returns the following year, and correlations with marine conditions in the Labrador Sea are used to describe the prospects for 1995. These are summarized in the following figure in terms of whether or not the returns of fish would be expected to equal or exceed the target.



Long term - beyond 1995

A long term view of the prospects of the Atlantic salmon stocks of eastern Canada can be obtained from changes in abundance of juveniles in freshwater and spawning escapement levels achieved in recent years.

Juvenile abundance in several monitored rivers of the Gulf of St. Lawrence has increased since 1985 and has remained at these higher levels. A similar response to increased egg depositions has been noted in Gander River (Section 2.5). In a monitored river of the inner Bay of Fundy, juvenile densities have continued to decline since 1984.

Escapements over time relative to targets have improved in some areas of Atlantic Canada but have declined in others. The Bay of Fundy/Atlantic coast of Nova Scotia rivers status has declined. Most of the rivers received egg depositions in 1994 which were less than half of the target whereas in previous years, some of these rivers met or exceeded target, the most important example being the Saint John River (SFA 23). In the Gulf of St. Lawrence, the number of rivers which received egg depositions less than 50% of target has increased since 1992. In the major river, the Miramichi (SFA 16), target egg deposition has been exceeded in 8 of the last 10 years. An improvement in egg depositions in Northern Peninsula and east coast rivers in Newfoundland was noted in recent years; during 1989 to 1991, more than 50% of the rivers assessed received less than 50% of the target egg requirements.

		Year of spawning of small and large salmon									
		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Bay of Fundy / Atlantic Coast of Nova Scotia (% of rivers assessed)											
# of rivers assessed		2	2	2	2	4	4	4	5	5	13
Depositions as % of target	>=100%	100%	50%	50%	50%	75%	50%	50%	20%	20%	15%
	<50%	0%	0%	0%	0%	0%	25%	0%	40%	60%	69%
Rivers flowing into the Gulf of St. Lawrence (% of rivers assessed)											
# of rivers assessed		27	27	27	27	26	26	26	29	32	36
Depositions as % of target	>=100%	26%	37%	56%	70%	54%	42%	54%	55%	38%	36%
	<50%	26%	4%	11%	7%	4%	8%	8%	17%	19%	25%
South and Northeast Newfoundland and Labrador (% of rivers assessed)											
# of rivers assessed		4	5	6	10	11	11	11	11	12	14
Depositions as % of target	>=100%	50%	60%	67%	40%	27%	27%	9%	36%	42%	29%
	<50%	25%	20%	33%	40%	55%	55%	73%	45%	33%	43%

The increased egg depositions in recent years should result in improved recruitment back to the rivers before the end of the decade if marine survival stabilizes or increases. The returns observed to the rivers of Newfoundland in the last three years are some of the progeny from the lower spawning escapements of 1988 to 1990. In spite of having received egg depositions which were greater than 50% of target, returns to the Bay of Fundy rivers continue to decline or stay low. For these rivers, the spawning stock is not replacing itself, the causes of which remain uncertain. A similar situation may be occurring at Conne River and various factors have been examined for their contribution to the declining returns although none were conclusive.

2.8 Environmental Conditions

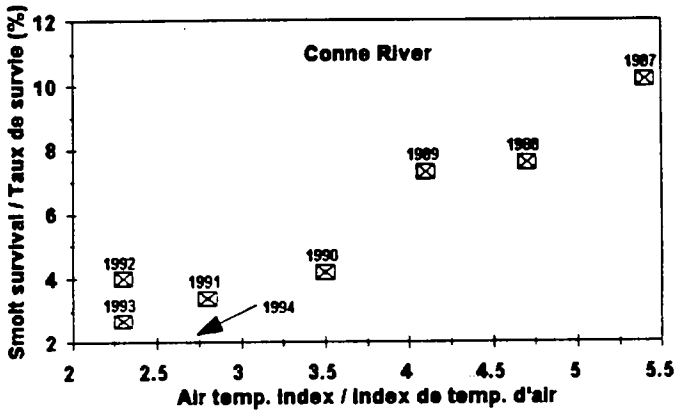
Environmental conditions in freshwater potentially affect the production of the rivers as well as the migration of adult salmon into the rivers. Marine conditions have an important role in the survival and growth of smolts to adults.

Most rivers in SFA 6 to 10 (Newfoundland) were closed to angling for most of July in 1994 because of low water conditions and high temperatures. Low water levels were observed through the summer and fall of 1994 in many rivers of Atlantic Canada. The most directly observed affect was poorer than normal angling conditions (Nova Scotia SFA 18 to 21) and the delayed movement until late fall of salmon through several counting facilities (LaHave River - SFA 21, Stewiacke River - SFA 22. Nashwaak - SFA 23, Miramichi River headwater barriers - SFA 16, Morell River - SFA 17). Rivers along the south and northeastern shore of Nova Scotia (SFA 20 and 21) remain vulnerable to acid precipitation. In 1994, a prolonged winter-spring pH depression was noted.

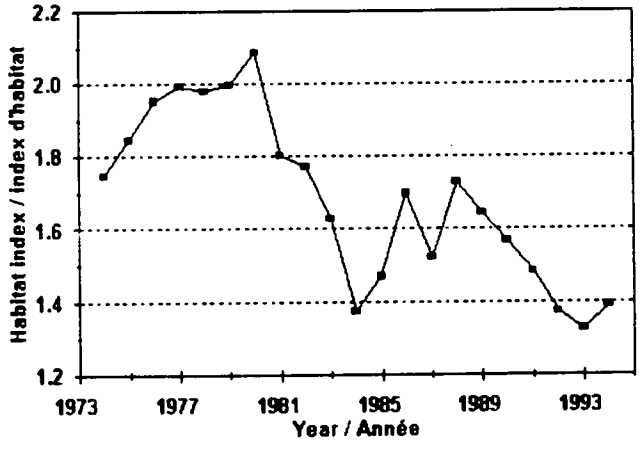
Marine conditions in 1993 would have affected the small salmon returning to the rivers in 1994. Cold spring conditions are likely to have the greatest impact on the early sea survival of post-smolts. In the Gulf of St. Lawrence in 1993, the ice duration was longer than normal and for several rivers of the Gulf, sea survivals from the 1993 smolts were among the lowest recorded. Off Newfoundland and Labrador, the ice coverage from April to June was generally greater than normal although farther offshore than in recent years.

Cold spring conditions were also evident at Conne River where an air temperature index for the period April 1 to May 15 has shown a consistent decline since 1987. The coldest cumulative temperatures were recorded in 1991 to 1993, which corresponds to the lowest smolt sea survivals. Cold spring temperatures continued at Conne River in 1994. Elsewhere in Newfoundland and Labrador, ice conditions in the early spring of 1994 were above normal but not as severe as in 1993.

Air temperature index versus smolt survivals for Conne River (SFA 11).
Labels above symbol refer to the year of smolt migration.



On the Grand Banks, above average cold water areas have been evident since 1988. Cold water temperatures have also been recorded in the Labrador Sea. Recent studies have shown a significant correlation between the estimated production of North American 2SW salmon and an index of marine habitat in the northwest Atlantic. 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 at 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.

2.9 Effects of Recent Changes in Salmon Management on Stock Status

The closure of the commercial fisheries in the Maritime Provinces in 1984 resulted in a noticeable increase in returns of small and large salmon to the rivers. The effect of this reduced marine exploitation and the reduced in-river mortality, as a result of the mandatory hook and release in the recreational fishery of large salmon in many areas of eastern Canada, has been increased egg depositions in many rivers 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 1984.

The commercial fishery moratorium in Newfoundland introduced in 1992 and maintained in 1993 and 1994 has had the most noticeable impact on the escapement to rivers of Newfoundland and Labrador. 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 delayed opening of the commercial seasons in 1978 and 1984. 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 large salmon showed an overall improvement in the last three years, higher returns had been observed at several monitoring facilities in years prior to the moratorium. It was generally felt that, had the moratorium not been in affect, severe over-exploitation of many Atlantic salmon stocks would have occurred in 1994.

Regional Summaries
Nova Scotia, New Brunswick and Prince Edward Island

3.1 Bay of Fundy (SFAs 22-23)

General description

Atlantic salmon of the Bay of Fundy are comprised of two discrete complexes: i) those of the **inner** Bay, which most always mature after just one winter at sea (1SW), can have a high incidence of repeat spawning (returning for up to six consecutive spawnings) and are not known to migrate to the Labrador Sea and, ii) those of the **outer** Bay which have both one sea-winter (1SW) and two sea-winter (2SW) components, a relatively low incidence of repeat spawning and migrate like Atlantic coast stocks to the Labrador Sea.

About 25 relatively small **inner Fundy** rivers in New Brunswick and Nova Scotia have had historical angling for Atlantic salmon. The status of these stocks was assessed using data from the Stewiacke and Big Salmon rivers - the largest in Nova Scotia and New Brunswick, respectively. Sea-age composition of Stewiacke River salmon is typically 70% recruit 1SW salmon and 30% repeat spawning 1SW salmon; that of the Big Salmon River is 50% 1SW and 50% repeat spawning 1SW. Eggs from the stocks of the Big Salmon and Petitcodiac rivers in New Brunswick have been hatched and reared to fall fingerlings or smolts at the Saint John Hatchery for research in their rivers of origin; eggs of Stewiacke River salmon in Nova Scotia have been hatched and raised at the Coldbrook Hatchery, N.S., for research purposes in their river of origin.

Outer Fundy rivers number six in New Brunswick (excl. of tributaries) and two in Nova Scotia (Annapolis and Gaspereau rivers with very small salmon resources). The assessed stocks include those of the Saint John River *above* Mactaquac, the Nashwaak River (tributary to the Saint John below Mactaquac), the Magaguadavic and the St. Croix rivers - all in New Brunswick. Small:large salmon ratios at Mactaquac average about 2:1 for wild fish and 3:1 for hatchery origin fish. In 1994, the proportion of hatchery fish increased to 36% of small salmon and 22% of large salmon. Previous spawners comprise only about 10% of large salmon; escaped sea-cage fish at Mactaquac comprised only about 1% of the run. Small:large salmon ratios on the Magaguadavic River at tide-head are closer to 1:1; hatchery fish are not stocked but sea-cage escapees (mostly non-mature 1SW fish) in 1994 comprised more than 90% of the small and 70% of large salmon. Eggs of Saint John River adults taken at Mactaquac Dam are reared at the Mactaquac and Saint John hatcheries to provide in excess of 250,000 smolts, 400,000 fry and parr for mitigation of hydro development and for colonization. Eggs are provided to four stream-side incubators operated by stakeholders. Eggs of a few salmon returning to the Nashwaak, Hammond, Kennebecasis, St. Croix, Annapolis, Bear and Gaspereau rivers are reared at Saint John or Coldbrook hatcheries for enhancement, native fisheries development, mitigation for hydro or colonization.

The New Brunswick Atlantic salmonid aquaculture industry is located in Passamoquoddy Bay. Growers produced about 12,000t of Atlantic salmon and 400t of rainbow trout in 1994. Escapes, most notably in a Labour Day weekend storm in 1994, were rumoured at 20,000 to 40,000 Atlantic salmon or about the same as estimated for 1993. However, escapes in 1994, perhaps coupled with those from the nearby Eastport area of Maine were significantly more abundant at nearby river counting facilities

than in 1993. Aquaculture in **outer Fundy**, Nova Scotia, has been restricted to an experimental site near Digby.

Description of fisheries

Inner Fundy rivers have had no legal harvest since 1990 ; the Indian Brook and Millbrook First Nations signed agreements to harvest a total of 313 grilse and 87 large salmon from non-inner Fundy stocks. Fisheries in **outer Fundy** rivers of New Brunswick were conducted by First peoples (5 First Nations and the New Brunswick Aboriginal Peoples' Council on the Saint John River) using only trapnets and hook-and-line to harvest an allocation of 1,295 1SW fish. The fishery was delayed until July 15 and open through the attainment of quotas. First Peoples harvested or were provided an estimated 700 1SW and 180 MSW salmon from the rivers of southwest New Brunswick. This included 365 fish of sea-cage origin that were removed from the Magaguadavic River fishway. The Bear River First Nation (Annapolis River area of Nova Scotia) was allocated 75 small salmon of which only a few were taken; the Annapolis and Acadia First Nations were allocated 300 small salmon from Atlantic coast stocks.

Recreational fishers of **outer Fundy** rivers of New Brunswick were restricted to hook-and-release of all salmon in 1994. The recreational fishery for black salmon was closed (except on the St. Croix); the bright salmon season was delayed until July 15 and extended until, depending on area, the traditional Sep 15 - Oct 31 closing dates. Recreational fishing effort was the lowest in decades.

Public consultations

Consultations with First Peoples, angling groups, the provinces and DFO area staff and fisheries officers concerned with **inner Fundy** rivers were facilitated at two September meetings of a Steering Committee over-seeing the communal installation of the Stewiacke River Counting Fence and two meetings of the SFA 22 Zone Management Advisory Committee. For **outer Fundy** rivers, meetings of the SFA 23 Zone Management Advisory Committee were held in July, December and January to assess in-season and post-season returns and devise appropriate management strategies. These meetings were chaired by the DFO Area Manager and attended by First Peoples, angler associations, outfitters, DFO area staff and provincial and National Parks biologists. Deliberations were evaluated for inclusion in the draft assessments that were peer reviewed in Feb, 1995.

Environmental considerations

Analyses and the search for significant interaction between survival of **inner Fundy** smolts and environmental conditions, fisheries and/or status of prey and predator populations of the Bay of Fundy are ongoing but are hampered by direct evidence of the location of over-wintering areas and of a reliable index of survival. Analysis of historical angling and commercial records do, however, indicate periodic collapses of these stocks. River discharges in Sept and Oct, 1994, were extremely low and in all probability prevented many salmon from ascending those rivers until rain and spate conditions at the end of October.

For **outer Fundy** stocks, indices of winter habitat in the North Atlantic (used to estimate prefishery abundance and allocations for the Greenland fishery) have not yet been fully linked to estimated recruitment of wild Saint John River salmon. However, relationships between the March index of habitat and i) return rates for 1SW salmon from hatchery smolts, ii) return rates of 2SW hatchery salmon (affected by each winter) and iii) the length of wild 1SW returns (hatchery not tested) destined for Mactaquac are significant. Length and proportion of 1SW salmon from a smolt class are also related to winter habitat and have been previously interpreted as an expression of environmentally induced "cross-over" of potential non-maturing 1SW fish to maturing 1SW fish. The 1994 March index of habitat improved slightly over that of 1993 (see section 2.8).

Status of stocks

Assessments of **inner Fundy** stocks are based on diver and shore observation counts on the Big Salmon River (New Brunswick Dept. of Natural Resources and Energy), and a partial count at a fence on the Stewiacke River (Indian Brook First Nation, Cobequid Salmon Assoc., and Atlantic Salmon Federation). Juvenile salmon populations are monitored using electrofishing of parr in the Stewiacke and Big Salmon rivers and count of smolts out of the Little River, tributary to the Stewiacke.

Little River smolts numbered 4,098, the highest of the 1990-1994 record. Age-1+ parr densities in the Stewiacke River and tributaries reached a record low in 1994. The fence in the Stewiacke River operated from Sep 16 to Nov 2, 1994 (when it was breached by high water) and passed 205 small and large salmon. Attempts to recapture marked fish up river were unsuccessful and the resultant spawning escapement was about 20% of requirement.

On the Big Salmon River, average densities of age-0+ parr increased to 10.4 from 2.3 per 100 m^2 in 1993; age-1+ parr decreased to 6.7 from 12.5 per 100 m^2 in 1993. Counts of salmon from the shore on Sep 27, 1994, indicated approximately 225 salmon in the river (about 30% of requirements); 60% were classified as small salmon. No additional entrants were believed to have ascended in Oct when the spawning escapement was supplemented with 197 female and 182 male mature 1SW Big Salmon River fish reared in sea-cages. Observations in other inner Bay of Fundy rivers, especially Fundy National Park, indicate that returns in 1994 were once again very low.

Assessment of **outer Fundy** stocks is based on counts in the Saint John River at Mactaquac Dam (DFO), counts on the Nashwaak River at a fence (St. Mary's and Kingsclear First Nations) and counts on the Magaguadavic and St. Croix rivers in fishways (Magaguadavic River at St. George - operated by the Magaguadavic Watershed Management Association and St. Croix River at Milltown - operated by the St. Croix River Recreational Fisheries Development Committee). The fence count on the Nashwaak River was incomplete; escapement was assessed by seining for marked fish in August, September and October. Fish of sea-cage origin were identified on the basis of erosion on the upper and lower lobes of the caudal fin. Sea survival was assessed on the basis of 1SW and MSW returns to Mactaquac from hatchery reared and released smolts.

Total small (3,534) and large (2,375) returns destined for above Mactaquac were the fewest in at least 20 years. Identifiable hatchery fish increased to 36% of small and 22% of large returns; return rates for hatchery smolts were among the lowest of record. Spawners numbered 1,647 large salmon and 2,901 small fish, 37% and 91% of the respective targets. Egg deposition (89% from large salmon) was 39% of requirement; the target has not been met since 1985. Survival of small and large hatchery returns remain among the lowest of record.

Counts at the Nashwaak fence contributed to a mark-recapture estimate of 555 small and 442 large salmon. Spawners numbered 541 small and 366 large fish or 35% and 23% of respective targets while egg depositions were estimated at about 30% of target - 6% less than in 1993.

External and scale characteristics of 1,064 small and 228 large salmon captured in the Magaguadavic trap indicated that only 69 small and 61 large salmon were of wild origins - the lowest of several years of counts. The effective female escapement was estimated at 31 small and 91 large fish because many sea-cage fish were removed and the remainder were determined to be immature. Potential egg deposition was 56% of target; 44% of the total was of sea-cage origin. Returns to the St. Croix, a river that has largely been undergoing redevelopment with Penobscot-origin stock, remained among the lowest of record. Egg deposition did not exceed 3% of requirement.

Prospects

Age-1+ parr populations in **inner Fundy** rivers may have reached their recent low in 1994. The age-1+ parr resultant of low escapements in 1992 will be the principal component of the 1995 smolt run. The age-0+ densities in 1994 were not the lowest of record and if there was a substantial improvement in marine survival, a potential for recovery seems to exist.

The forecasts of small salmon destined for Mactaquac in 1995, based on the regression of small returns on adjusted eggs, would meet target requirements of 3,200, be similar to the returns of 1994 (3,500) and may perhaps even number 4,000 or 5,000 fish. Returns from stocked fry, fingerlings and smolts are expected to comprise about 25-35% of small salmon and 20-30% of large salmon returns. The 1994 March index of habitat improved slightly over that of 1993 (See Section 2.8 Environmental conditions) and with potentially high turbine by-pass rates for 1994 smolts could yield a slight increase in returns of wild and hatchery small salmon returns to Mactaquac Dam in 1995.

Estimates of large salmon returns destined for Mactaquac have been based on regressions of large salmon returns on small salmon returns and their fork length with and without the effects of the recent moratoria in distant fisheries. The most realistic forecasts of large salmon returns may be 2,200 from the model without the effect of the moratoria in Newfoundland and Greenland or 2,500 based on the abbreviated subset with effects of the moratoria. In any event, it is highly unlikely that returns will meet conservation requirements of 4,400 fish or provide for salmon development initiatives in the Aroostook River and above Grand Falls. Low small salmon returns in other rivers in 1994, and a general expectation of associated low large salmon returns from the same smolt class, suggest that target egg depositions by wild stocks are unlikely to be met in outer-Fundy rivers in 1995.

Management considerations

Target egg depositions were not met in any stocks assessed in 1994 and there is every indication that closures/restrictions should continue in 1995. Openings for First Peoples' food fisheries or, if numbers warrant, hook-and-release recreational fisheries require in-season forecasts at Mactaquac and Big Salmon River and consultations with clients. Entry of mature sea-cage origin fish to the rivers of Passamoquoddy Bay (1994 escapees which were largely immature) could be significant in 1995 and their harvest should be encouraged.

Research recommendations

- Investigate the effect of obstructions on downstream fish passage and on potential for increased survival with appropriate remedial actions.
- Include information on any changes in the freshwater ecosystem as measured on the Saint John or tributaries, e.g., new predator complexes, changes in spill/generating patterns at dams etc.
- Examine length-frequency data for small salmon of the Saint John and other rivers to assess if observed shifts in mean length could be the result of reductions in gillnet selectivity or changes in the environment.

Summary sheets

More detailed information on individual assessments for the Stewiacke and the Saint John rivers are presented in the summary sheets.

STOCK: Stewiacke River (SFA 22)
TARGET: 3.1 million eggs (1061 salmon of all ages)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
First Peoples harvest									
In-river									
Angling catch									
Small	1323	0	0	0	0	0	0	1323	221
Large	223	0	0	0	0	0	0	223	37
Broodstock (small + large)									
	19	18	13	12	30	14			
Counts at fence									
Small				37	178	211	37	211	142
Large				119	47	10	10	119	59
Efficiency of the fence (%)				65%	55%	100%			
Population estimate (small + large)				240	409	221			
% Hatchery origin in the returns				1	4	14			
% of Adults required				23%	39%	21%			
Average juvenile densities (# per 100m^2)									
# of sites	31	31	34	37	35	34	29	37	33
Age 0+	21.17	18.70	8.35	14.91	1.28	9.74	1.28	21.17	13.00
Age 1+	16.46	19.75	12.27	15.03	12.65	2.89	2.89	19.75	13.94
Age 2+	6.31	3.31	4.08	1.96	2.52	3.68	1.96	6.97	4.12

[1]1989-1994 data.

Harvests: The angling fishery has been closed since 1990.

Research data and assessment: Juvenile salmon are sampled by electrofishing and adult returns are enumerated at a counting fence located at the head of tidal influence.

State of the stock: These data are used as indices for inner Bay of Fundy rivers which are presently severely underescaped.

STOCK: Saint John River, N.B. (*above Mactaquac*) (SFA 23)
TARGET: 29.4 million eggs (4,400 large and 3,200 small salmon)

Year	1989	1990	1991	1992	1993	1994[3]	MIN[1]	MAX[1]	Mean[2]
First Peoples harvest									
Small	560	273	657	560	241	250	241[2]	657[2]	458[2]
Large	240	247	957	748	462	90	240[2]	957[2]	531[2]
Recreational catch									
Small	2304	2110	1690	2104	852	0	852[1]	3580[1]	2174[1]
Counts at Mactaquac									
1SW	9587	7907	7575	7664	3907	3313	3907[1]	17314[1]	8552[1]
MSW	4291	3919	4226	4203	2980	2206	2010[1]	10451[1]	5050[1]
Returns									
1SW	10861	8804	8751	8940	4369	3534	4369[1]	19275[1]	10057[1]
MSW	4541	4125	5215	4898	3389	2375	3389[1]	13916[1]	7333
Spawning escapement									
1SW	7533	6057	5721	5128	2819	2901	2819[2]	7533[2]	6031[2]
MSW	3491	3202	3481	3269	2149	1647	2149[2]	3491[2]	3118[2]
% of Target met									
1SW	235	189	179	160	88	91	88[2]	235[2]	170[2]
MSW	79	73	79	74	49	37	49[2]	79[2]	71[2]
Eggs	95	85	87	81	51	39	51[2]	95[2]	80[2]

[1] For the period 1975-1993

[2] For the period 1989-1993

[3] Preliminary data

Harvests: The harvest by First Peoples reflects a late opening of the season, poor river returns, and ineffectiveness of some trapnets relative to retired gill nets. Hook-and-release regulations in the recreational fishery eliminated the harvest of small salmon.

Data and methodology: Counts of fish are obtained from the collection facility at Mactaquac Dam; returns destined for the Dam are the counts plus estimates of down river removals. Spawners equal the releases above Mactaquac minus estimates of upriver removals, not including poaching and disease.

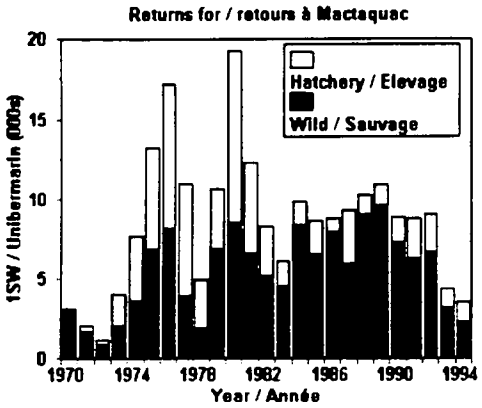
State of the stock: Small and large salmon returns were the fewest in 20 years. Egg deposition (89% from large salmon) was 39% of requirement; the target has not been met since 1985. Identifiable hatchery fish increased to 36% of small and 22% of large salmon returns; return rates for hatchery smolts correlate with a 20-year index of marine winter habitat and remain among the lowest of record.

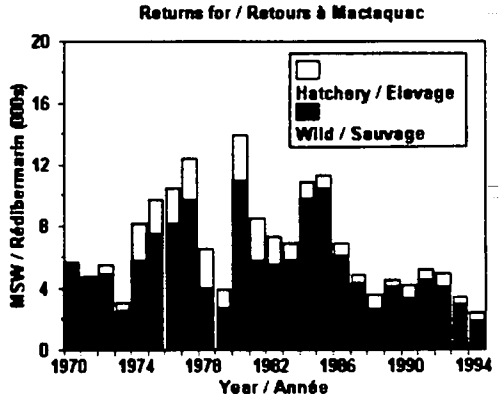
Forecasts: Small salmon returns destined for Mactaquac in 1995 may be no fewer than those of 1994 (3,500) and could number 4,000 or 5,000 fish if marine survival paralleled the slight improvement noted in the index of winter habitat, if increased hatchery stocking of juvenile salmon contributed to more smolts in 1994, and if, as suggested, turbine by-pass rates for 1994 smolts were the best in recent years. In any event, the return should equal and may exceed target spawning requirements of 3,200 small salmon above Mactaquac.

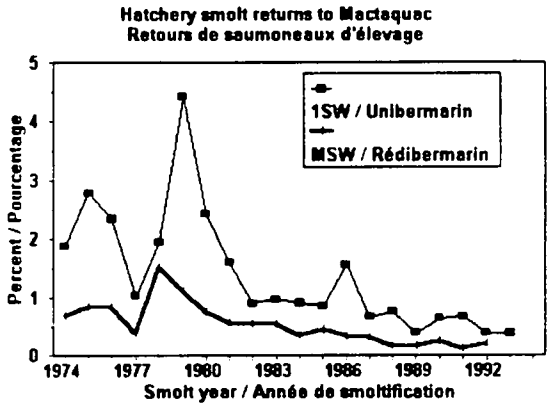
Large salmon returns destined for Mactaquac in 1995 could number as few as 2,200 or 2,500 fish depending on models and assumptions. Hence it is highly unlikely that large salmon returns will be adequate to meet the 4,400 large salmon target spawning requirement for above Mactaquac or provision for salmon development initiatives in the Aroostook River and above Grand Falls.

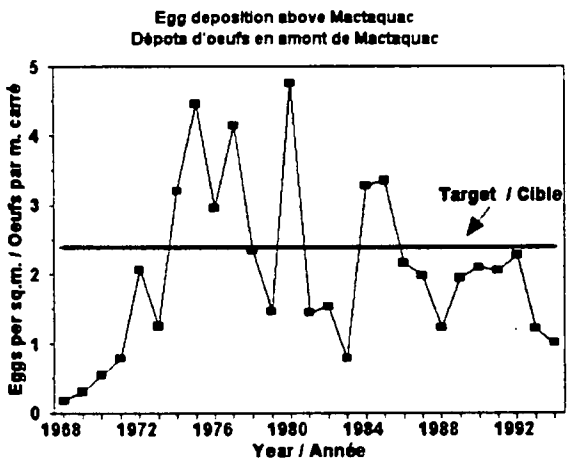
Early in-season forecasts and client consultations will be necessary to determine the utility of any surplus 1SW fish.

Saint John River, New Brunswick (above Mactaquac)









3.2 Atlantic Coast Nova Scotia (SFAs 19-21)

General description

Atlantic coast Nova Scotia stretches from Digby Gut on the outer Bay of Fundy to the northerly tip of Cape Breton Island. The area minimally contains 73 salmon rivers (16 in SFA 21, 29 in SFA 20, and 28 in SFA 19). The rivers are medium-sized or smaller; only five (St. Mary's, LaHave, Medway, Mersey and Tusket) exceed drainage areas of 1400 km^2. Many of the rivers are in the 200 to 700 km^2 size range. Spawner stock composition varies but most of the stocks are composed of 70% to 80% small salmon and 20% to 30% large salmon. The St. Mary's River is unique in that historically about 9% of the run was 3-sea-winter salmon. Exceptions on Cape Breton Island include the North, Middle, and Baddeck rivers where 70 to 85 percent of the runs are large salmon and small salmon are in the minority.

Stocking from the Cobequid, Mersey and Coldbrook hatcheries in 1994 included 232,000 smolts to ten rivers of southwestern Nova Scotia (SFA 21), 112,000 smolts to six rivers of the Eastern Shore (SFA 20) and 87,000 smolts to six rivers of eastern Cape Breton (SFA 19). Underyearling fish surplus to the smolt programs were also stocked to many of the same rivers. Fish are stocked primarily to mitigate for losses to acid rain, hydroelectric development, enhancement, colonization and development of First Peoples' fisheries. Salmon returning to rivers affected by acidification or obstructions, such as the Clyde, and Mersey rivers, are comprised of high proportions of hatchery-released fish. In other rivers where only modest stock supplementation is targeted, the hatchery component is usually under one-third.

The salmon aquaculture industry is not as large as in the Bay of Fundy. Sea-cage production at Shelburne Harbour, St. Peters and Bras D'Or Lakes have produced less than a thousand tonnes. About 300t of rainbow trout are produced at sites in SFA 21 and in the Bras D'Or Lakes. Escapees have been observed in some Bras D'Or tributaries (SFA 19).

Description of fisheries

Allocations totalling 600 small salmon from rivers of SFAs 20 and 21 were made to 5 First Nations located within SFAs 20, 21 and 22. Rivers included the LaHave, Musquodoboit and East River Sheet Harbour but small runs limited total reported removals to only 20 fish. Five First Nations of SFA 19, Cape Breton Island, were allocated 950 small salmon from adjacent waters as well as 130 small and 650 large salmon from the Margaree River (SFA 18). Only 133 fish were reported harvested from waters of SFA 19.

As in previous years, commercial fisheries were closed, by-catch in non-salmon commercial gears was prohibited, and recreational fishery catches were restricted to fish less than 63cm. In 1994, SFA 19 had no licensed retention of any angled fish. In SFA 20, the angling seasons opened as usual, were closed July 21 - August 11, and were re-opened for hook-and-release until normal closure times. In SFA 21, the angling seasons opened as usual but were closed on July 5 except for the Clyde,

Jordan and Mersey rivers where there is no possibility of natural reproduction (all returns were of hatchery origin) and conservation is not a concern.

The angling effort in 1994 was only one-third to one-half that seen in 1993 which is well below the mean effort of the five previous years; a current decrease of that magnitude in 1994 is consistent with the abbreviated angling seasons and creel limitations. Combined SFA angling catches in 1994 were 481 small and 807 large fish compared with respective mean catches in 1989-1993 of 4,675 and 2,339. Hook-and-release of large salmon continued more or less normally before the drought conditions developed.

Public consultations

Consultations with First Peoples, anglers, commercial fishermen, and provincial biologists took place at: Zone Management Advisory Committees of SFAs 19, 20 and 21; monthly meetings of the Cape Breton Sports Fish Advisory/Working committees; meetings with St. Mary's River Association, LaHave Salmon Association, Eastern Shore Wildlife Assoc., Sackville Rivers Assoc., and numerous separate meetings with First Peoples and the Aboriginal Fisheries Services. Materials discussed and presented were considered for inclusion in the draft assessments which were peer reviewed in February, 1995.

Environmental conditions

Early ice-out and adequate mid-spring river discharges started the river conditions off favourably in 1994. However, after mid-June the lack of adequate rain was a fore-runner of a drought that was apparent by early July. No substantial rain was received until well into October, having created a prolonged period of low river discharges such as seldom seen. For many rivers, the decreased flows came before major portions of the salmon runs had entered. Presumably, many fish stayed in the sea until river flows increased and were therefore less vulnerable to fishing mortality, except at two tidal fishing sites on the Musquodoboit and Salmon (Guysborough County) rivers.

The rivers in SFAs 20 and 21 are vulnerable to the effects of acid precipitation, some to such an extreme that salmon stocks have been extirpated. In 1994, the usual winter-spring pH depression lasted over a longer period than has been observed before and likely impacted growth/survival of juvenile Atlantic salmon.

Status of the stocks

Salmon abundance estimated from angling catches is available from most rivers, but has to be interpreted cautiously because angling success rate can be affected by several factors. Sometimes angling catches are useful in-season indicators, but fence or fishway counting facilities are usually more reliable. The Nova Scotia license stub system provides estimates of the catch and fishing effort for each river. In SFAs 19, 20, and 21, there are three fishway enumeration sites, Grand Falls, Liscomb Falls, and Morgan Falls, respectively, and one counting fence site is on the Sackville River.

In the less-coloured waters, some fall censusing of salmon spawners by mark-and-recapture (re-observation) has been possible, such as in the North, Baddeck and Middle rivers of Cape Breton.

Return rates from hatchery-reared fish released to the Liscomb and LaHave rivers remained among the lowest of respective 15- and 22-year records.

Most indicators pointed to lower-than-average salmon returns in rivers of all three SFAs, with the exception of the North River. Decreases appeared in both the small and large size groups. Some of the low apparent numbers of small salmon may have resulted from fish delaying their ascent of the rivers until after the closure of the angling season. Egg depositions above Morgan Falls on the LaHave River were about the same as those of 1993, equalled the target, but were the lowest of the previous 16 years. Returns to the Liscomb, Grand, Baddeck and Middle rivers were all below conservation targets but the North River was 255% of requirement. Hatchery-origin fish comprised nearly one-half of the large and one-quarter of the small salmon returns to Morgan Falls and nearly one-half the small and large returns to Liscomb Falls. In general, most other rivers were believed to have received fewer salmon than required for conservation.

Prospects

Data series for the Liscomb and LaHave counting sites are sufficient to provide a basis for estimating large salmon returns in 1995 based on the small salmon returns in 1994. At Liscomb, the 1995 estimate of 25 fish is not different from the low return in 1994. At Morgan Falls on the LaHave, the 1995 estimate of hatchery large salmon is only half of the 1994 count, partly because of a decrease in numbers stocked. Wild large salmon returns are expected to be 135% of the 1994 count but only 79% of the mean value for 1990-1994.

No wild smolt counts are available from any river in the three SFAs. Expectations for small salmon returns in many rivers in 1995 are not optimistic given that the 1991 egg depositions, based on angling as the abundance indicator, which will produce most of those 1995 fish, were lower than most of the depositions for the prior six years. On the LaHave above Morgan Falls, the 1991 egg deposition estimated from fish counts was only 43% of the 1990 deposition and less than half those of the prior seven years.

In summary, the prospects for salmon runs to rivers in SFAs 19, 20, and 21 in 1995 are low, with the exception of the North River. Moreover, it appears that return to the numbers of fish seen eight or ten years ago will require a long re-building process involving improvement in marine survival rates.

Management considerations

Target egg deposition levels in many rivers are not being achieved in spite of current highly restrictive fishing practices. The shift to greater emphasis on in-season management adjustments has been a positive development for salmon stocks, especially where some potential harvest is available.

Many of the rivers are at the southerly edge of the range of the Atlantic salmon in Canada. More than half the area is degraded by the North American industrial and civilization fallout of acid precipitation, a prospect that is not likely to change in the near future. The low sea survival of salmon smolts, as evidenced by the return rates on hatchery-reared fish, may be a portent of an oceanic problem.

Research recommendations

- Determine appropriate salmon egg deposition rates for stocks in rivers that are stressed by acidification.

Summary sheets

More detailed information on individual assessments for the LaHave River, Liscomb River, St. Mary's River, Grand River, Middle River, Baddeck River, and North River are provided in the individual river summary sheets.

STOCK: LaHave River above Morgan Falls Fishway (SFA 21)
TARGET: Under development for this acid-stressed river

Year	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean
Recreational catch									
Small[3]	2411	2008	233	1058	1655	127[1]	127	2411	1473
Counts									
Wild 1SW	2087	1880	495	1915	777	641	495	2087	1431
Wild MSW	511	396	236	215	121	128	121	511	296
Hatchery 1SW[4]	443	596	109	558	381	207	109	596	417
Hatchey MSW[4]	183	112	90	59	84	119	59	183	106
Total	3224	2984	930	2747	1363	1095	930	3224	2057
Return rate of hatchery smolts[5]									
1SW (%)	1.65	1.95	0.42	3.35	0.83	0.56	0.42	3.35	1.64
MSW (%)	0.63	0.32	0.23	0.17	0.47	0.23	0.22	0.63	0.36

[1] Preliminary data

[2]For the period 1989-1994

[3]Retained catch taken mostly below the enumeration site

[4]Mostly as a result of smolt releases

[5]Includes some parr; rates adjusted from prior publications

Recreational catches: Catches are for the entire river rather than only those from the stock above Morgan Falls. Retention of large salmon since 1983 has been prohibited, but large numbers have been released after hooking. Fisheries were closed July 5.

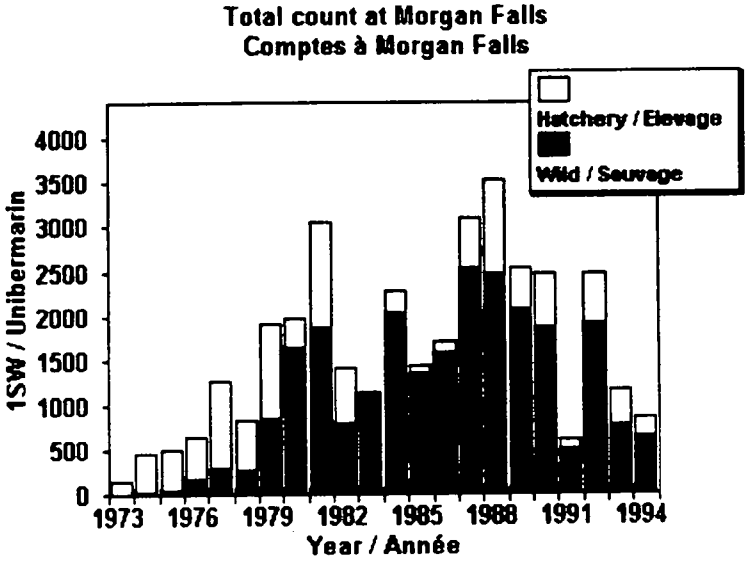
Data and assessment: Spawner counts are made at a fishway at a natural falls, 25.3 km above tidehead.

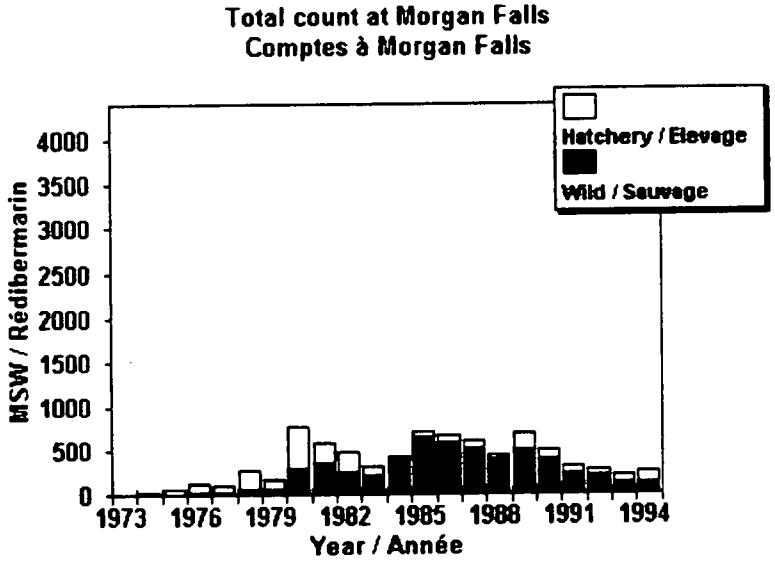
State of the stock: Target egg requirements according to the 2.4 eggs m^{-2} (approx. 2,800 small and 500 large salmon for the entire river; 60% of the drainage is below Morgan Falls) have generally been exceeded except for 1991, but the adequacy of that rate under conditions of some acid stress is uncertain at this time. The estimated egg deposition in 1994 is 1.63 eggs m^{-2}, without any downward adjustment for instream losses above Morgan Falls.

Conditions in 1994: River discharge during the angling season declined rapidly in July and low flows persisted until mid-October.

Forecast: A significant regression (n=20) of wild large salmon counts at Morgan Falls on wild small salmon counts at Morgan Falls in the previous year forecasts a count of 173 large salmon in 1995. A significant regression (n=21) of hatchery-return large salmon counts at Morgan Falls on hatchery-return small salmon counts there in the previous year, forecasts a count of 62 large salmon in 1995.

LaHave River above Morgan Falls - SFA 21





STOCK: St. Mary's River (SFA 20).
TARGET: 7.4 million eggs (2,436 1SW fish; 437 small (74 cm) and 281 large (85 cm) MSW salmon) based on a rearing area of 3,078,500 m^2.

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch									
Small[2]	645	2063	975	319	909	44	319	2063	1072
Large	462	274	264	152	396	30	152	944	454
Escapement (estimated) based on 30% exploitation rate									
Small	1318	3761	1736	663	1722	47	663	3761	2026
Large	1494	886	854	491	1019	70	491	3052	1458
Stocking									
Main River									
0+ parr					5008				
West Branch									
2+ smolt	7216	5538							
East Branch									
0+ parr	54094	25060		43315	63471				
1+ parr		2565	7820	15293	10815	9561			
2+ smolt	8588	18201	20683		19638	19755			

[1] For the period 1984-1993

[2] Numbers include harvest and release

Recreational catches: No retention of large salmon since 1984. Small salmon catches (1985-1994) have ranged from 319 in 1992 to 2,063 in 1990. The 1994 recreational fishing season was restricted by a closure July 21 - August 11 and subsequent limit to a hook-and-release fishery.

Data and assessment: The St. Mary's River sport catch was used as an indicator of returns to the St. Mary's River. The Liscomb River wild small salmon counts are correlated with the St. Mary's River small salmon sport catch (p=0.005). The large salmon sport catch is related to the LaHave River wild small salmon returns the previous year (p=0.006). Targets were based on sample data collected from the recreational fishery between 1972 and 1984. Recent adult data from the West Branch suggest a repeat-spawning 1SW stock from that branch.

State of the stock: Total returns to the St. Mary's River can be estimated using an exploitation rate on sport catch data. At an exploitation rate of 30%, the St. Mary's River returns would have met target spawning requirements for 1SW salmon only once since 1989 (in 1990) and for MSW fish in 4 of the previous 5 years (1989-93). The 1994 estimated escapement would have fallen short of target by over 2000 small salmon and over 600 large salmon. However, the 1994 sport catch may not represent returns as in other years because of the extra restrictions in place during the season.

Forecast for 1995: Forecasts of small salmon returns are unavailable. The relationship between St. Mary's River large salmon sport catch and LaHave River wild small salmon returns the previous year forecasts a large salmon sport catch in 1995 of 90 or 190 fish depending on the time series used for the regression. 1982-93 (excl. 1985) regression: 90 fish; p=0.011; 90% C.I. 0-462. 1974-93 regression: forecast 190 fish; p=0.006; 90% C.I. 0-573.

STOCK: Liscomb River above Liscomb Falls Fishway (SFA 20)
TARGET: Currently under development due to acid stress; nominal target is 1.54 million eggs.

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch									
Small[2]	65	177	68	19	14	25	14	289	120
Counts									
Wild small	532	955	586	145	134	134	134	1,614	632
Wild large	75	44	38	27	11	10	11	117	63
Hatchery small	288	438	178	125	128	119	49	766	325
Hatchery large		22	22	12	12	8	12	175	58
Total	966	1,459	824	309	283	271	285	2,279	1,077
Egg depositions / m^2 (above fishway)									
	1.2	1.6	0.9	0.4	0.34	0.32	0.34	2.5	1.25
Return rate of hatchery smolts									
Small (%)	0.60	1.56	0.79	0.50	0.42	0.56	0.35	2.75	1.21
Large (%)	0.23	0.05	0.08	0.05	0.05	0.03	0.05	0.23	0.13

[1] For the period 1985-1993.

[2] Below fishway 1985-92; for the entire river 1993-94; numbers include harvest and release.

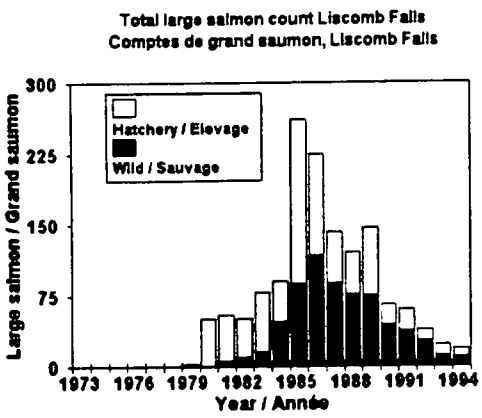
Recreational catches: No retention of large salmon since 1984. Small salmon catches (1985-1994) have ranged from 14 in 1993 to 289 in 1987. Prior to 1993, the recreational fishery was limited to the 5 km of river below the fishway.

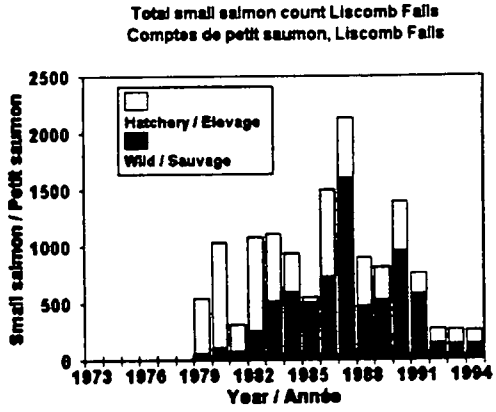
Data and assessment: Counts of adult fish are obtained at Liscomb Falls fishway. Return rates are based on adults returning from 1- and 2-year old smolts released from the Cobequid or Mersey Fish Culture Stations (10,000 and 11,380 respectively, in 1993). The largest tributary to the main river, the Little Liscomb, has pH levels believed to be incapable of supporting Atlantic salmon.

State of the stock: The nominal target egg requirement of 2.4 eggs/m^2 has been met only once since 1979 (1987); a significant contribution to egg deposition comes from hatchery-origin fish of Liscomb River stock. The 1994 escapement resulted in egg deposition of only 13% of nominal target.

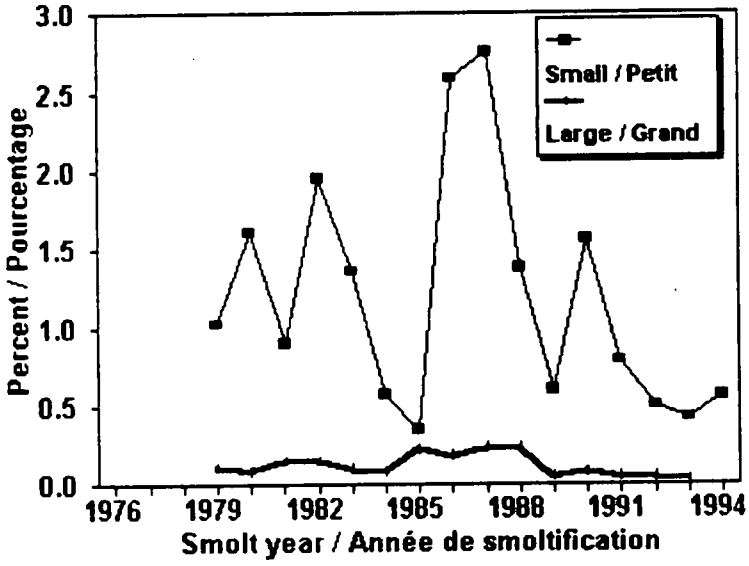
Forecast for 1995: Forecasts of small salmon are unavailable. An annually-updated relation between small salmon returns in year t and large salmon returns in year t + 1 predicts a return of 25 large salmon ($p<0.05$; 90% CI 0-81) in 1995.

Liscomb River - SFA 20





Hatchery smolt return to Liscomb Falls
Retour de smolt d'élevage



STOCK: Grand River, Richmond Co. (SFA 19)
TARGET: 1.1 million eggs, 545 adult salmon; 234 adult salmon above Grand River Falls

Year	1988	1989[1]	1990	1991[1]	1992	1993	1994	MIN[3]	MAX[3]	Mean[3]
First Peoples' harvest										
In-river			24	39						
Estuarial										
Angling catch										
Small	338	307	416	115	139	113	81	81	416	195
Large	105	74	98	15	46	22	10	10	98	44
% Caught and retained above the fishway									•	
		42	31	31	31	31	0			
Broodstock[2]	33	25	18	19	10	0	7			
Count at fishway										
Small	554	512	527	234	114	91	64	64	527	257
Large	31	25	27	18	18	5	5	5	27	16
% Hatchery			43	45	38	45	14	14	45	37
Fish which by-pass the fishway										
Small	55	51	52	176	40	32	96	32	176	74
Large	54	19	20	14	14	4	9	4	20	13
Population estimate above the fishway (small + large)										
	694	607	626	442	186	132	173	132	626	361
Estimated escapement above the fishway (small + large)										
		453	455	348	133	97	166	97	455	275
% of fish required										
above fishway		194	194	149	57	41	71	41	194	118
entire river		83	83	64	24	18	31	18	83	51

[1]Inseason variation closures.

[2]Broodstock collected at or above fish fishway

[3]Max, Min and Mean for the period 1988-1994

Harvests: There was no legal retention of small or large salmon in the angling fishery in 1994.

Data and assessment: The falls located 10.2 km from the head of tide is a partial barrier. A trap in the top of the fishway has been operated since 1988. Collections made above the fishway in October have been used to estimate the by-pass rate in 1989, 1991 and for small salmon in 1994. Phone surveys conducted in 1989 and 1990 to estimate proportion angled above. Fluvial area above is 2.33 million m^2 and below is 3.1 million m^2.

State of the stock: There is no consistent estimate for below the falls and escapement above is expressed relative to the entire production area and to the area above the falls only.

STOCK: Middle River, Victoria Co. (SFA 19)
TARGET: 2.07 million eggs (470 large, 80 small)

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[2]
First Peoples' harvest (small + large)										
In-river					38		15			
Estuarial[4]	45	53	65	127	75	40	0	0	158	61
Angling catch										
Small	52	51	107	27	11	30	31	0	158	41
Large	148	276	197	186	30	44	184	9	276	128
Visual counts by divers										
Wild small	-	7	53	18	56	2	48[3]	2	56	36
Wild large	-	323	208	244	211	31	442[3]	31	455	230
Hatchery small	-	5	16	0	0	0	0	0	16	3
Hatchery large	-	25	26	10	1	1	0	0	26	8
Proportion of holding area covered in visual counts										
	-	0.55	0.83	1.00	0.96	0.55	0.83	0.55	1.00	0.83
Estimated escapement of small and large salmon										
	-	655	365	272	241	62	475	62	655	283
% of adults required										
	-	119	66	49	44	11	86	11	119	54

[1]1974-93 for the angling catches and for the period shown for all other ranges.

[2]Average for 1990-94.

[3]Mark-Recapture estimate with 20% tag loss.

[4]Assumed 50% of the Wagmatcook harvest.

Harvests: First Peoples' food fisheries occur outside the estuary and in-river. About 130 large salmon have been allocated to the Wagmatcook Band since 1983. These salmon are traditionally harvested in gillnet fisheries in the Bras D'or Lake adjacent to Wagmatcook. Other Bands have harvested within the river. First Peoples' catches are as reported by DFO Fishery Officers and First Peoples' Guardians.

Data and assessment: Annual counts of adult salmon are conducted by teams of divers during mid to end October. Counts cover 55% to 100% of the adult holding area of the river. A mark-recapture estimate using diver observations was conducted for the first time in 1994. Some electrofishing was conducted in 1994.

State of the stock: Estimates of escapements declined steadily since 1989, were critically low in 1993, and improved in 1994.

STOCK: Baddeck River, Victoria Co. (SFA 19)
TARGET: 2.0 million eggs (450 large, 80 small)

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
First Peoples' harvest										
In-river										
Estuarial[2]	44	52	65	128	75	40	0	0	128	60
Angling catch										
Small	36	18	71	51	57	50	21	18	71	45
Large	175	243	182	213	165	105	92	92	243	167
Population estimate										
Wild small							36			
Wild large							196			
Hatchery small							0			
Hatchery large							1			
Estimated escapement (small + large)							232			
% of adults required							48			

[1]1989-1994 angling catch data.
[2]Assumed 50% of Wagmatcook fishery.

Harvests: First Peoples' food fisheries occur outside the estuary and in-river. About 130 large salmon have been allocated to the Wagmatcook Band since 1983. These salmon are traditionally harvested in gillnet fisheries in the Bras D'or Lake adjacent to Wagmatcook. Harvests within the river are unknown. There was no legal retention of small or large salmon in the angling fishery in 1994.

Data and assessment: A mark-recapture estimate using diver observations was conducted for the first time on October 19 and 20, 1994.

STOCK: North River, Victoria Co. (SFA 19)
TARGET: 0.85 million eggs (200 large, 30 small)

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
First Peoples' harvest										
In-river										
Estuarial										
Angling catch										
Small	135	160	268	186	178	69	77	69	268	156
Large	535	395	610	355	550	110	111	110	610	355
Population estimate										
Wild small							138			
Wild large							354			
Hatchery small							0			
Hatchery large							0			
Estimated escapement (small + large)							587			
% of adults required							255			

[1]1989-1994 angling data

Harvests: There was no legal retention of small or large salmon in the angling fishery in 1994.

Data and assessment: A mark-recapture estimate using diver observations was conducted for the first time on October 17, 18 and 20, 1994.

3.3 Prince Edward Island (SFA 17) and Gulf Nova Scotia (SFA 18)

General description

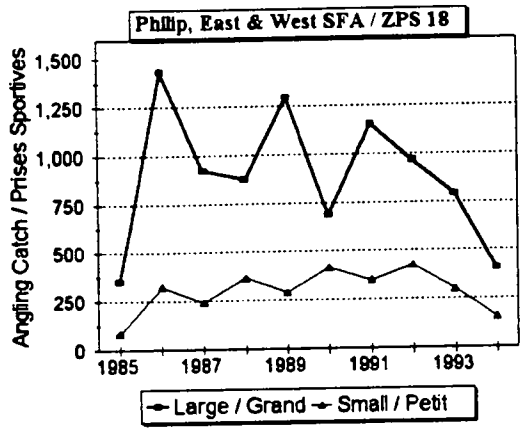
Rivers in Salmon Fishing Areas 17 and 18 are in Prince Edward Island and Gulf Nova Scotia. River assessments are provided for River Philip, East (Pictou), and West (Antigonish) in the mainland portion of Nova Scotia and the Margaree River in Cape Breton, Nova Scotia. These rivers represent about 70% of the total salmonid production area of Gulf Nova Scotia. The Morrell River in Prince Edward Island represents about 8% of the total rearing area of that province. The Nova Scotia rivers have salmon populations that consist of 75% large salmon. Mainland Nova Scotia rivers are primarily late run with most of the salmon returning after September 1. The Margaree River has early and late run components, with about 40% of the salmon returning before September 1 in most years. The Morrell River is primarily an early run small salmon river which is dependent upon hatchery stocking for more than 95% of the returns.

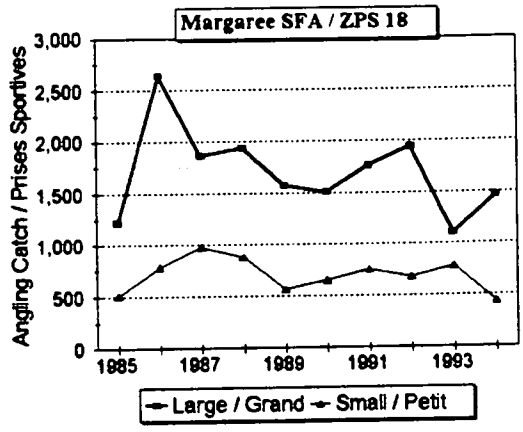
Hatchery reared progeny from the Margaree River Salmonid Enhancement Centre and the Cobequid Fish Culture Station (on River Philip) have been released exclusively to the Margaree River in the past five years. A streamside incubation box for the hatching of eggs and release of unfed fry to the Middle River (Pictou Co.) is ongoing. Numerous rivers in PEI have been stocked with hatchery progeny from the Cardigan Salmonid Enhancement Centre. These include: Morrell River, West River, Dunk River, Mill River, Valleyfield River and Midgell River. Only some of the hatchery released progeny in PEI were marked for identification at the returning adult stage.

Description of fisheries

Fishing agreements were signed with seven First Peoples bands in Nova Scotia for the harvest of salmon from the Margaree River, and several rivers within mainland Nova Scotia, primarily East River (Pictou Co.) totalling 306 small and 947 large salmon. Reported harvests were 34 small salmon and 261 large salmon in 1994. In PEI, an agreement for 400 small salmon from the Morell River was negotiated although none were taken because of the low returns to the Morell River in 1994.

Angling seasons in PEI and Gulf Nova Scotia were similar to previous years: for PEI from June 15 to Sept. 15 with variations depending upon the river, for Gulf Nova Scotia, Sept. 1 to Oct. 31 except for the Margaree River where the season opened June 1. The angling catch on the Morell River in 1994, estimated at 40 small salmon of which probably more than 75% were hatchery progeny, was the lowest recorded since 1984. Small salmon angling catches were down in every river in mainland Gulf Nova Scotia compared to 1993. Low water conditions throughout the fall have been indicated as a probable factor which kept salmon out of the rivers until well into November. Small salmon catches in the Margaree were the lowest since 1985 while large salmon catches were the third lowest. Hatchery fish made up 35% of the small salmon angling catch and 5% of the large salmon catch in the Margaree River in 1994.





There has not been any commercial salmon fishery or legal retention of bycatch in Gulf Nova Scotia since 1984. There are no salmonid aquaculture operations in the area.

Public consultations

A series of Science workshops was conducted during December 1994 for the Margaree River, for mainland Gulf Nova Scotia rivers and in PEI. These meetings were attended by angling groups, First Peoples, DFO Area staff, DFO Fisheries Officers, and Nova Scotia provincial biologists. Data collected by these groups were tabled at the meetings, assessment methodologies were described and preliminary stock status was presented and discussed. The data tabled at the meeting and discussions related to the analysis and interpretation were included in the assessment which was peer reviewed in February 1995.

Environmental considerations

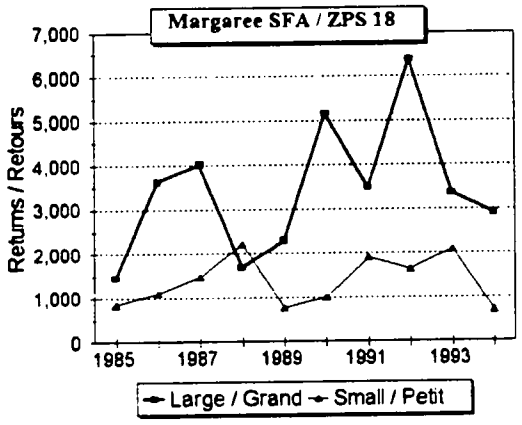
Monthly discharges in the Margaree River in 1994 were below historical means and these probably affected the timing of the returns of small and large salmon. Water levels were also low in the fall throughout the mainland Gulf Nova Scotia rivers. Temperatures were similar between rivers in the fall and these would not have delayed the fall returns.

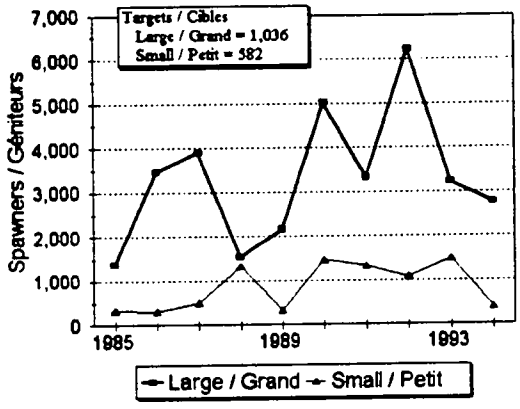
Status of the stocks

Returns to the Morell River are based on angling catches and counts at the Leard's Pond fishway located about 11 km above head of tide. Returns to mainland Nova Scotia rivers were derived from angling catches and exploitation rates based on the Margaree River assessment. Mark-recapture techniques using trapnets to mark fish and tag recoveries from angling, and counting fences were used to estimate returns to the Margaree River.

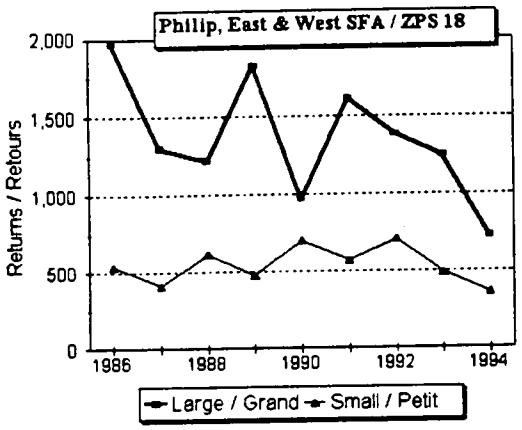
Returns of adipose-clipped small salmon to the Morell River in 1994 were very low. No 2+ smolts but about 19,000 1+ smolts were released in 1993. Releases in previous years were as high as 40,000 2+ smolts. Returns to Leard's Pond fishway were 28 small hatchery salmon and 8 wild small salmon, the lowest values since 1985 for hatchery salmon and the lowest since 1988 for wild small salmon. A total of 5 salmon were released upstream at Leard's representing an egg deposition equal to 9% of target.

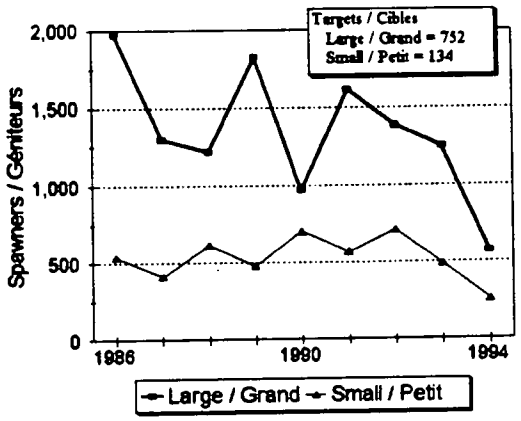
Returns of large salmon to the Margaree were 2900 large salmon and 708 small salmon. Large salmon escapement exceeded the target spawning requirements by almost 200%, the target has been exceeded each year since 1985. Wild large salmon accounted for 93% of the eggs deposited in 1994. Small salmon escapement was below target in 1994 but the spawning target has been exceeded in 5 of the last 10 years.





Estimated returns to all three mainland rivers were 44% to 74% less in 1994 than the previous 5-year mean values. Escapement estimates were similarly below mean values. Spawning escapement targets for large salmon were exceeded on West River (Antigonish Co.) but not on River Philip or East River (Pictou Co.). Although the angling catch method for estimating returns and escapement indicated that spawning escapement was not met on East River, a total of 226 large salmon were released from the Pictou Landing Band trapnet in the fall of 1994, a number equivalent to 80% of the target for large salmon, therefore, the spawning escapement target was probably met for this river. Large and small salmon spawning escapements have been above targets in Gulf Nova Scotia every year since 1988.





Prospects

Short term prospects (forecast for 1995) are available from estimates of sea-survivals of hatchery stocked smolts in the Morell River, and from stock and recruitment relationships for the Margaree River. Average returns is the only method of forecasting for the mainland Gulf Nova Scotia rivers.

Based on smolt releases in 1994 and estimates of wild salmon returns from natural production, the expected returns to the Morell River in 1995 should exceed 500 fish and thus be substantially above the target spawning requirements. For the mainland Gulf Nova Scotia rivers, returns are expected to exceed targets. For the Margaree River, the returns of large salmon are expected to exceed the target by 2.5 to 4 times.

Management considerations

Effects of current fishing practices

Stocking of Atlantic salmon in the Morell River has provided put-and-take angling opportunities in most years. The drastic declines in angling catches in 1994, following a year in which 2+ smolts were not released, underlines the importance of stocking the system to maintain fishing opportunities. The wild salmon stock does not appear to have benefited from any enhanced spawning escapement to the system.

The stocks of mainland Gulf Nova Scotia rivers are healthy in that spawning requirements have been met in recent years on each of the major rivers. Current fishing practices do not appear to be having a detrimental effect on these stocks.

The management objective for the Margaree River stock needs to be clarified. Managing for maximum recruitment to the river would be based on a target which is higher than that for maximum yield. Returns in recent years have exceeded both targets mentioned above such that the stock is in

good health and has not in recent years been threatened by over-exploitation. There is a great interest in harvesting and conserving the early returning salmon. As a result, determining a management definition and target for early salmon is an important issue.

Ecological considerations

The Morell River is a low gradient stream with 11 impoundments in its headwaters. These factors combine to make the Morell vulnerable to high water temperatures, especially in warm dry summers such as 1994. Excessive temperature is probably the major ecological concern. Brook trout are an equally important resource on PEI. Rainbow trout have been angled from the Morell River.

Brown trout are present in the mainland Gulf Nova Scotia rivers as well as in the Margaree River but to a lesser extent. Brook trout is a species of local interest in the Margaree River whose abundance has reportedly declined inversely to that of Atlantic salmon.

Summary sheets

More detailed information on individual assessments for the Morell River, River Philip, East River (Pictou), West River (Antigonish) and Margaree River are provided in the summary sheets.

STOCK: Morell River (SFA 17)
TARGET: Total system: 482,000 eggs (141 large salmon, 66 small salmon)
Above Leard's Pond Fishway: 202,000 (59 large salmon, 28 small salmon)
REARING AREA: Total system: 200,700 m^{2*}
Above Leard's Pond Fishway: 84,300 m^2

	1989	1990	1991	1992	1993	1994
Angling catch						
Large (released)	N/A	N/A	164	N/A	N/A	155
Small (released)	N/A	N/A	1033	N/A	N/A	N/A
Small (kept)	167	768	657	781	N/A	40
First Peoples' harvest						
Large	N/A	N/A	N/A	N/A	N/A	0
Small	N/A	N/A	N/A	N/A	N/A	0
Spawning escapement						
Large	48	44	14	14	0	3
Small	330	368	280	824	461	2
Percent target met (above Leard's)						
Large	81	75	24	24	0	5
Small	1179	1314	1000	2943	1646	7
%egg target met (above Leard's)	182	184	107	270	138	9

*Estimated rearing area has been updated based on new survey data.

Introduction: Atlantic salmon were almost extirpated on Prince Edward Island in the 19th and early 20th centuries, but stocking and habitat restoration have brought back substantial runs on the Morell River, which is PEI's most important angling stream. The present fishery is based largely on fish raised in semi-natural ponds and stocked as 2+ smolts, but some naturally-reared fish are also part of the run.

Description of fisheries: The salmon fishery on the Morell River opens on 1 June and closes from 15 September to 30 November, depending on location. Anglers are permitted to retain up to seven small salmon per season. No retention of large salmon is permitted.

Target: 141 large and 66 small salmon are needed to meet the Morell's spawning requirements, and 117 large and 54 small salmon are needed for broodstock at the Cardigan Salmonid Enhancement Centre.

Fishery data: A creel census produced estimates of 4911 salmon rod-days on the Morell in 1994. No retained small salmon were reported in the census, but anecdotal information suggests that about 40 small salmon were caught and retained in 1994, which is less than 10% of the kill of most previous years.

Research data: Numbers of small salmon ascending the fishway at Leard's Pond in the upper portion of the river declined dramatically from previous years, but numbers of large salmon rose. Juvenile salmon densities measured at six electrofishing sites, scaled up for the entire river, produced population estimates for the Morell of 36,995 0+ fish and 15,633 1+ fish.

Estimation of stock parameters: Counts of salmon ascending the fishway at Leard's Pond are the centrepiece of Morell salmon data, but total run size cannot be estimated from these movements because the proportion of fish that remain below the fishway is not known.

Assessment results: Numbers of salmon ascending the Leard's fishway were much below spawning requirements for the Morell. Most of the fish that did ascend were taken for broodstock, and only five salmon were released into the pond above.

Ecological considerations: The major habitat issue on the Morell is high water temperatures during warm summers. The planned dewatering of some of the Morell's headwater impoundments in 1995 may aid salmon by cooling water temperatures.

Forecast/Prospects: The low numbers of small salmon returning in 1994 can be viewed as an aberration due to the absence of stocking of 2+ smolts in the previous year. Numbers of small salmon should recover in 1995 but returns of large salmon cannot be predicted because the at-sea survival of salmon released as 1+ smolts is not known. Based on extrapolations of electrofishing densities, 156 salmon should return in 1996 and 1997 from naturally reared smolts going to sea in spring 1995.

Management considerations: The spawning target was not met in 1994 because of the collapse of small salmon numbers.

Research recommendations: Research should be conducted to measure the seaward exodus of smolts in the spring of 1995 and to test fry production in the area above Leard's where only five fish were released in 1994. The possibility that fish may circumvent the fish counting facility should also be investigated.

STOCK: Margaree River (SFA 18)
TARGET: 6.7 million eggs (1,036 large, 582 small salmon)

Year	1989	1990[1]	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
Angling catch[3]									
Large	1570	1507	1757	1938	1102	1466	1102	2636	1575
Small	561	649	752	678	777	434	434	977	683
First Peoples' harvest									
Large	-	-	1	-	58	50			-
Small	-	-	2	-	8	14			-
Total returns									
Large	2289	5156	3484	6375	3358	2900	1462	6375	4132
small	768	1977	1909	1645	2087	708	708	2209	1677
Spawning escapement									
Large	2164	5022	3323	6222	3224	2759	1378	6222	3991
Small[4]	328	1471	1340	1088	1504	390	328	1504	1146
% of Egg target met (Large)									
	209	485	321	601	311	266	133	601	385

[1] Total returns and spawning escapement estimates for 1990 have been revised using average trapnet efficiencies.

[2] Min, Max are for 1985 to 1994. Mean for 1989 to 1993.

[3] All angling catches are NS license stub estimates. Angling catches for large salmon are hook and release estimates.

[4] Small spawning escapement has been updated, as previous removal estimates included both retained and released small

Description of fisheries: Harvests occurred in recreational and First Peoples' fisheries. Recreational season was from June 1 to Oct. 15 with an extension in the lower part of the river to Oct. 30. Food fishery agreements were signed with Wagmatcook, Membertou, Chapel Island, Eskasoni, and Waycobah First Nations. Wagmatcook and Membertou were the only First Nations to fish and all their harvest occurred in the fall.

Fishery Data: Depends on voluntary sampling in First Peoples' fisheries and angler logbooks. Abundance indices from angling are more similar to population estimates for small than for large salmon.

Research Data: Tagging at estuarial trap and recaptures at Lake O'Law counting fence and logbook anglers provide raw data for population estimates by mark-recapture methods. Electrofishing surveys provide information on juvenile populations. Most small salmon enter the river in the summer, most large salmon in the fall. Juvenile densities are consistent with spawning requirements being met in recent years.

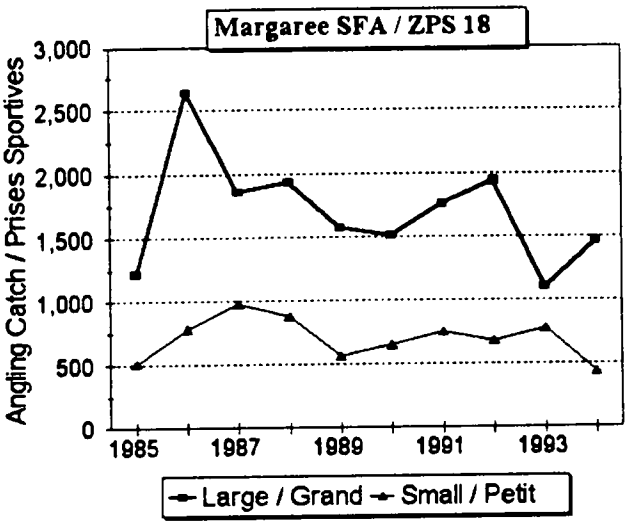
Estimation of stock parameters: Population is estimated using mark-recapture techniques. The assumption of equal mixing and vulnerability is tested by comparing tagged to total catch ratios from Lake O'Law fence and angler logbooks, tag loss is estimated by experiments at the hatchery, and sampling intensity is tested by simulations. These requirements were found to be satisfied.

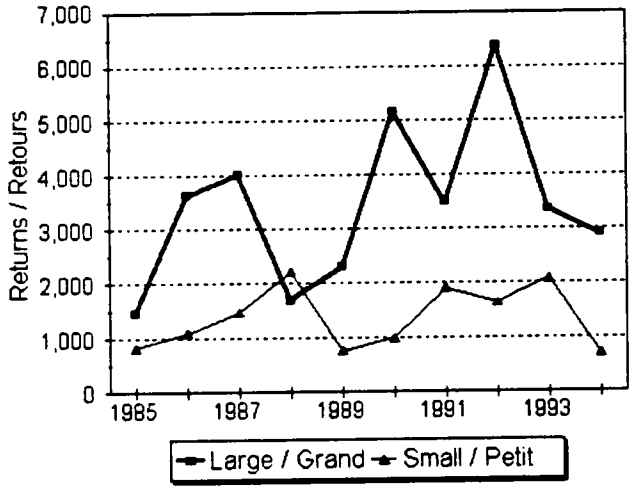
Assessment results: Large salmon spawning escapement exceeded requirements but small salmon did not. Large salmon have exceeded requirements in each of the last 10 years, small salmon requirements have been met in 5 of the last 10 years.

Ecological considerations: Temperatures in all parts of the river were higher in 1994 than 1993. Stream discharge was among the lowest and summer returns were the latest on record.

Future prospects: Forecasts for 1995 are 2731 large salmon using a Ricker stock-recruitment model, 4236 large salmon using a Beverton-Holt model, and 4687 using a Tabular model.

Management considerations: Forecasts are well above spawning targets. Allocations based on these forecasted surpluses should take into account average run-timing as they have in the past.


Margaree SFA / ZPS 18
Angling Catch / Prises Sportives
3,000
2,500
2,000
1,500
1,000
500
0
1985
1987
1989
1991
1993
Large / Grand
Small / Petit


Returns / Retours
7,000
6,000
5,000
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3,000
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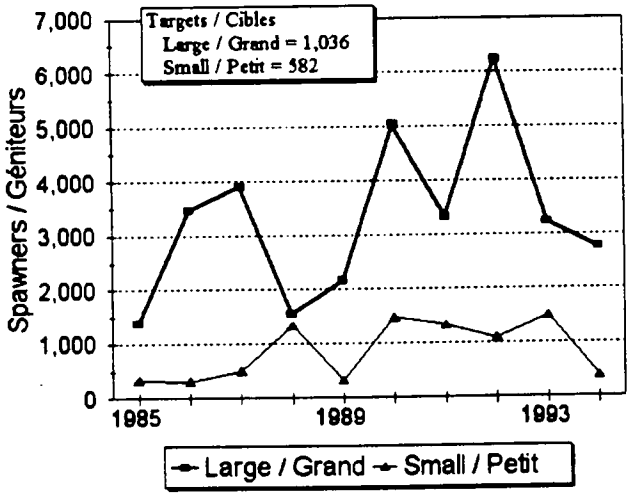
1985
1987
1989
1991
1993
Large / Grand
Small / Petit


Targets / Cibles
Large / Grand = 1,036
Small / Petit = 582
Spawners / Géniteurs
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1985
1989
1993
Large / Grand
Small / Petit

STOCK: River Philip (SFA 18)
TARGET: 2.3 million eggs (358 large, 75 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
Angling catch[1]									
Large[1]	407	191	421	322	338	184	184	421	336
Small	114	155	164	179	167	88	76	179	156
First Peoples' harvest									
Large	-	-	-	-	50	15			-
Small	-	-	-	-	0	9			-
Total returns									
Large	566	279	578	461	474	281	279	578	472
small	254	362	360	398	373	198	169	398	349
Spawning escapement									
Large	561	276	573	457	469	264	264	573	467
Small	187	268	262	292	276	137	124	292	257
% of Egg target met (large)									
	157	77	160	128	131	74	44	160	131

[1] All angling catches are NS license stub estimates. Large salmon angling catch for 1986 to present is hook-and-release estimates.

[2] Min, Max are for 1986 to 1994. Mean for 1989 to 1993.

Description of fisheries: Harvests occurred in recreational and First Peoples' fisheries. A food fishery agreement was signed with Millbrook First Nation. Harvest under this agreement was 9 small salmon and 15 large salmon. Recreational catches on River Philip were about half the mean and 1993 values in 1994.

Fishery Data: Depends on voluntary sampling in First Peoples' fishery and angler logbooks. Catch rates in angler logbooks show declines in small salmon abundance but increases in large salmon. A food fishery trapnet on River Philip operated for three weeks but showed the greatest catches on Oct. 28 with very few salmon being caught after the angling season.

Research Data: No research data were collected in 1994. Electrofishing surveys are scheduled for 1995.

Estimation of stock parameters: Returns are calculated using fall fishery exploitation rates from the Margaree River and License Stub return estimates of small and large salmon catches.

Assessment results: Spawning escapement estimates were below target for large salmon but not for small salmon.

Ecological considerations: Water temperatures at River Philip recording site did not rise above 21 degrees in 1994 and were much cooler than sites on East River Pictou and West River Antigonish.

Future prospects: Average returns indicate that target spawners are likely to be met in 1995.

Management considerations: Low water conditions may have caused escapement to be under-estimated in 1994 because of poor angling conditions.

STOCK: East River (Pictou Co.) (SFA 18)
TARGET: 1.8 million eggs (281 large, 59 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
Angling catch[1]									
Large	670	299	440	371	221	89	89	670	400
Small	87	109	121	111	56	24	24	129	97
First Peoples' harvest									
Large	-	-	-	-	139	141			-
Small	-	-	-	-	-	5			-
Total returns									
Large	942	407	619	523	456	265	265	942	589
small	196	247	270	251	127	60	60	303	218
Spawning escapement									
Large	933	403	614	519	313	123	123	933	556
Small	143	182	200	184	92	41	41	223	160
% of Egg target met (large)									
	332	143	219	185	111	44	44	332	198

[1] All angling catches are NS license stub estimates. Large salmon angling catch for 1986 to present is hook-and-release estimates.

[2] Min, Max are for 1986 to 1994. Mean for 1989 to 1993.

Description of fisheries: Harvests occurred in recreational and First Peoples' fisheries. A food fishery agreement was signed with Pictou Landing First Nation. Harvests under this agreement occurred on East River Pictou, West River Pictou, Merigomish Harbour, and River John by trapnets, gillnets, and angling. Recreational catches on East River Pictou were about 70% of the mean and 1993 values in 1994.

Fishery Data: Depends on voluntary sampling in First Nation fishery and angler logbooks. Catch rates in angler logbooks show declines in small salmon abundance but increases in large salmon. A food fishery trapnet on East River Pictou operated from September 27 to November 5. A total of 146 fish were harvested from the trapnet with 273 fish released. A total of 78 fish entered the trapnet after the angling season.

Research Data: Juvenile surveys by electrofishing indicated parr levels above 27 parr/100 m^2.

Estimation of stock parameters: Returns are calculated using fall fishery exploitation rates from the Margaree River and License Stub return estimates of small and large salmon catches.

Assessment results: Spawning escapement estimates were below target for both large and small salmon.

Ecological considerations: Water temperatures at East River Pictou recording site were above 20 degrees for the months of July and August in 1994. Water temperatures were much higher in 1994 than 1993.

Future prospects: Average returns indicate that target spawners are likely to be met in 1995.

Management considerations: Low water conditions may have caused escapement to be under-estimated in 1994 because of poor angling conditions.

STOCK: West River (Antigonish Co.) (SFA 18)
TARGET: 0.4 million eggs (113 large, 0 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
Angling catch[1]									
Large	218	200	294	277	248	131	126	476	247
Small	90	152	65	136	66	46	46	152	102
First Peoples' harvest									
Large	-	-	-	-	-	-			-
Small	-	-	-	-	-	-			-
Total returns									
Large	316	284	414	398	339	181	175	649	350
small	200	342	146	312	148	105	105	342	230
Spawning escapement									
Large	314	281	410	395	335	180	173	645	347
Small	147	253	108	233	108	77	77	253	170
% of Egg target met (large)									
	278	249	363	350	296	159	153	571	307

[1] All angling catches are NS license stub estimates. Large salmon angling catch for 1986 to present is hook-and-release estimates.

[2] Min, Max are for 1986 to 1994. Mean for 1989 to 1993.

Description of fisheries: Harvests occurred in recreational fisheries. No food fishery agreements were signed with First Peoples' for fishing on West River Antigonish. Recreational catches on West River Antigonish were about 50% of the mean and 1993 values in 1994.

Fishery Data: Depends on voluntary angler logbooks. Catch rates in angler logbooks show increases in small salmon abundance but decreases in large salmon.

Research Data: Juvenile surveys by electrofishing indicated parr levels above 71 parr/100 m^2.

Estimation of stock parameters: Returns are calculated using fall fishery exploitation rates from the Margaree River and License Stub return estimates of small and large salmon catches.

Assessment results: Spawning escapement estimates were above targets for both large and small salmon.

Ecological considerations: Water temperatures at the West River Antigonish recording site were above 20 degrees for the months of July and August in 1994.

Future prospects: Average returns indicate that target spawners are likely to be met in 1995.

Management considerations: Low water conditions may have caused escapement to be under-estimated in 1994 because of poor angling conditions.

3.4 Gulf New Brunswick (SFAs 15 and 16)

General description

Rivers in Salmon Fishing Areas 15 and 16 are included in Gulf New Brunswick. River assessments in this area are provided for Restigouche, Jacquet, Nepisiguit, Tabusintac, Northwest Miramichi, Southwest Miramichi, Richibucto and Bouctouche rivers. The Restigouche is an early run river with most salmon returning before the end of August and on average the returns are 50% small and 50% large salmon. The Nepisiguit, Northwest and Southwest Miramichi rivers have both early and late run components and about 25% to 30% of the returns to these rivers are large salmon. The Jacquet, Tabusintac, Richibucto, and Buctouche rivers are primarily late run rivers with most of the returns entering the river after September 1. About 60% of the returns to these rivers are large salmon. The Northwest and Southwest Miramichi rivers together comprise about 60% of the rearing area in Gulf New Brunswick and the Restigouche about 30% of the area. The rivers assessed in 1994 represent 93% of the total rearing habitat area.

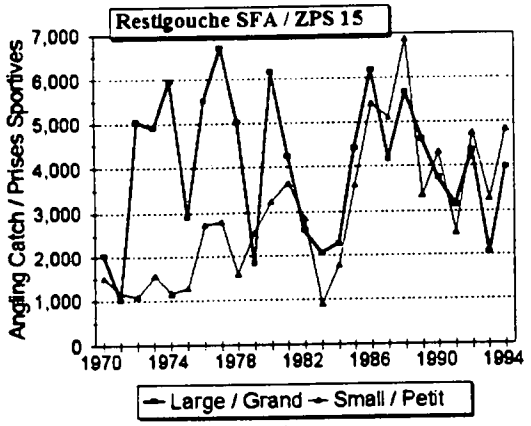
Hatchery stocking in the last five years has occurred in the Restigouche River, Tetagouche River, Nepisiguit River, the Big Tracadie River, the Northwest Miramichi and the Southwest Miramichi rivers. A large portion of the hatchery stocking is of unmarked stages especially unfed and feeding young-of-the-year. Smolt stocking has occurred exclusively in the Miramichi River system. There is no salmonid aquaculture activity in Gulf New Brunswick.

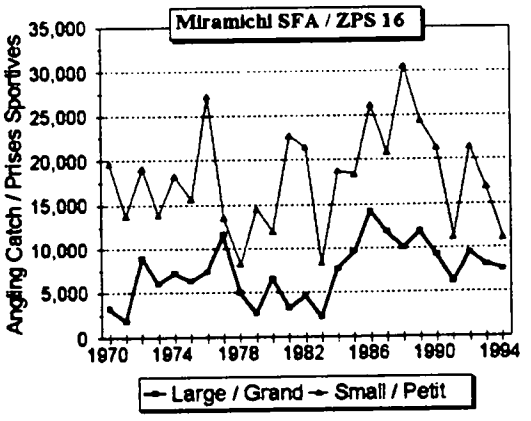
Description of fisheries

Food fishery agreements were signed with six First Peoples in Gulf New Brunswick in 1994. Harvest allocations, by size group. and gear limits were included within the terms of the agreements. Total harvests from Gulf New Brunswick water, by First Peoples in 1994 were about 4500 small and 1500 large salmon.

There has not been any commercial fishery or legal retention of bycatch of Atlantic salmon in Gulf New Brunswick since 1984.

The major recreational fisheries occur on the Restigouche River and the Northwest and Southwest Miramichi rivers. Angling seasons varied by individual rivers. Effort was essentially unchanged from the previous five years. The catches of small salmon from the Restigouche River in 1994 were the fourth highest recorded since 1970 and 33% above the previous five-year average. Small salmon catches in the Miramichi River were the second lowest since 1984. Large salmon catches in 1994 were also above the previous five-year average in the Restigouche but they were the lowest since 1984 in the Miramichi River.





Public consultation

A series of Science workshops was conducted during November and December 1994 for each of the rivers assessed. These meetings were attended by angling groups, First Peoples, DFO Area staff, DFO Fisheries Officers, and Quebec (Ministère de l'Environnement et de la Faune) and New Brunswick (Department of Natural Resources and Energy) biologists. Data collected by these groups were tabled at the meetings, assessment methodologies were described and preliminary stock status was presented and discussed. The data tabled at the meeting and discussions related to the analysis and interpretation were included in the draft assessment prepared by the team leader which was subsequently peer reviewed in February 1995.

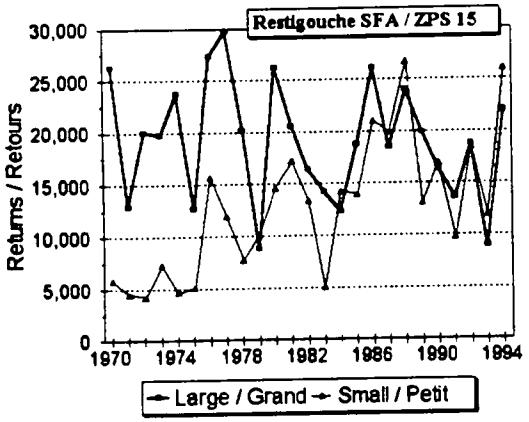
Environmental considerations

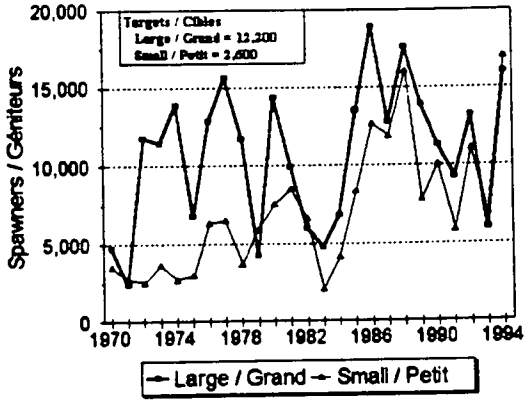
Major ice jamming occurred in the Miramichi and in the Restigouche in the spring of 1994.This was followed by high discharges in the spring for the Restigouche River. In August to October, the precipitation and discharge levels were below normal throughout Gulf New Brunswick. These low discharge conditions in the fall delayed the migration of salmon into the headwater and tributary streams of the Miramichi River.

Status of the stocks

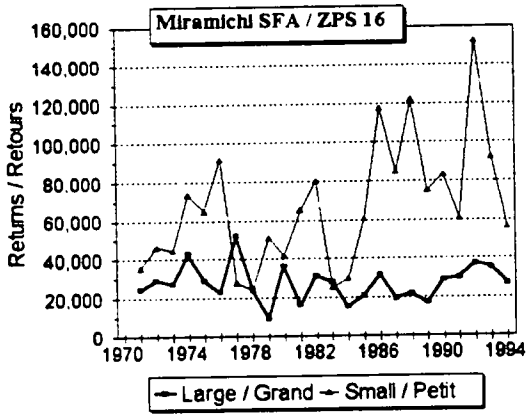
Except for the Jacquet River and the Nepisiguit River (SFA 15) where counting fences were used to enumerate all the fish, the returns to the rivers were estimated using mark and recapture techniques. Trapnets were used to mark fish entering the river and recaptures of tags at upriver trapnets, angling fisheries, and counting fences were used to estimate the population size.

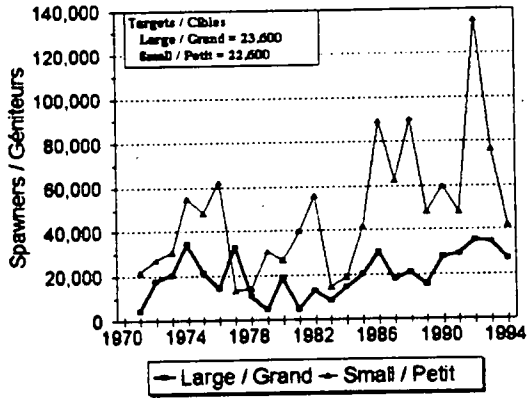
Returns and spawning escapement of small and large salmon to the Restigouche River in 1994 were double the values of 1993 and the spawning escapement target was attained.





Returns of both small and large salmon to the Miramichi River were down in 1994 compared to the previous five years; for small salmon, returns in 1994 were the lowest in 10 years but large salmon returns were the third highest. Spawning targets were met in the Northwest and Southwest Miramichi rivers.





Spawning targets were exceeded in both the Jacquet River and the Tabusintac River. Escapement to the Nepisiguit River was 59% of target while escapement to the two rivers (Bouctouche and Richibucto) flowing into Northumberland Strait were less than half the target.

Prospects

Short term prospects (forecasts for 1995), are available using small salmon returns to predict large salmon returns the following year, spawner to recruit relationships and smolt enumerations. For the Miramichi River, a small salmon to large salmon relationship indicates that the large salmon returns in 1995 will exceed the target spawning requirements. Trends in smolt migrations and

subsequent returns of small salmon the following year at Catamaran Brook, a tributary stream of the Northwest Miramichi, would suggest that small salmon returns in 1995 should be greater than those of 1994, and therefore well above target. A spawner to recruit relationship for the Nepisiguit indicates that the returns in 1995 will be below target. Qualitative forecasts for the Restigouche River indicate returns in 1995 should exceed the target for small and probably equal the target for large salmon. In-season forecasting could be used for the Miramichi River and the Nepisiguit River.

A long term view, beyond 1995, is obtained by looking at spawning escapement levels in recent years relative to target, and time series of juvenile densities, In the Miramichi River, the spawning target has been exceeded in eight of the last ten years. Juveniles densities as measured at index sites in the Miramichi have increased in response to the increased spawning escapement and are now at the highest levels recorded since the time series began in 1970. Juvenile densities in the Restigouche River since 1986 have been more than twice the levels observed in the 1970 to 1985 time period. For the two main rivers in Gulf New Brunswick (Restigouche and Miramichi), whether the increased freshwater production in recent years results in increased returns of salmon to the rivers depends upon the marine conditions. The Catamaran Brook smolt to small salmon survivals are high but variable; other indices of marine survival are nonexistent for these stocks.

Management considerations

Effects of current fishing practices

Current fishing practices do not seem to be having an adverse effect on Miramichi and Tabusintac rivers as spawning requirements have been exceeded in most years. The Bouctouche and Richibucto rivers have had returns well below spawning requirements and there is no harvestable surplus. In the Restigouche River, the level of large salmon harvests in both the First Peoples' food fisheries and in the recreational fisheries are resulting in spawning escapements which have been on average 92% of target. Surpluses of small salmon have occurred annually in the Restigouche and escapements have exceeded the target.

Ecological considerations

Abnormally low water conditions in the fall of 1994 delayed the migration of salmon into the smaller rivers of Gulf New Brunswick and into the headwater tributaries of the Miramichi and Restigouche rivers. Spring run-off pH depression was noted in a tributary of the Northwest Miramichi and habitat limitations may be as important as spawning escapement levels in explaining the low juvenile densities in one of the major tributaries (Little Southwest Miramichi) of the Miramichi River. There are no concerns in Gulf New Brunswick rivers regarding aquaculture escapees or foreign species intrusions. Negative interactions between brook trout and salmon are of concern to numerous angling associations who are equally interested in trout stocks.

Research recommendations

- On all the river systems using mark and recapture methods to estimate returns, there is a pressing need to develop larger and more reliable recapture programs. On small river systems, mark and recapture may not be a useful approach and alternate ways of estimating returns should be considered.

- With increased interest and participation by user groups, there is a potential to collect a large amount of data in a short time frame. Both juvenile surveys and visual counts of spawners must be standardized and validated against known values.

Summary sheets

More detailed information on individual assessments for the Restigouche River, Jacquet River, Nepisiguit River, Tabusintac River, Miramichi River system, Northwest Miramichi River, Southwest Miramichi River, Richibucto River, and Bouctouche River are provided in the summary sheets.

Stock: Restigouche River (SFA 15)
Target: 71.4 million eggs (12,200 large salmon, 2,600 small salmon)
Rearing area: 29.8 million m^2, 76% of SFA 15 area, 30% of Gulf New Brunswick (SFA 15 & 16)

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[2]
Angling catch									
Large	4603	3735	3137	4355	2055	3979	1016	6707	3577
Small	3360	4324	2522	4751	3268	4840	896	6873	3645
First Peoples' harvest									
Large	1649	1606	1111	1412	1194	1333	129	2950	1394
Small	163	136	19	55	0	47	0	178	75
Spawning escapement (mark-recapture method)[3]									
Large (000's)	-	-	-	-	6 (4-9)	16 (12-26)	6	16	11
Small (000's)	-	-	-	-	7 (5-12)	17 (12-29)	7	17	12
Total returns (mark-recapture method)[3]									
Large (000's)	-	-	-	-	9 (7-13)	22 (18-34)	9	22	16
Small (000's)	-	-	-	-	12 (10-18)	26 (20-40)	12	26	19
% egg target met (mark-recapture method)[3]									
	-	-	-	-	48 (37-76)	137 (105-218)	48	137	92
Spawning escapement (angling exploitation method)[4]									
Large (000's)	7-13	6-11	5-9	7-13	3-6	6-12	1-2	11-19	6-10
Small (000's)	3-8	4-10	3-6	5-11	3-8	5-11	1-2	10-16	4-9
Total returns (angling exploitation method)[4]									
Large (000's)	13-20	10-16	9-14	12-19	6-9	11-17	6-9	23-26	10-16
Small (000's)	8-13	10-17	6-10	11-18	8-13	11-19	3-4	16-26	9-14
% egg target met (angling exploitation method)[4]									
	65-116	53-95	43-78	62-111	28-52	56-101	9-20	89-159	50-90

[1] MIN MAX for years 1970 to present.

[2] MEAN for years 1989 to 1993.

[3] Most probable value with 95% confidence limits.

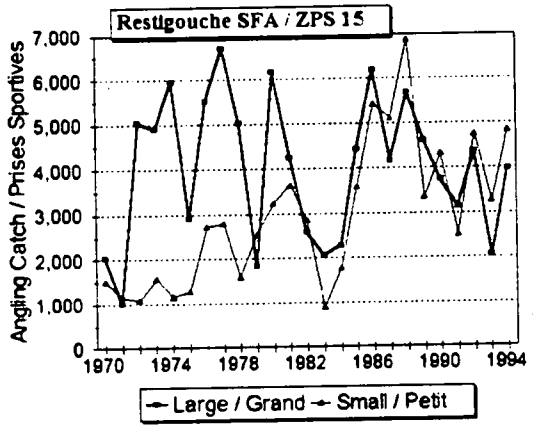
[4] Range given reflects uncertainty of angling exploitation rate (assumed to be between 0.3 and 0.5).

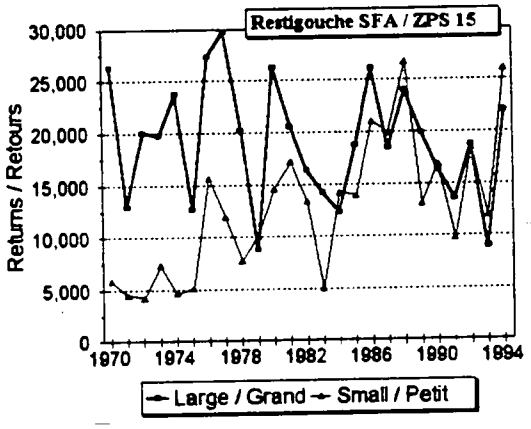
Landings: Angling catches of large (including catch and release in N.B.) and small salmon in 1994 were 11 and 33% higher than the five-year means, respectively. Estimated First Peoples' harvest was 6% below the five-year mean.

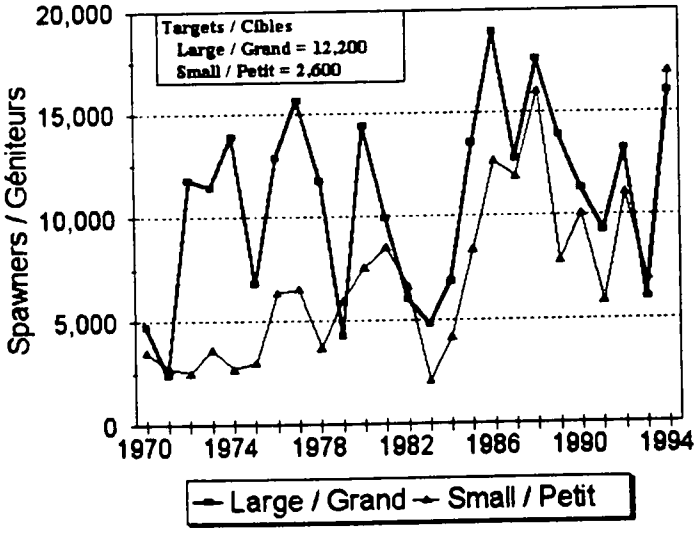
Data and assessment: In 1989-1992 the assessment was based only on angling catch and an assumed exploitation rate of 0.3-0.5. A mark-recapture experiment was used to estimate river population and spawning escapement in 1993 and 1994 and this estimate is presented along with that of the earlier method. In 1994, mark-recapture population estimates are about three times higher than the most conservative angling-based estimates. Canoe surveys of spawners were in agreement with the angling-based estimate with an exploitation rate of 0.5. The mark-recapture estimate may be the most scientifically defensible, but for management purposes the angling-based estimate is more conservative.

State of the stock: Egg deposition was 137% (C.L. 105-218%) (mark-recapture estimate) or 56-101% (angling-based estimate) of target. According to the mark-recapture estimate, both large and small salmon escapements were met or exceeded. According to the angling-based estimate, large salmon spawning escapement target was not met but the small salmon spawning target was exceeded.

Forecast for 1995: Based on mean returns from 1990-1994, between 9,500-16,500 large salmon and 9,000-17,500 small salmon are expected to return in 1995. The ranges given reflect upper and lower exploitation rates used in calculating returns, not confidence limits.







STOCK: Jacquet River (SFA 15)
TARGET: 2.74 million eggs (320 large salmon, 180 small salmon)
REARING AREA: 1.135 million m^2

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[2]
Angling (bright salmon)									
Large (Released)	42	58	23	95	--	100	23	105	55
Small (Retained)	70	82	56	105	--	33	33	110	78
Spawning escapement									
Large	--	--	--	--	--	493	--	--	--
Small	--	--	--	--	--	486	--	--	--
Total returns									
Large	--	--	--	--	--	595	--	--	--
Small	--	--	--	--	--	613	--	--	--
% egg target met (large salmon only)									
	--	--	--	--	--	154	--	--	--

[1] Min and Max are for 1984-1994
[2] Mean is for 1989-1993

Landings: Small and large salmon angling catches were lower and higher than average, respectively.

Data and assessment: Salmon spawning escapement has been estimated from returns to a counting fence in conjunction with harvest statistics. Poaching mortalities are estimated at 16% for large and 14% for small salmon (based on the Restigouche assessment).

State of the stock: The estimated spawning escapement of large salmon was 493 in 1994, well above requirements for the system. Small salmon spawning escapement of 486 was also above requirements. The estimated egg deposition was 54% above target.

STOCK: Nepisiguit River (SFA 15)
TARGET: 9.6 million eggs (1363 large salmon, 690 small salmon)
REARING AREA: 3.973 million m^2, 30% of SFA 15, 4% of Gulf New Brunswick

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[2]
Angling catch									
Large (Released)	490	300	300	270	258	250	60	600	374
Small (Retained)	600	500	700	800	470	380	229	1000	690
First Peoples' Harvest									
Large	n/a	n/a	n/a	n/a	50	0			
Small	n/a	n/a	n/a	n/a	200	0			
Spawning escapement									
Large	1239	1117	1026	336	925	773	109	2381	1083
Small	309	1593	2164	1092	836	587	309	2900	1316
Total returns									
Large	1568	1390	1290	642	1084	892	545	2700	1373
Small	968	2152	2930	1974	1511	984	562	2930	2104
% egg target met									
	92	89	85	29	72	59	9	187	85

[1]Min and Max are for 1982-1994.
[2]Mean is for 1989-1993.

Landings: Small and large salmon angling catches were the lowest since 1985. First Peoples' harvest in 1994 is assumed to be 0.

Data and assessment: Salmon spawning escapement has been estimated from returns to a counting fence in conjunction with harvest statistics. For the years 1990, 1991, 1993 and 1994 counting fence returns were estimated using the relationship between fence counts and angling catch above the fence. Spawning escapement below the fence was estimated using the distribution of spawning redds above and below the fence. Total returns below the fence were then calculated as the sum of spawning escapement plus removals.

State of the stock: The estimated spawning escapement of large salmon was 773 in 1994, well below requirements for the system. Small salmon spawning escapement of 587 was also below requirements for the first time in four years.

Forecast for 1995: A Ricker recruitment model indicates that returns of wild (i.e. non-adipose clipped) large salmon in 1995 will most likely be between 800 and 900 fish, with an 87% probability that returns will exceed the 1994 figure of 869 wild fish.

STOCK: Tabusintac River (SFA 16)
TARGET: 1.978 million eggs (363 large salmon, 236 small salmon)[1]

	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
Angling catch									
Large (Released)	165	80	84	488	191	102	25	488	202
Small (Rel + Kept)	184	95	154	330	258	110	15	330	204
First Peoples' harvest									
Large				270	101	44			
Small				126	79	30			
Spawning escapement									
Large					667	1214			
Small					348	844			
Total returns									
Large					799	1414			
Small					599	1067			
Percent target met									
Large					179	334			
Small					174	358			
% egg target met									
					184	345			

[1]New habitat estimates from New Brunswick Department of Natural Resources & Energy based 2.4 egg/m^2.
[2]Angling catch min. max apply to1969 to 1993; mean applies to 1989 to 1993.

Description of Fishery: Salmon are angled in leased and public water; catch and effort data for 1994 are preliminary. Burnt Church First Nation harvests salmon by gillnet and trapnet.

Research Data: Tags applied at trapnets and recaptured in the angling fishery were the basis for the assessment. Biological data were collected on the stock and juvenile densities were determined at 18 sites.

Estimation of Stock Parameters: A Bayesian estimator was used to calculate small salmon returns from angling recaptures; large salmon returns were calculated from the large:small ratio.

Assessment Results: Spawning escapement was met for large and small salmon in 1994.

Ecological Considerations: Low water conditions delayed the upstream movement of salmon and reduced the angling catch in lease water.

Management Considerations: There is a harvestable surplus of salmon from the Tabusintac River; the amount of this surplus is not predictable.

Stock: Miramichi River (SFA 16)
Target: 132 million eggs (23,600 large, 22,600 small salmon)

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[6]
Angling catch[2]									
Large	11928	9258	6147	9476	8131	5129	1792	14215	8988
Small	24382	21372	11300	21482	16898	11203	8310	30586	19087
First Peoples' harvest[3]									
Large	540	609	544	608	208	124	124[5]	898[5]	502
Small	1085	2110	1111	1652	601	2977	100[5]	2977[5]	1312
Other removals [4]									
Large	153	99	131	142	166	119	99[6]	166[6]	138
Small	155	142	189	198	236	270	142[6]	270[6]	184
Spawning escapement									
Large (000's)	16	28	29	36	35	27	4	36	29
Small (000's)	48	60	48	135	76	42	13	135	73
Total returns									
Large (000's)	17	29	30	37	35	27	9	52	30
Small (000's)	75	83	61	153	92	56	24	153	93
% Egg target met	98	152	159	242	170	130	23	242	164

[1] MIN MAX over the period 1971-1994 unless stated otherwise.

[2] Angling harvest of hook and release estimates of catch.

[3] First Peoples' harvest includes catch reported by Burnt Church, Red Bank, and Eel Ground Indian Bands.

[4] Other removals includes broodstock removals, mortalities at all index traps, and all samples.

[5] For 1975 to 1994.

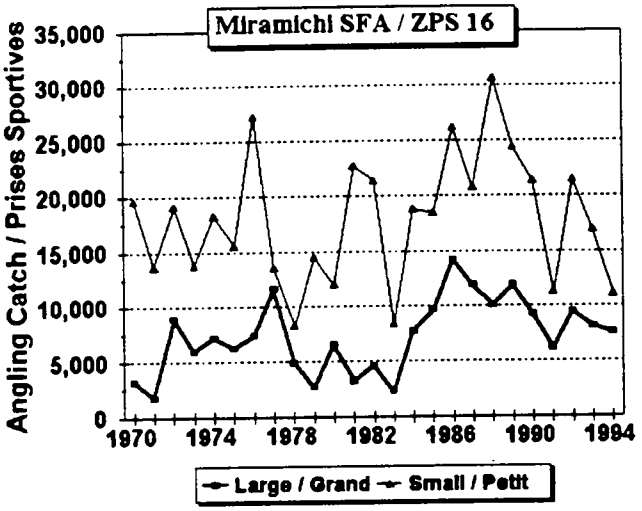
[6] For 1989 to 1993.

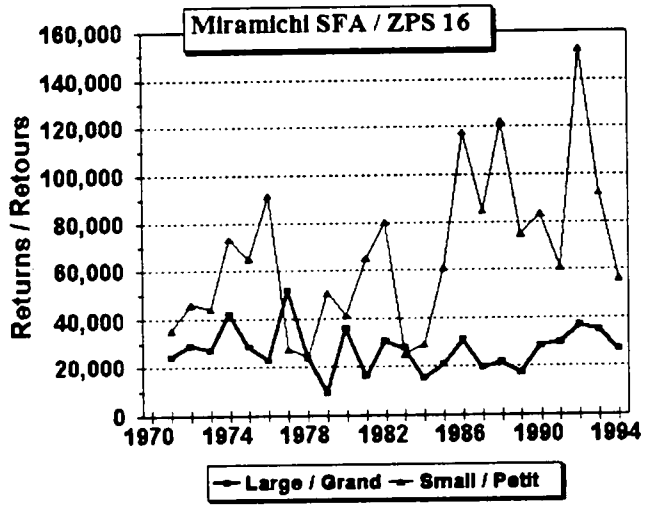
Recreational catches: Have ranged from 6147 to 14,215 large and 11,165 to 30,586 small salmon during the past 10 years. Effort in rod-days has increased in recent years. Large salmon catches in 1994 were 16% below and small salmon catches were 42% below previous 5-year average.

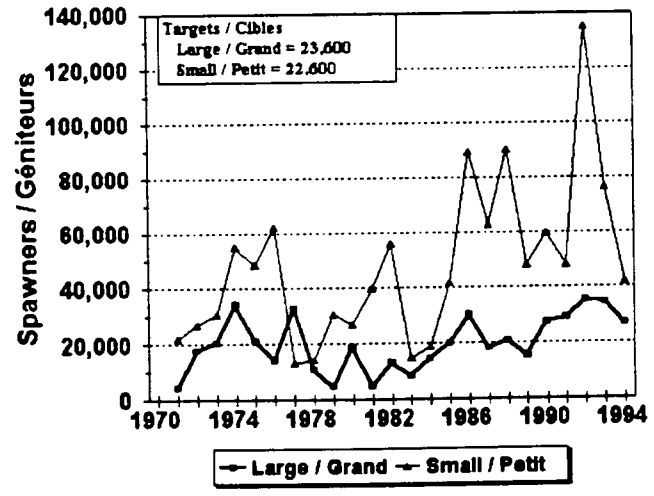
Data and assessment: For 1989-1991, returns were estimated from trap efficiency at a DFO trap operated in the estuary of the Miramichi River at Millbank. The efficiency of this trap was calibrated from tag recapture experiments in 1985 through 1992. Index traps were operated in the estuaries of the Northwest and Southwest Miramichi rivers in 1992, 1993, and 1994. Returns of small and large salmon were estimated separately from marks applied at these traps and recaptures upstream. Escapements were estimated as returns minus known removals.

State of the stock: Target egg deposition rates have been almost met or exceeded in each of the last nine years.

Forecast for 1995: The probability distribution model prediction for large salmon returns in 1995 is 30,040 with a probability of meeting the spawning target (23,600) of 78%.


Miramichi SFA / ZPS 16
Angling Catch / Prises Sportives
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1970
1974
1978
1982
1986
1990
1994
Large / Grand
Small / Petit


Miramichi SFA / ZPS 16
Returns / Retours
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1970
1974
1978
1982
1986
1990
1994
Large / Grand
Small / Petit


Targets / Cibles
Large / Grand = 23,600
Small / Petit = 22,600
Spawners / Géniteurs
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1970
1974
1978
1982
1986
1990
1994
Large / Grand
Small / Petit

STOCK: Northwest Miramichi River (SFA 16)
TARGET: 41 million eggs (7316 large, 7006 small salmon)

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[6]
Angling catch [2]									
Large	2805	2229	1533	1794	2186	1868	419	3836	2109
Small	7568	6825	3056	6960	6171	4131	2232	9825	6116
First Peoples' harvest[3]									
Large	462	502	462	580	54	81	54[5]	898[5]	412
Small	1054	2095	1109	1616	477	2921	100[5]	2921[5]	1270
Other removals [4]									
Large	26	39	44	56	100	51			53
Small	0	0	29	61	106	68			39
Spawning escapement									
Large (000's)	n.a.	n.a.	n.a.	9	10	12			
Small (000's)	n.a.	n.a.	n.a.	22	40	13			
Total returns									
Large (000's)	n.a.	n.a.	n.a.	10	11	13			
Small (000's)	n.a.	n.a.	n.a.	31	46	21			
% Egg target met	n.a.	n.a.	n.a.	198	175	198			

[1] MIN MAX over the period 1972 to present unless stated otherwise.

[2] Angling catches are NB DNRE Fishsys values. Angling harvest for large salmon are hook and release estimates.

[3] First Peoples' harvest includes catch reported by Red Bank, and Eel Ground Indian Bands.

[4] Other removals includes broodstock removals, mortalities at all index traps, and all samples.

[5] For 1972 to present.

[6] For 1989 to 1993.

Recreational catches: New Brunswick Department of Natural Resources and Energy FISHSYS estimates indicate that over the period 1987-1991, 27-34% (mean: 31%) of total angling in the Miramichi River has occurred in the Northwest Miramichi.

Data and assessment: Returns of small and large salmon to the Northwest Miramichi River were estimated in 1992, 1993, and 1994 from a mark-recapture program, applying tags at Eel Ground Enclosure trap and recovering tags from traps at Redbank (NW), and from fences in the headwaters of the Northwest Miramichi and in Catamaran Brook. Spawners were estimated as returns minus known and estimated removals.

State of the stock: The spawning target for large salmon was exceeded in 1992, 1993, and 1994.

Forecast for 1995: Because 1994 is only the third year of data on returns, no quantitative forecast can be made of returns in 1995.

STOCK: Southwest Miramichi River (SFA 16)
TARGET: 88 million eggs (15730 large, 15063 small salmon)

	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[5]
Angling catch [2]									
Large	9123	7029	4614	7682	5945	3261	1373	10387	6879
Small	16814	14547	8244	14522	10727	7072	4570	22137	12971
First Peoples' harvest[3]									
Large	0	0	0	0	0	0			
Small	0	0	0	0	0	0			
Other removals [4]									
Large	78	49	39	75	66	68			61
Small	0	0	39	26	130	202			37
Spawning escapement									
Large (000's)	n.a.	n.a.	n.a.	27	22	14			
Small (000's)	n.a.	n.a.	n.a.	106	33	27			
Total returns									
Large (000's)	n.a.	n.a.	n.a.	27	22	14			
Small (000's)	n.a.	n.a.	n.a.	121	43	34			
% Egg target met	n.a.	n.a.	n.a.	259	150	104			

[1] MIN MAX over the period 1972 to present unless stated otherwise.

[2] Angling catches are DNRE Fishsys values. Harvest for large salmon are hook and release estimates

[3] No First Peoples' harvests have occurred in the Southwest branch.

[4] Other removals includes broodstock removals, mortalities at all index traps, and all samples.

[5] For 1989 to 1993.

Recreational catches: New Brunswick Department of Natural Resources and Energy FISHSYS estimates indicate that over the period 1987-1991, 66-73% (mean: 69%) of total angling in the Miramichi River has occurred in the Southwest Miramichi.

Data and assessment: Returns of small salmon and large salmon to the Southwest Miramichi River were estimated in 1992, 1993, and 1994 from a mark-recapture program, applying tags at Enclosure trap and recovering tags from creel surveys, and from fences and barriers in the Southwest Miramichi. Spawners were estimated as returns minus known and estimated removals.

State of the stock: The spawning target for large salmon was exceeded in 1992 and 1993. 86% of the large salmon target was attained in 1994.

Forecast for 1993: Because 1994 is only the third year of data on returns, no quantitative forecast can be made of returns in 1995.

STOCK: Richibucto River (SFA 16)
TARGET: 2.942 million eggs (626 large salmon, 270 small salmon)[1]

	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
First Peoples' harvest									
Large	32	73	82	452	253	113	32	452	178
Small	16	93	51	61	50	51	16	93	54
Spawning escapement									
Large				467					
Small				80					
Total returns									
Large				1119					
Small				142					
Percent target met									
Large				81	Below	Below			
Small				26	Below	Below			
% egg target met									
				83	Below	Below			

[1]Target is updated based on revised sex ratio data.
[2]Min, Max, Mean for the period 1989-1993.

Description of Fishery: Angling effort is very low and catch is not estimated. Big Cove First Nation harvests salmon by gillnet and trapnet.

Research Data: Juvenile densities were determined at several sites, a stream habitat survey was begun, and biological data from the 1993 sample are presented.

Estimation of Stock Parameters: Returns were qualitatively assessed assuming a similar exploitation rate in the First Nation fishery from 1992 to 1994.

Assessment Results: Spawning escapement was probably not met in 1994.

Ecological Considerations: Salmon by-catch in commercial gear may have a significant effect on the stock.

Management Considerations: There is no harvestable surplus of salmon from the Richibucto River.

STOCK: Bouctouche River (SFA 16)
TARGET: 1.586 million eggs (337 large salmon, 147 small salmon)[1]

	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean
Angling catch									
Large (Released)	52	47			22	na	34	52	
Small (Rel + Kept)		16			55	na	13	55	
First Peoples' Harvest									
Large				12	0	12			
Small				0	0	11			
Spawning escapement									
Large					28	198			
Small					18	96			
Total returns									
Large					79	255			
Small					62	126			
Percent target met									
Large					13	59			
Small					14	65			
% egg target met									
					13	61			

[1]Target updated based on new habitat areas provided by New Brunswick Department of Natural Resources & Energy and revised sex ratio data.
[2]Angling catch min, max apply to 1984 to 1993; the mean was not calculated because angling catches are not estimated on a consistent basis.

Description of Fishery: Salmon are angled in public water; catch and effort data for 1994 are not available. The Bouctouche First Nation harvests salmon by trapnet.

Research Data: Tags applied at trapnets and recaptured at a counting fence were the basis for the assessment. Biological data were collected on the stock and juvenile densities were determined at several sites.

Estimation of Stock Parameters: A mark and recapture expeiriment was used to calculate large salmon returns from counting fence recaptures; small salmon returns were calculated from the small:large ratio.

Assessment Results: Spawning escapement was not met for large or small salmon in 1994. Total egg deposition was only 61% of target. Egg deposition above the counting fence was only 32% of target for this area; half the estimated spawning escapement remained below the fence.

Ecological Considerations: Low water conditions delayed the upstream movement of salmon and reduced the angling catch.

Management Considerations: There is no harvestable surplus of salmon from the Bouctouche River.

Regional Summaries
Québec

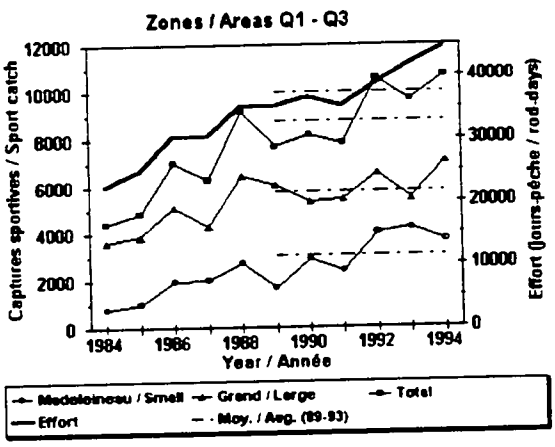
3.5 Gaspé (Fishing Areas Q1-Q3) and Anticosti (Q10)

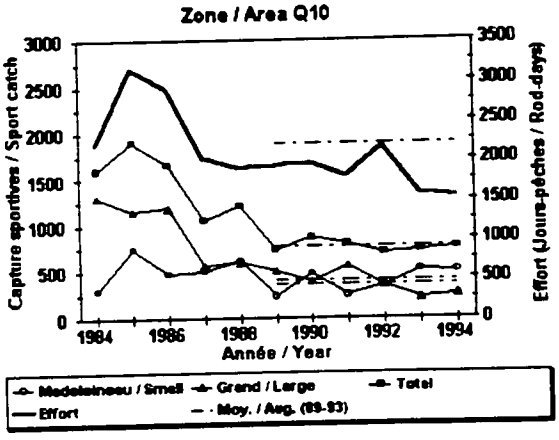
There are 28 salmon rivers within areas Q1 to Q3, and 24 salmon rivers within Area Q10. Public consultations with user groups took place in November and December of 1994 in each region having salmon fisheries.

Description of fisheries

First Peoples' food fisheries occur in two locations in area Q1: near the mouths of the **Restigouche** and **Cascapédia** rivers. There is no commercial fishery in these areas.

Recreational catches increased by 10% from 1993 and were 20% above average (tables 3.5.1 and 3.5.2) mainly due to an increase in the large salmon catch of 28% over 1993, and of 18% above the average. The angling effort increased to over 46,000 angler-days and fishing conditions were generally reported to have been very good; fishing success (catch per unit effort) remained high at 0.25 fish per day. The exploitation rate was 41% in areas Q1 to Q3, the highest recorded during the last 10 years.





Status of the stocks

In areas Q1 to Q3, counts of returning salmon are made at 10 counting sites and visual spawner estimates, by snorkling or canoe, are conducted in almost all the other rivers. The total number of salmon returning to the Gaspé in 1994 was 2% less than in 1993 and 16% less than the average of the past five years (Table 3.5.1). Because of the high exploitation rate in the recreational fishery, the number of spawners was severely reduced and the egg deposition compared to target was estimated at 71% in Gaspé areas compared to an average of 80% for the previous five years.

On Anticosti, returns are estimated for eleven rivers. Returns in 1994 were 13% above 1993 and unchanged from the average but egg depositions were only 41% of target (Table 3.5.2).

Prospects

Returns in 1995 will mostly come from the spawners of 1989 and 1990, two years for which egg depositions were good. The commercial fishery closures in Greenland and Newfoundland should result in better returns to rivers if sea survival improves. Consequently, no modifications are recommended to fishing plans for 1995.

Summary sheets

More detailed information on individual river assessments for Bonaventure, Saint-Jean, Matane, and Bec-Scie rivers are presented in the summary sheets.

Table 3.5.1. Sport catch, removals, returns, spawning escapement and percent of target met in the rivers of Gaspé, Areas Q1 to Q3, 1984 to 1994. Target eggs was 77.71 million prior to 1993 and is 78.14 million since 1993. Eggs deposited are expressed in millions. ER = Exploitation rate.

	Sport Catch						Removals			Spawning		
Year	Small	Large	Total	Effort	CPUE	ER	Other	Total	Total Returns	Fish	Eggs	% of target
1984	779	3582	4361	22464	0.19	30%	280	4641	14662	10021	41.06	53%
1985	976	3847	4823	24919	0.19	34%	130	4953	14070	9117	34.68	45%
1986	1919	5087	7006	30450	0.23	32%	420	7426	22082	14656	47.96	62%
1987	1994	4266	6260	30435	0.21	26%	566	6826	23857	17031	60.01	77%
1988	2731	6454	9185	35204	0.26	32%	296	9481	28669	19188	71.48	92%
1989	1666	6025	7691	35208	0.22	28%	712	8403	27230	18827	70.65	91%
1990	2874	5313	8187	36562	0.22	30%	545	8732	26913	18181	61.67	79%
1991	2354	5458	7812	35154	0.22	30%	369	8181	25631	17450	61.80	80%
1992	4014	6546	10560	38762	0.27	36%	319	10879	29661	18787	62.74	81%
1993	4186	5464	9650	41807	0.23	39%	245	9895	25040	15145	54.75	70%
1994	3652	7031	10683	44616	0.24	41%	441	11124	25966	14842	55.24	71%
89-93	3019	5761	8780	37499	0.23	33%	438	9218	26896	17678	62.32	80%
1994 compared to												
1993	-13%	29%	11%	7%	4%	7%	80%	12%	4%	-2%	1%	1%
89-93	21%	22%	22%	19%	2%	26%	1%	21%	-3%	-16%	-11%	-12%

Table 3.5.2. Sport catch, removals, returns, spawning escapement and percent of target met in the rivers of Anticosti, Area Q10, 1984 to 1994.

	Sport Catch					Removals			Spawning[1]		Target[1]	
Year	Small	Large	Total	Effort	CPUE	Other	Total	Total Returns[1]	Fish	Eggs	Eggs	% of target
1984	288	1308	1596	2191	0.73	0	1596	6004	4408		15.23	
1985	745	1156	1901	3147	0.60	0	1901	7101	5200		15.23	
1986	473	1191	1664	2898	0.57	0	1664	6763	5099		15.23	
1987	499	555	1054	2025	0.52	0	1054	3521	2467		15.23	
1988	612	594	1206	1887	0.64	0	1206	4090	2884		15.23	
1989	227	502	729	1921	0.38	0	729	3246	2651	5.46	15.23	54
1990	474	389	863	1948	0.44	0	863	3027	2290	4.20	15.23	41
1991	243	559	802	1783	0.45	23	825	2964	2230	5.54	15.23	54
1992	351	353	704	2164	0.33	0	704	2443	1855	4.77	15.23	47
1993	513	216	729	1583	0.46	17	746	2563	1955	2.94	15.23	29
1994	507	254	761	1529	0.50	6	767	2888	2208	4.14	15.23	41
89-93	362	404	765	1880	0.41	8	773	2849	2196	4.58	15.23	45
1994 compared to												
1993	-1%	18%	4%	-3%	8%		3%	13%	13%	41%		41%
89-93	40%	-37%	-1%	-19%	22%	-25%	-1%	1%	1%	-10%		-10%

[1] Variable number of rivers included in the total for Q10. For comparative purposes, 1989 to 1994 totals include the following rivers: à l'Huile, Macdonald, Patate, Box, Dauphiné, Chaloupe, Ferrée, Galiote, Jupiter, la Loutre and Bec-Scie. The spawning target for these rivers is 10.16 million eggs.

STOCK: Bonaventure (Q1)
TARGET: 8.42 million eggs

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small + large)										
	1 534	1 376	1 460	1 098	1 404	1 303	1 718	537	1 534	1 118
Smolt	-	-	-	-	-	-	-	-	-	-
Returns										
Total	3 783	3 525	3 924	3 697	3 444	2 596	3 718	1 226	3 924	2 942
Small	1 173	878	1 291	1 333	1 163	829	919	163	1 291	925
Large	2 610	2 647	2 633	2 364	2 281	1 767	2 799	858	2 647	2 017
% Target eggs met[2]:										
	79	85	95	85	73	51	91	25	95	67

[1] MIN, MAX, and Mean period 1984 -1993.
[2] Represents contribution from both small and large salmon.

Methodologies: Target egg deposition is for accessible habitat

Data and assessment: Complete adult counts are based on a visual spawning count and registration of recreational catches.

STOCK: Saint-Jean (Q2)
TARGET: 3.77 million eggs

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small + large)										
	737	611	474	650	926	828	834	474	926	704
Smolt	-	92575	97928	113871	154906	142841	74216	92575	154906	120424
Returns										
Total	2 238	1 629	1 292	1 920	2 034	1 716	1 743	1 292	2 238	1 805
Small	425	259	512	433	546	614	481	259	614	465
Large	1 903	1 370	780	1 487	1 488	1 102	1 262	780	1 903	1 107
% Target eggs met[2]:										
	131	95	58	107	94	66	78	58	107	92

[1] MIN, MAX, and Mean period 1988 -1993.
[2] Represents contribution from both small and large salmon.

Methodologies: Target egg deposition is for accessible habitat. Total returns to the river are based on visual count.

Data and assessment: Smolt are surveyed by mark-recapture.

STOCK: Matane (Q3)
TARGET: 5.64 milion eggs

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small + large)										
	978	**173**	**837**	**854**	**1 325**	1 332	1 081	173	1 332	839
Smolt	-	-	-	-	-	-	-	-	-	-
Returns										
Total	3 399	2 147	2 807	2 958	3 593	3 168	2 676	2 091	3 867	2 954
Small	1 081	1 171	1 227	1 508	2 014	1 830	1 186	794	2 236	1 384
Large	2 318	976	1 580	1 450	1 579	1 338	1 490	976	2 330	1 570
% Target eggs met[2]:										
	148	73	89	82	78	62	71	60	152	91

[1] MIN, MAX, and Mean period 1984 -1993.
[2] Represents contribution from both small and large salmon.

Methodologies: Target egg deposition is for accessible habitat. Target eggs to come from small and large salmon. Total returns to the river are based on counts at a fishway located on the lower river.

Recreational fishery: In 1989, the recreational fishery closed in August due to a reduced number of large salmon counted at the fishway.

Data and assessment: Adult counts are available from a fishway and included a small number of salmon caught above the fishway.

STOCK: Bec-Scie (Q10)
TARGET: 0.23 million eggs

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small + large)										
	46	4	44	36	32	35	23	4	71	45
Smolt	3 286	5 319	2 649	4 441	4 339	5 628	5 118	1 851	5 446	3 610
Returns										
Total	167	200	198	224	166	140	83	137	224	187
Small	97	75	143	93	83	102	49	47	143	92
Large	70	125	55	131	83	38	34	38	147	95
% Target eggs met[2]:										
	83	187	92	165	111	65	47	65	187	116

[1] MIN, MAX, and Mean period 1984 -1993.

[2] Represents contribution from both small and large salmon.

Methodologies: Target egg deposition is for accessible habitat. Target eggs to come from small and large salmon. Smolts are enumerated at a counting fence; numbers prior to 1992 will be revised. Total returns to the river are based on fence counts.

Recreational fishery: The recreational fishery is limited to 4 fishermen per day.

3.6 North Shore of the St. Lawrence (Fishing Areas Q5-Q9)

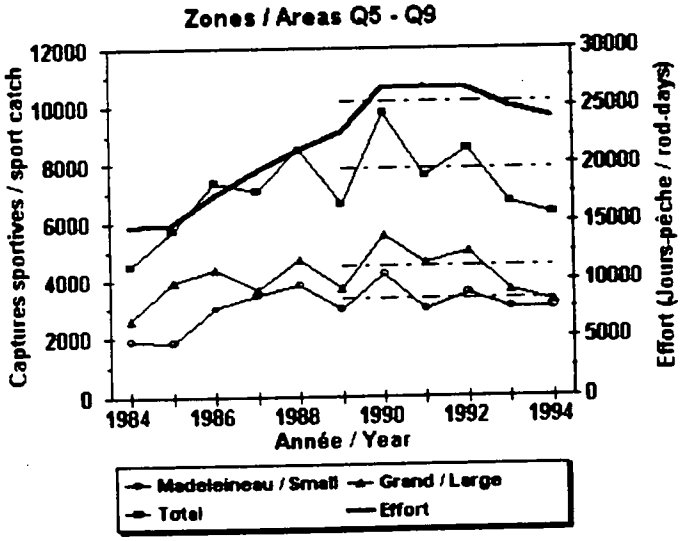
Description of fisheries

There are 60 salmon rivers in areas Q5 to Q9, 54 of which are open to recreational fishing. The retention of large salmon was prohibited on three rivers from the beginning of August onwards due to the estimated low adult return.

First Peoples' food fisheries occur at sites, near the **Escoumins**, **Betsiamites**, **Moisie**, **Mingan**, **Natashquan** and **Saint-Augustin** rivers. No food fishery took place this year in **Olomane** River. Total food fisheries harvests in 1994 were 1426 fish.

The commercial fishery was closed in Area Q7 in 1993 and in Area Q8 in 1994. In Area Q9, 90 commercial fishermen now share a quota of 15,175 salmon. The commercial catch of large salmon declined to 9897 fish, 10% less than 1993 and 35% less than the average (Table 3.6.1). The small salmon catch was 3858, 6% above last year and 15% above average.

In spite of the reduction in the commercial fishery in recent years, recreational catches continue to declined significantly. Landings of 3241 large salmon were 11% less than last year, and 28% below the average. The reported catch of 3043 small salmon was the same as 1993, 9% below the average.



Status of stocks

Egg deposition evaluation is carried out on only ten rivers in the western portion of this area (areas Q5 to Q8), and 4 of these evaluations are for enhancement projects. In these rivers, egg

deposition in 1994 varied from 7% to 71% of the requirement, a reduction compared to last year and to the average. Sea survival mesured on wild smolts in rivière de la Trinité and on hatchery smolts on rivière Aux Rochers were the lowest in the time series.

Prospects

With average smolt survival rates, increased returns are expected to rivers in these areas as a result of the local commercial closures, as well as the closures of the Newfoundland and Greenland fisheries since salmon stocks from the Q7 and Q8 are known to have contributed to these distant fisheries.

Summary sheets

More detailed information on individual river assessments for Sainte-Marguerite and de la Trinité rivers are presented in the summary sheets.

Table 3.6.1. Sport catch, commercial catch and First Peoples' food fisheries catches in Areas Q5 to Q9, 1984 to 1994. Effort in the sport fishery is in units of rod-days. Catches are expressed as numbers of fish. Target egg deposition for rivers in these zones was 221.06 million eggs up to 1991 and is 223.93 million eggs since 1992.

	Sport catch					Commercial catch			Sport + Commercial	First Peoples' fisheries
Year	Small	Large	Total	Effort	CPUE	Small	Large	Total		
1984	1876	2628	4504	14572	0.31	794	11220	12014	16518	827
1985	1825	3906	5731	14830	0.39	2093	14834	16927	22658	1281
1986	2994	4376	7370	17213	0.43	3707	18095	21802	29172	487
1987	3473	3612	7085	19401	0.37	2992	20533	23525	30610	1399
1988	3795	4716	8511	21206	0.40	4760	18103	22863	31374	1805
1989	2955	3673	6628	22693	0.29	2615	17910	20525	27153	1336
1990	4219	5579	9798	26592	0.37	3425	15867	19292	29090	1430
1991	2946	4625	7571	26674	0.28	3282	15982	19264	26835	1316
1992	3537	5006	8543	26519	0.32	3849	15514	19363	27906	1642
1993	3043	3648	6691	24993	0.27	3627	11030	14657	21348	1728
1994	3043	3241	6284	23980	0.26	3858	9897	13755	20039	1426
89-93	3340	4506	7846	25494	0.31	3360	15261	18620	26466	1490
1994 compared to										
1993	0%	-11%	-6%	-4%	-2%	6%	-10%	-6%	-6%	-17%
89-93	-9%	-28%	-20%	-6%	-15%	15%	-35%	-26%	-24%	-4%

STOCK: Sainte-Marguerite (Q6)
TARGET: 1.74 million eggs

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small + large)										
	118	187	334	201	320	118	240	49	334	156
Smolt	-	-	-	-	-	-	-	-	-	-
Returns										
Total	520	1 191	1 536	898	713	357	700	299	1 536	691
Small										
Large										
% Target eggs met[2]:										
	43	89	159	100	74	47	49	17	159	65

[1] MIN, MAX, and Mean period 1984 -1993.
[2] Represents contribution from both small and large salmon.

Methodologies: Target egg deposition is for accessible habitat

Data and assessment: Adult counts are available from a fishway located on the lower river.

STOCK: de la Trinité (Q7)
TARGET: 3.03 million eggs

Year	1988	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small + large)										
	688	626	832	473	373	228	218	228	832	559
Smolt	51827	79774	50109	40695	50799	86093	55858	40695	96469	66867
Returns										
Total	2449	2288	2435	1850	1187	680	888	680	2435	1897
Small	1629	1806	1905	1329	570	409	578	409	1905	1340
Large	820	482	530	521	617	271	310	271	820	557
% Target eggs met[2]:										
	135	71	81	75	84	41	61	41	135	79

[1] MIN, MAX, and Mean period 1984 -1993.
[2] Represents contribution from both small and large salmon.

Methodologies: Target egg deposition is for accessible habitat. Target eggs to come from small and large salmon.

Data and assessment: Counts are available from a fishway located on the lower river. Smolt are surveyed by mark-recapture.

Commercial fishery: The commercial fishery was closed in 1992.

3.7. Ungava Bay (Fishing Area Q11)

In Ungava, Area Q11, there are four salmon rivers. A recreational fishery is permitted on three of them, but the majority of the landings are taken by the food and the commercial fisheries, which are restricted to the local Inuit people.

The catch reports for the food and commercial fisheries are preliminary and indicate an increased of 25% compared to 1993 and 24% of the 1989-93 average. The recreational catch of 383 salmon is 4% below 1993 and a decrease of 61% from the 1989-93 period.

Regional Summaries

Newfoundland

3.8 Southwest Newfoundland (SFAs 12-13)

General description

River assessments in this area are provided for Humber River (second largest in insular Newfoundland), Pinchgut Brook (Harry's), Highlands River, and Flat Bay Brook. Several rivers in St. George's Bay (SFA 13) possess a significant large salmon component of which many are maiden multi-sea-winter fish. For example, returns to Highlands River in 1994 were comprised of 50% small salmon and 50% large salmon, which compares to 64% and 36%, respectively, for 1993. Seven rivers are managed by river-specific quotas. Hughes Brook (in Bay of Islands/Humber River estuary) was the site of an enhancement program during 1987-92 involving the stocking of Atlantic salmon swim-up fry. Fry were also stocked into North Brook (a tributary of Humber River) during the same period.

In the past few years, Arctic charr were reared in cages in Grand Lake (Humber River); an estimated 20000-40000 charr escaped in 1994. A rainbow trout fish-out pond operated at Mine Pond, near Stephenville.

Description of fisheries

In SFA 13, eight rivers were closed on August 8 after an in-season review in mid-July indicated returns for 1994 would be less than 50% of target requirements. Historically, only 10% or less of the total season catch was taken after this date, which should not affect comparability of the recreational fishery data with previous years. The recreational catch of small salmon (retained plus released fish) in 1994 was below the 1984-89 and 1986-91 means and was the lowest of the three commercial salmon fishery moratorium years (1992-94) (Fig. 3.8.1). Catches of small salmon during the moratorium period were among the lowest recorded. The number of large salmon released in 1992-94 was well above average; however, there were years prior to the moratorium, in the late 1970s and early 1980s, when catches were comparable. Effort in 1994 was below average while CPUE (for small and large salmon combined) was average. The number of small salmon retained (Fig. 3.8.1) in 1994 was the second lowest on record. Individual river quotas for retained fish were not reached in Fischell's and Fox Island rivers in 1994.

Public consultations

Advisory meetings were held with representatives of the Government of Newfoundland and Labrador and organized angler groups. Meetings with the general public were held in Stephenville and Corner Brook. The purpose of these meetings was to give the public at large the opportunity to input into the stock assessment process. Items discussed included effects of water temperatures and water levels in 1994 on angling success, effects of hook-and-release on angling habits, effects of the management plan on angling effort and success, accuracy of angling statistics, and perceptions of abundance both past and present. Results of these deliberations are reflected below. Stock assessments were subjected to peer review in February.

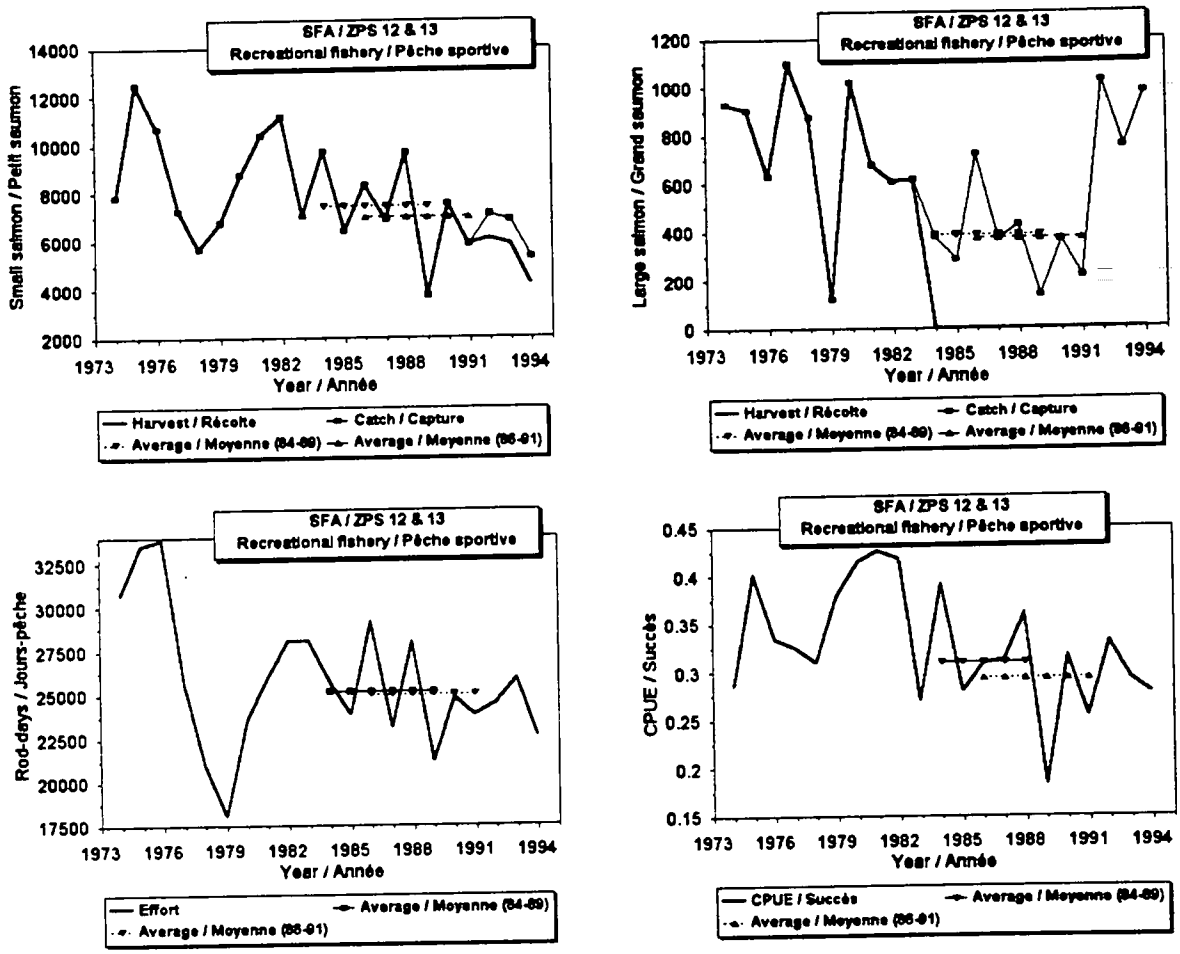


Fig. 3.8.1. Recreational catch of small salmon (harvest = retained for 1974 to 1994 and catch = retained plus released for 1992 to 1994), effort (rod-days), and catch per unit of effort (catch of small plus large divided by effort) during 1974 to 1994 in Southwest Newfoundland (SFAs 12-13). The catch of large salmon prior to 1985 was all harvested and for 1985 to 1994 was all released.

Environmental considerations

In SFA 12, 8 rivers were closed to angling during the last week of the angling season due to low water levels; in SFA 13, water levels were moderate to high for most rivers. During public consultations, opinions were mixed as to the impact of high water levels on catches.

Status of stocks

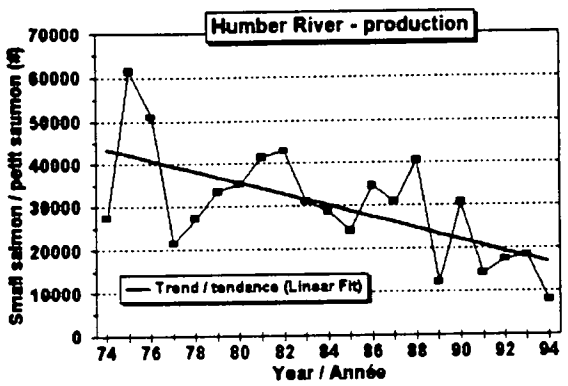
Indices of abundance were from complete counts (Highlands River and Pinchgut Brook), mark and recapture estimates of run size (Humber River), and angling data (retained plus released fish, Fig. 3.8.1.). For Pinchgut Brook, counts of small and large salmon in 1994 were similar to 1993 but higher than in 1992. Although estimates of small salmon entering Humber River during the moratorium years 1992 and 1993 improved over 1990 and 1991, the only pre-moratorium years for which data were available, the estimate for 1994 declined and was the second lowest recorded. Returns of large salmon in 1992 showed a marked improvement over 1990-91, but there was no improvement for 1993 and 1994. Counts of small and large salmon for Highlands River in 1993 and 1994 improved over the period 1980-82 (only previous data available), being most pronounced for large salmon. The average number of smolts counted at the Highlands River counting fence in 1992-93 (10244) declined from that recorded during 1980-82 (14447). Adult counts were available for Flat Bay Brook for the first time in 1994 (480 small salmon; 70 large salmon).

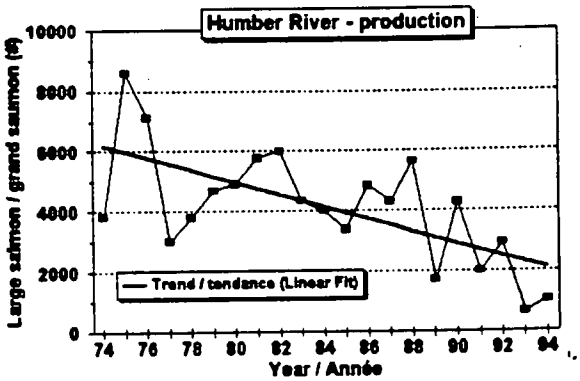
Of the rivers assessed, only Pinchgut Brook achieved target egg deposition in 1994. Pinchgut Brook is a tributary of Harry's River and contains a large proportion of the spawning habitat for the entire system. Therefore, the percentage of target achieved for Pinchgut Brook is expected to be higher than Harry's River as a whole. The percentage of target achieved by Humber River in 1994 was among the lowest recorded.

Percent target egg deposition achieved in rivers of SFA 13 during the five-year period prior to the commercial salmon fishery moratorium (1987-1991) and the three years during the moratorium (1992-1994)

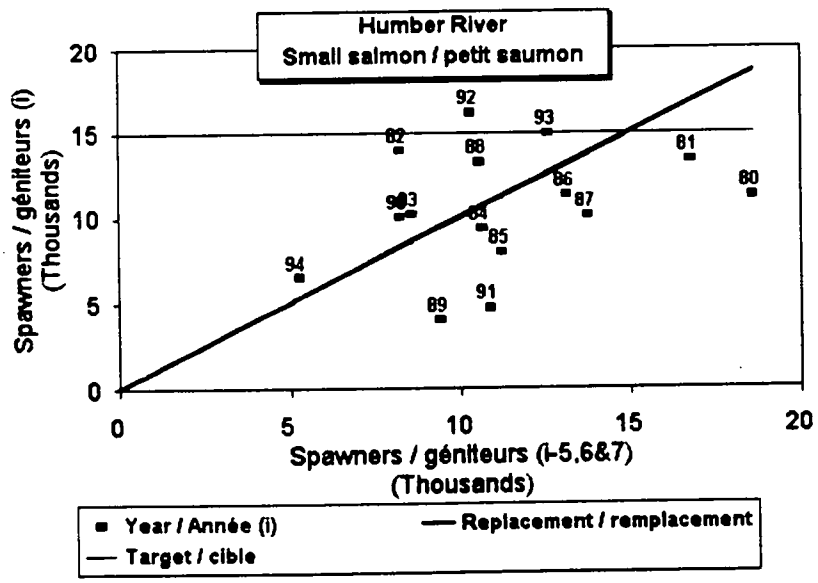
	1987	1988	1989	1990	1991	1992	1993	1994
Humber River	61%	80%	24%	60%	27%	117%	96%	40%
Pinchgut Brook (Harry's River)			137%	383%	108%	42%	146%	182%
Flat Bay Brook								20%
Highlands River							52%	86%

Estimates of the size of the total population of small and large salmon (before any exploitation) for Humber River have declined significantly since 1974, with values for the moratorium years being among the lowest recorded.





The relationship between parents and future spawners (after exploitation including in-river) for Humber River (small and large salmon combined) is shown below. The diagonal line is the replacement line and the horizontal line the target spawning requirement. In 13 of the 15 years, the spawners have been below target but have replaced themselves in eight out of fifteen years. Spawners were above the replacement line during all three moratorium years with 1994 being considerably less pronounced. The target was achieved in 1992 and 1993 but not in 1994.



Prospects

Catches of small and large salmon were relatively low in 1989-91, and if indicative of spawning escapements, returns could continue to be low in the next few years, if natural survival rates remain the same. There are indications that escapements of large salmon improved markedly during moratorium years; however, the first significant returns of adults from these spawners are not expected until 1997. Based on a retrospective analysis of total population size and the numbers of small and large salmon produced per spawner, returns of small salmon to the Humber River in 1995 are anticipated to be slightly above the target requirement while returns of large salmon are expected to exceed the target.

Management considerations

Reasons for the lack of improvement in returns of small salmon to this area are unclear. Opinions expressed during public consultations were that clear-cutting of forest areas along several rivers in St. George's Bay and poaching may play a significant role. Stocks in SFAs 12 and 13 are not expected to benefit as much from the moratorium as other areas of insular Newfoundland because these stocks were subjected to a shorter commercial fishery season introduced in 1978, which should have resulted in lower exploitation. Typically Atlantic salmon enter rivers in SFAs 12 and 13 in late May and early June. The change in the commercial fishing season opening date from May 24 to June 5 in 1984 in other areas of insular Newfoundland should have reduced interception of fish destined for SFAs 12 and 13. Also, the closure of the SFA 12 commercial fishery in 1984 should have further reduced exploitation on these stocks. Consequently, the number of fish available for release into freshwater during the moratorium would be lower than for some other areas.

The number of small salmon retained in 1994 was less than for the quota years 1992 and 1993.

Summary sheets

More detailed information on individual river assessments for Humber River, Pinchgut Brook, Highlands River, and Flat Bay Brook are provided in the summary sheets.

STOCK: Humber River (SFA 13)
TARGET[1]: 28.3 million eggs (~13,651 small and 1,326 large salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[2]	MAX[2]	Mean[2]
Angling catch[3]:									
Small	1217	3054	1431	4349	4161	2523	1217	6147	3268
Large	10	75	11	177	112	166	10	303	100
Returns[4]									
Small	4868	12216	5724	17571	18477	7995	4868	24588	13074
Large	341	855	401	2945	636	1030	341	2945	915
Estimated spawning escapement:									
Small	3651	9162	4293	13222	14316	5472	3651	18441	9805
Large	341	855	401	2945	636	1030	341	2945	850
% Target eggs met (small + large)									
	24	60	27	117	96	40	24	119	63

[1] The target egg deposition requirement is based on fluvial and lacustrine habitat.
[2] MIN, MAX, MEAN are for 1974-1991.
[3] Angling catch in 1992-1994 is estimated based on a creel survey conducted at Big Falls.
[4] Total returns for 1974-1991 were estimated based on an angling exploitation rate of 25% adjusted for tag loss and reporting rate.

Methodology: Fluvial habitat includes 11.5 million m^2 and lacustrine habitat includes 1,751 ha (excluding Deer Lake - 5930 ha). Target egg deposition is based on 2.4 eggs /m^2 of fluvial area and 368 eggs per ha of lacustrine area. Target eggs are to come from small and large salmon. Biological characteristics are based on samples from the recreational fishery and from the tagging trap located in the estuary of the Humber River. Returns of small salmon to the river are currently estimated by mark-recapture method. Returns of large salmon are assumed to equal the ratio of large to small salmon in the the tagging traps. Returns of small salmon in 1992 were based on an angling exploitation rate derived from tags recovered at the Big Falls section of the river by DFO creel survey personnel. The estimate of exploitation rate reported in 1992 had not been adjusted for tag loss but the current value for 1992 includes this adjustment based on a tag loss rate of 23%.

Recreational fishery: The Humber River produces about 40% of the small salmon catch in SFA 13. Recreational catches estimated in 1992 and 1993 were among the highest on the river since the early 1980s. However, catches in 1994 were among the lowest, with the exception of large salmon released which were above the 1974-1991 mean.

Data and assessment: The 1994 assessment was the fifth assessment of Humber River salmon using the mark-recapture method.

State of the stock: The mean potential egg deposition in 1974-1991 represented about 63% of the target. In 1992-1993 egg depositions were the highest since 1975, but in 1994 were below the 1974-1991 mean.

Forecast: Based on a retrospective analysis of total population size and the numbers of small and large salmon produced per spawner, returns of small salmon in 1995 are anticipated to be slightly above target requirement while returns of large salmon are expected to exceed target.

STOCK: Pinchgut Brook, (tributary of Harry's River) (SFA 13)
TARGET: 0.8 million eggs (~ 509 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Returns to fence:									
Small				222	576	563			
Large				5	43	47			
Angling catch above fence (retained catch of small):									
Small	33	92	26	10	28	18	2	92	22
Large	0	0	0	1	0	0	0	0	0
Estimated total returns[2]:									
Small	733	2044	578	222	576	563	44	2044	493
Large	0	0	0	5	43	47	0	0	0
Estimated spawning escapement:									
Small	700	1952	552	212	548	545	42	1952	470
Large	0	0	0	5	43	47	0	0	0
% Target eggs met (small + large):									
	137	383	108	42	146	182	8	383	92

[1]MIN, MAX, MEAN are for 1984-1989.
[2]Returns in 1984-1991 were estimated based on an angling exploitation rate of 0.0450 on small salmon derived in 1992. This is a change from that first reported in 1993 where the 1993 value had been used to estimate returns in these years.

Methodology: Fluvial habitat includes 165,500 m^2 and lacustrine habitat includes 1,036 ha. Target egg deposition is based on 2.4 eggs/m^2 of fluvial area and 368 eggs per ha of lacustrine area. Target eggs are to come from small salmon. Total returns are based on counts at the fence. Potential egg depositions in 1989-1991 were calculated from total spawning escapement based on 1,528 eggs per small salmon spawner and 5,128 eggs per large salmon spawner.

Recreational fishery: The recreational fishery on Pinchgut Brook is affected by the quota of 350 small salmon on Harry's River. The quota was reached in 1987-1988 and 1990-1991. The SFA 13 zonal quota affected catches in 1992. The catch of small salmon in 1994 was the third lowest since 1983.

Data and assessment: Pinchgut Brook and other tributaries account for 84% of the spawning, but only 40% of the rearing habitat on Harry's River. Therefore, many juvenile salmon probably move out of Pinchgut Brook to rear in the main stem of Harry's River. Hence, the potential egg deposition relative to the target on Pinchgut Brook is not necessarily representative of Harry's River as a whole. The counting fence was operated from 4 July to 23 September 1992, 17 June to 18 October 1993, and 22 June to 18 October 1994. Counts in 1992 may not represent the complete run.

State of the stock: The state of the stock should be assessed in terms of the whole river. However, the potential egg deposition on the Pinchgut Brook tributary has increased since 1992.

STOCK: Highlands River (SFA 13)
TARGET: 1.55 million eggs

Year	1980	1981	1982...	1993	1994	MIN	MAX	MEAN
Recreational catch[1] Closed since 1978						19	114	67
Counts								
Smolt	15130	15839	12373	9986	10503			
Small	82	127	100	137	145			
Large	55	29	56	78	148			
%Target eggs met:								
(small + large)				52	86			

[1]Recreational fishery data are available for 1953-1977 only since the river was closed to angling from 1978 to present.

Data and assessment: Complete counts of salmon were obtained with a fish counting fence in 1980-82 and in 1993 and 1994.

State of the stock: Egg deposition is based on 1993 and 1994 adult salmon returns (contribution of small and large) and was 55 and 86%, respectively, of the target spawning requirement (1,542,608 eggs). This compares to a range of 27% (in 1981) to 36% (in 1982) observed during counting fence operations in the early 1980s.

Comments: Despite closure to angling since 1978, egg deposition has remained below the reference 2.4eggs/m^2. It is possible that this target is too high for the Highlands River system. The study of juvenile densities ten years ago indicated a wide range in relative production. It also indicated that the main stem (River Brook) above Loch Leven Pond had a wide range of discharge, sparse spawning habitat above the Trans Canada Highway, and relatively low production of juvenile salmon (about 15% of the total smolt yield), and yet this reach comprised 28% of the fluvial habitat. Relatively greater production occurred below Loch Leven and in the tributaries. A major tributary is blocked by a collapsed bridge, and others by beaver dams.

Continuation of this investigation will provide a better estimate of the potential of the river system, and juvenile studies at the higher egg deposition following the moratorium will give a better estimate of the potential production of different reaches within the system, and a more accurate estimation of the target egg deposition. Stream mapping is planned to better estimate predicted yields of smolts, and to enable removal of obstructions.

STOCK: Flat Bay River (SFA 13)
TARGET: 3.843 million eggs

Year	1989	1990	1991	1992	1993	1994	MIN	MAX	Mean
Recreational catch[1] (retained only)									
Small salmon	130	277	251	223	173	128	72	609	306
Large salmon[2]	0	0	0	0	0	0	4	59	28
Brood removals:							43		
Total returns:							554		
Small Salmon							484		
Large Salmon							70		
% Target eggs met:							20[3]		

[1] MIN, MAX mean period from 1974-1991.
[2] MIN, MAX mean period from 1974-1983.
[3] preliminary data

Methodologies: Habitat includes 1.6 million m^2. Target egg requirements are to come from small and large salmon. Total returns are based on a fence count and angling below the fence.

Broodstock requirements: 40 small and 3 large salmon.

Recreational catches: The Flat Bay River stock has been under quota (small salmon) since 1986, as follows: 1986 = 400, 1987-1988 = 300, and 1989-1994 = 250. The quota has only been achieved in two years. Concern is expressed over the number of large salmon hooked and released.

State of the stock: The stock is severely depressed and every effort should be made to increase spawning escapement.

3.9 South Newfoundland (SFAs 9-11)

General description

Rivers assessed in this area include Conne River, Little River, Northeast River (Placentia), Rocky River, and Biscay Bay River. Historically, rivers in this area have been characterized by runs comprised of in excess of 90% small salmon. Since the moratorium, the proportion of large salmon has increased in Rocky River and Northeast River (Placentia). Most large salmon are repeat spawning one-sea-winter (1SW) salmon.

Bay D'Espoir is the site of an aquaculture industry utilizing rainbow (steelhead) trout and Atlantic salmon. Production (t) during 1991-94 was as follows:

Year	Rainbow trout	Atlantic salmon
1991	30	31
1992	87	75
1993	113	100
1994	328	46

Numbers of both of these species have escaped sea cages and entered Conne River. A rainbow trout fish-out pond also operated at St. Veronica's, Bay D'Espoir.

Little River was stocked with Atlantic salmon swim-up fry for several years, ending in 1993. Atlantic salmon broodstock were removed from Rocky River in 1994 for incubation and swim-up fry stocking in 1995.

Description of fisheries

In 1994, Conne River was closed to recreational fishing and there was no First Peoples' food fishery. The recreational catch of small salmon (retained plus released fish) in 1994 was similar to 1992 (below the 1984-89 and 1986-91 means); the catch in 1993 was average (Fig. 3.9.1). Effort in 1994 was average while CPUE was below average. Compared to the recreational fishery quota years 1992 and 1993, the number of small salmon retained in 1994 was below that of 1993 (when the period for retention lasted the entire season in SFA 9) but higher than in 1992 (Fig. 3.9.1).

In 1994, of the salmon sampled entering Conne River during June, 19% possessed net marks.

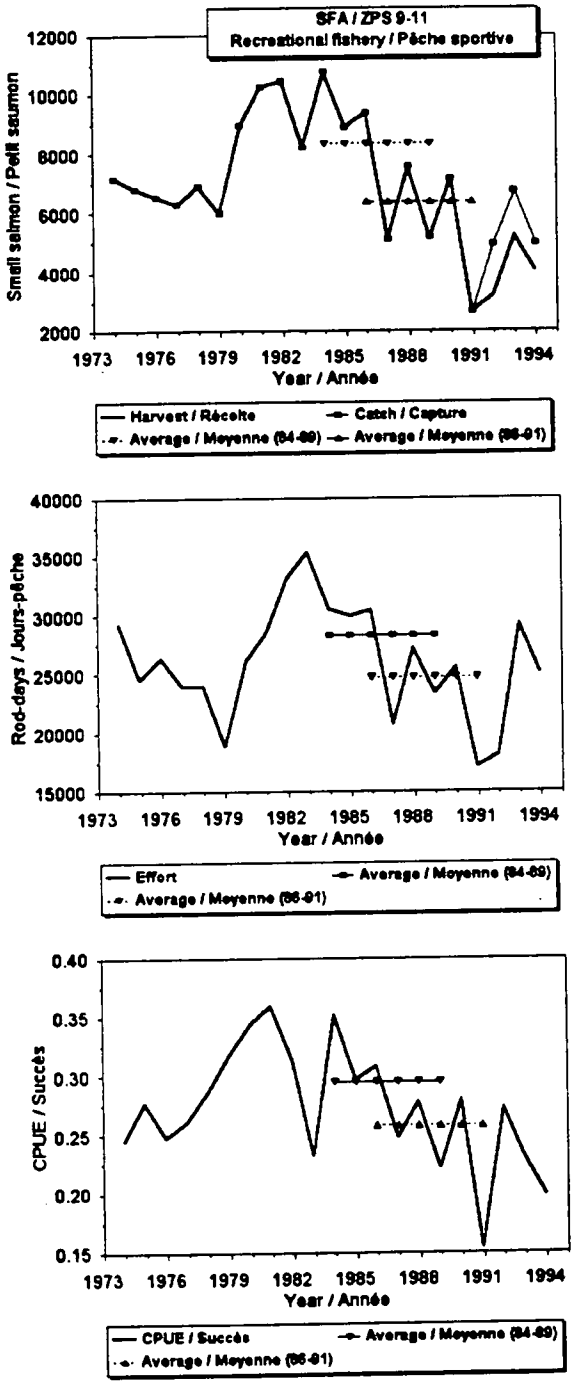


Fig. 3.9.1. Recreational catch of small salmon (harvest = retained for 1974 to 1994 and catch = retained plus released for 1992 to 1994), effort (rod-days), and catch per unit effort (CPUE = catch of small divided by effort) during 1974 to 1994 in South Newfoundland (SFAs 9-11).

Public consultation

Advisory meetings were held with representatives of the Government of Newfoundland and Labrador and organized angler groups. Meetings with the general public were held in St. John's and Gander. The agenda was the same as described for Southwest Newfoundland (Section 3.8). Stock assessments were subjected to peer review in February, 1995.

Environmental considerations

Rivers in SFAs 9 and 10 were closed to angling for most of July due to low water levels and high water temperatures. Smolt-to-adult survival back to the river for Northeast Brook (Trepassey) (SFA 9) and Conne River (SFA 11) during the moratorium years was as low or lower than in years when there was a commercial fishery. This is suggestive of high or above average natural mortality at sea in 1992-94 for these rivers and probably for southern Newfoundland rivers in general. Since 1987, smolt production for Conne River and Northeast Brook (except for 1994) has been relatively stable.

Spring environmental conditions at Conne River were again cold in 1994. An air temperature index for the period April 1-May 15 was among the coldest recorded over an eight year period (1987-94). This index is directly associated with the timing of the smolt migration, with later runs occurring in colder years. Water temperatures were recorded at 16 sites throughout Bay D'Espoir during the period of the smolt migration (May 18-21). With one exception, surface marine temperatures were generally between 1 and 3 °C while bottom temperatures were commonly less than 1.5 °C.

Status of stocks

Indices of abundance were from complete counts of small and large salmon for Conne River, Little River, Northeast River (Placentia), Rocky River, and Biscay Bay River, and except for 1994, recreational fishery data (retained plus released fish, Fig. 3.9.1). Recreational fishery data for 1994 cannot be used as indices of abundance or as indicative of the effectiveness of the 1994 management plan because of the extensive river closures in SFAs 9 and 10. Collectively over all rivers, counts of small and large salmon were significanlty lower during the three moratorium years than in the pre-moratorium years 1986-91.

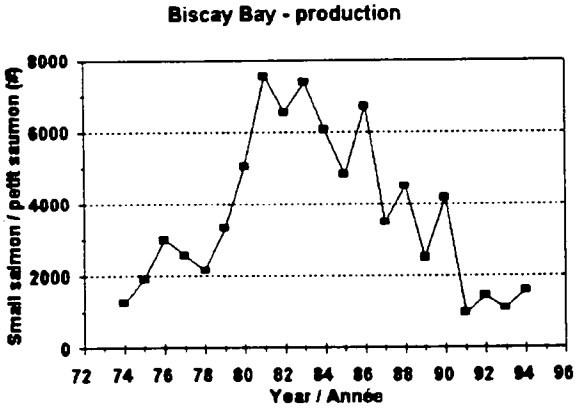
Of the rivers assessed, target egg deposition was achieved in 1994 in Northeast (Placentia) and Biscay Bay River.

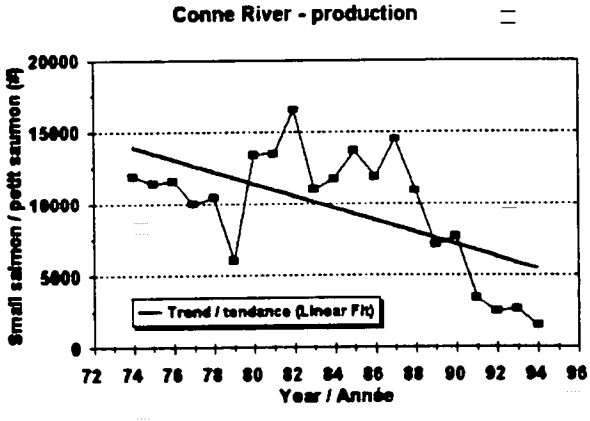
Percent target egg deposition achieved in rivers of SFAs 9, 10 and 11 during the five-year period prior to the commercial salmon fishery moratorium (1987-1991) and the three years during the moratorium (1992-1994)

	1987	1988	1989	1990	1991	1992	1993	1994
SFA 9 - Biscay Bay	119%	127%	89%	128%	39%	131%	90%	133%
SFA 9 - Rocky River	23%	36%	20%	47%	26%	32%	41%	30%
SFA 10 - Northeast Placentia	152%	209%	277%	251%	161%	440%	418%	343%
SFA 11 - Conne River	214%	159%	103%	112%	51%	51%	61%	40%
SFA 11 - Little River[1]	51%	30%	61%	105%	47%	54%	82%	38%

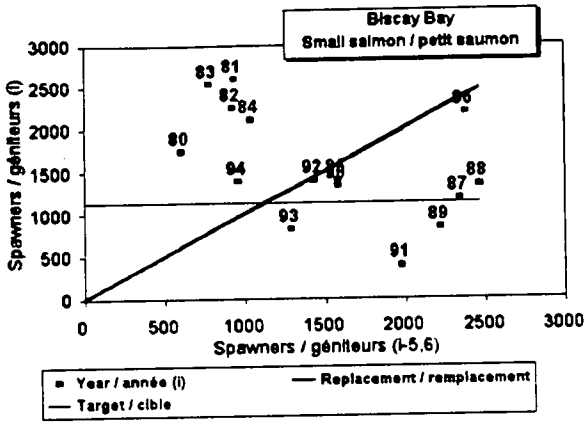
[1] There is a colonization program at Little River. Eggs were removed from most adult returns, incubated, and fry subsequently stocked into the system. Target acheived includes natural egg deposition and fry stocking egg equivalents.

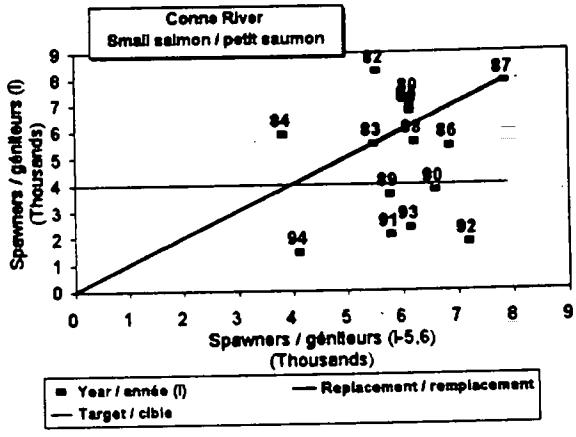
Estimates of the total numbers of small salmon produced in Biscay Bay River (before any exploitation) declined dramatically since 1981 and levels during the moratorium years were among the lowest on record. There was also a significant decline in small salmon production in Conne River since 1974 with lowest levels recorded during 1991-94.





The relationships between parents (small salmon) and future spawners of small salmon for Conne River and Biscay Bay River are shown below. For Conne River, since 1989, small salmon spawners were well below the replacement line and below the target requirement. For Biscay Bay River, the only moratorium year above the replacement line was 1994 although the target was also exceeded in 1992 and in several other years before the moratorium.





Prospects

Catches of small salmon were relatively low in pre-moratorium years 1989-91, and if indicative of spawning escapements, returns in 1995 and 1996 could continue to be low if natural survival rates remain at the same low levels observed in recent years. Angling data and counts suggest that low returns could continue after 1997.

Based on a retrospective analysis of total population size and the number of small salmon produced per spawner, returns to Biscay Bay River in 1995 are anticipated to be in excess of target requirement. Based on smolt-adult-survival rates in recent years, returns to Conne River in 1995 are anticipated to be well below target requirement; this forecast is corroborated by an analysis of the number of small salmon produced per spawner.

Management considerations

Conne River, in contrast to the other rivers under consideration, is characterized by early runs of small salmon (since 1986, 70-80% of the run has been complete by early July). The implementation of the 1984 management plan, which delayed the opening of the commercial fishery from mid-May to June 5, should have had a more noticeable impact on Conne River returns than the moratorium.

During public consultations, anglers expressed the opinion that the split in the seasonal bag limit of three retained fish prior to and after July 31 would result in an increase in effort after July 31 compared to previous years, in an attempt by anglers to retain the remaining three fish. There is evidence that this did occur in SFA 11.

The occurrence of net-marked salmon in Conne River could be due in part to by-catch in capelin traps. In 1994, 50 new capelin trap licenses were issued for the Pool's Cove - Hermitage area. Mesh size for the leaders of these traps was not regulated. The First Peoples' at Conne River have expressed concerns regarding possible high levels of illegal removals for the Conne River stock.

Summary sheets

More detailed information on individual river assessments for Conne River, Little River, Northeast River (Placentia), Rocky River, and Biscay Bay River are provided in the summary sheets.

STOCK: Conne River (SFA 11)
TARGET: 7.8 million eggs (~4000 small salmon) calculated as fluvial area x 2.4 eggs/m^2 and egg/recruit applied to total population as derived from assumed commercial exploitation rates.

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
HARVEST:									
First Peoples' harvest									
Large	1	11	3	5	3	0	0	11	3
Small	381	948	281	483	417	0	18	948	459
Recreational catch									
Small	1036	767	108	329	0	0	0	3302	1824
Returns:									
Large	320	372	89	159	100	100	89	516	355
Small	4968	5368	2411	2523	2703	1533	2411	10155	6472
Escapement:									
Large	319	361	87	153	97	99	87	488	345
Small	3609	3765	2062	1783	2353	1435	2062	7823	4709
% Target eggs met:									
	103	112	51	51	61	40	51	214	131

[1] Minimum, maximum and mean recreational catch for period 1974-91; other mean data for 1986-91 to coincide with the pre-moratorium period. Angling catches are DFO statistics. First Peoples' catch in salt water includes some salmon from other rivers. First Peoples' fishery quota of 1200 fish has been in effect since 1986, but reduced to 500 fish for 1993. First Peoples' fishery closed in 1994.

Data and methodology: Smolts used in adult forecasts are surveyed by mark-recapture. Returning adult salmon are enumerated at a fish counting fence. A video camera system was introduced in 1993.

State of the stock: Target requirements were met from 1986-90. Since then between 51-61% has been achieved until 1994 when only 40% of the target was achieved. Low sea survival continues to impact on salmon returns. An enhancement project was initiated in 1994. Assuming survival to the fry stage, this would result in a potential egg deposition equivalency of 55% of the target being achieved.

Forecast: Estimated smolt output in 1994 was 60,762 (53,759-67765); 9% higher than 1993. At 4% survival, the approximate average recorded during 1990-92, no more than 2,400 fish would be expected to return in 1995. A sea survival of about 7% will be needed in order for total returns to meet or exceed the 4,000 salmon necessary to reach the target egg deposition. Sea survival of 7-10% has been recorded at Conne River in past years. Survival of salmon appears to be associated with timing of the smolt run and smolt condition. Assuming this association holds, then a preseason forecast is not optimistic in terms of achieving the target. In-season monitoring could be used to update managers on changing conditions as the 1995 run progresses. An alternate forecast based on the number of recruits produced per spawner is consistent with the above in terms of anticipated low returns in 1995. This technique forecasts 1300-1730 small salmon returns for 1995.

STOCK: Little River (SFA 11)
TARGET: 0.314 million eggs (equivalent to 230 small salmon)[3]

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch	*	*	*	*	*	*	NA	NA	NA
Smolt				382	324	495	324	495	400
Total returns:	107	173	61	125	180	88	61	173	95
Small	102	158	55	104	169	75	55	158	89
Large	5	15	6	21	11	13	3	15	6
% Targt eggs met[2]:	61	105	47	45	82	38	29	105	54

[1] MIN, MAX, and Mean period 1987 -1991.
[2] Represents contribution from both small and large salmon.
[3] Adjusted.
* recreational fishery closed.

Background: Little River is the site of an enhancement project where limited fry stocking commenced in 1990 and ended in the spring of 1994.

Methodologies: Target egg deposition is for accessible habitat (1308 riverine units). Target eggs are to come from small salmon. Biological characteristics are those of Little River and the Conne River. Current fry releases are backcalculated to eggs for % of target egg achieved in areas stocked. Total returns to the river are based on fence counts.

Recreational fishery: The recreational fishery closed in 1989 and the only angling statistics for the river predate 1975.

Data and assessment: Complete adult counts are available from a counting fence. Smolt counts are available for 1992, 1993, and 1994.

State of the stock: For 1992-1994 the stock averaged 54% of target egg requirements based on natural spawning and fry releases.

STOCK: Northeast River (SFA 10)
TARGET: 0.72 million eggs (~224 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small salmon)									
	210	173	19	37	133	39	19	349	168
Counts									
Small	706	551	353	921	847	675	223	725	415
Large	15	25	8	46	65	70	0	56	29
% of target eggs met[2]									
	278	253	162	443	422	347	152	349	219

[1] Recreational catch is for the period 1974 to 1991. Catches for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994 are retained fish for the entire angling season. Data for 1987 are omitted from the calculation of the mean due to river closure resulting from drought conditions. Summaries for fishway counts are for the period 1976 to 1991 and for percent of target from 1984 to 1991. Percentage of target met reflects the contribution from both small and large salmon.

[2] Adjusted.

Recreational catches: For the period 1974-91, catches have ranged from 19 to 349 small salmon. Rod-days of effort peaked during the early 1980s but declined substantially in recent years. In 1994, a total of 39 small salmon was retained and 5 were released.

Data and assessment: Counts are available from a fishway.

State of the stock: Target egg deposition requirement has been exceeded in all years including salmon moratorium years 1992-94. The count of small salmon in 1994 decreased from the highs of 1992 and 1993; the count of large salmon in 1994 was the highest on record.

STOCK: Rocky River (SFA 9)
TARGET: 3.4 million eggs (equivalent to 881 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Total returns:	177	418	227	283	354	177	81	418	245
Small salmon	168	401	211	237	282	159	80	401	235
Large salmon	9	17	16	46	72	18	1	17	10
Broodstock						72			
Smolt		8287	7732	7813	5115	9781			
%Target eggs met:	20	47	26	32	41	30[2]	20	64	30

[1]Min, Max and Mean period from 1987-1991.

[2] Preliminary data

Background: Rocky River was stocked with salmon fry from 1983-1987 with the first returns to the reconstructed fishway realized in 1987.

Methodologies: Fluvial habitat consists of 1.08 million m^2 and lacustrine habitat includes 2200 ha. Target eggs are to come from small salmon. Biological characteristics used are those of the Rocky River stock. Previous fry releases are backcalculated to eggs for % of target egg achieved in areas stocked.

Recreational fisheries: The recreational fishery is closed on this river.

Data and assessment: Complete adult counts are available from a trap installed in the fishway. Smolt-to-adult survival for 1991, 1992, 1993, and 1994 was 2.5, 3.1, 4.1, and 2.4%, respectively.

State of the stock: On average, the watershed is achieving 30% of its required target egg deposition.

Forecast: Based on the 1990-1993 smolt-to-adult survival, between 234 and 318 maiden 1SW salmon are expected in 1995. As this forecast will not meet target egg deposition it is recommended that the recreational fishery remain closed.

STOCK: Biscay Bay River (SFA 9)
TARGET: 2.9 million eggs (~1134 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small salmon)									
	102	232	10	75	299	214	10	424	234
Counts[2]									
Small	912	1657	394	1442	1107	1592	394	2516	1656
Large	107	73	35	51	120	68	35	101	75
% of target eggs met									
	89	128	39	131	90	133	39	208	130

[1]Recreational catch is for the period 1974 to 1991. Catches for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994 are retained fish for the entire angling season. Data for 1987 are omitted from the calculation of the mean due to river closure resulting from drought conditions. Summaries for fence counts are from 1983 to 1991 and for percent of target from 1984 to 1991. Percentage of target met since 1984 reflects the contribution of both small and large salmon.

[2]Counts for 1985, 1989, 1992, and 1993 were adjusted to total counts.

Recreational catches: For the period 1974-91, catches have ranged from 10 to 424 small salmon. Rod-days of effort were relatively stable during the past decade. In 1994, a total of 214 small salmon was retained and 43 were released.

Data and assessment: Complete counts are available from a fish counting fence which has been in operation since 1983.

State of the stock: Since 1984, from 39 to 208% of target egg deposition was achieved. During commercial salmon fishery moratorium years, the target was exceeded in 1992 and 1994 but not in 1993. Generally, counts of small and large salmon were higher in pre-salmon moratorium years than in 1992 and 1993; however the 1993 count of large salmon was the highest recorded. Total population size of small salmon during the moratorium years was substantially lower than in the early 1980s.

Forecast: Based on a retrospective analysis of total population size and the number of small salmon produced per spawner, returns in 1995 are anticipated to be in excess of the target requirement.

3.10 Northern Peninsula and East Newfoundland (SFA 3-8 and 14A)

General description

Rivers assessed in this area include Lomond River, Torrent River, Western Arm Brook, Exploits River, Campbellton River, Gander River, Middle Brook, and Terra Nova River. Exploits River is the largest in insular Newfoundland and Gander River the third largest. Historically, rivers in this area have been characterized by runs comprised in excess of 90% small salmon. There has been a general increase in the proportion of large salmon during the moratorium. Most large salmon are repeat spawning one-sea-winter salmon.

The Exploits River has undergone Atlantic salmon enhancement since the 1950s with the last stocking with swim-up fry occurring in 1993. Bound Brook (SFA 14A) was stocked with Atlantic salmon swim-up fry during 1987-92. Enhancement involving adult transfers was carried out in Terra Nova River during 1985 to 1989.

In recent years, Arctic charr have been reared in cages in Portland Creek and a number of these have escaped. A rainbow trout fish-out pond has operated in Spirity Pond, Bay of Islands, just south of SFA 14A.

Description of fisheries

Most rivers in SFAs 6, 7, and 8 were closed to angling for most of July because of low water levels and high water temperatures. Since the contribution to total area catch by rivers in SFAs 6-8 is relatively small, river closures for most of July should have minimal impact on historical comparisons. The recreational catch of small salmon (retained plus released fish) in 1994 was similar to that of 1993 and well above the 1984-89 and 1986-91 means (Fig. 3.10.1). Effort in 1994 increased markedly over 1993 and the means while CPUE decreased from the moratorium high in 1993 and was similar to the means. Catches and catch rates comparable to those of the moratorium years occurred during some pre-moratorium years. The number of small salmon retained in 1994 was well above that of the quota years 1992 and 1993 and also above the means (Fig. 3.10.1).

Of the salmon sampled entering Gander River in 1994, 16% possessed net marks. For Campbellton River, the value was 6%. The Gander River sample may or may not be indicative of the entire run. At Campbellton River, net marks were observed on fish throughout the run using a video camera counter.

Public consultation

Advisory meetings were held with representatives of the Government of Newfoundland and Labrador and organized angler groups. Meetings with the general public were held in St. John's, Gander, and Plum Point. The agenda was the same as described for Southwest Newfoundland (Section 3.8). Stock assessments were subjected to peer review in February 1995.

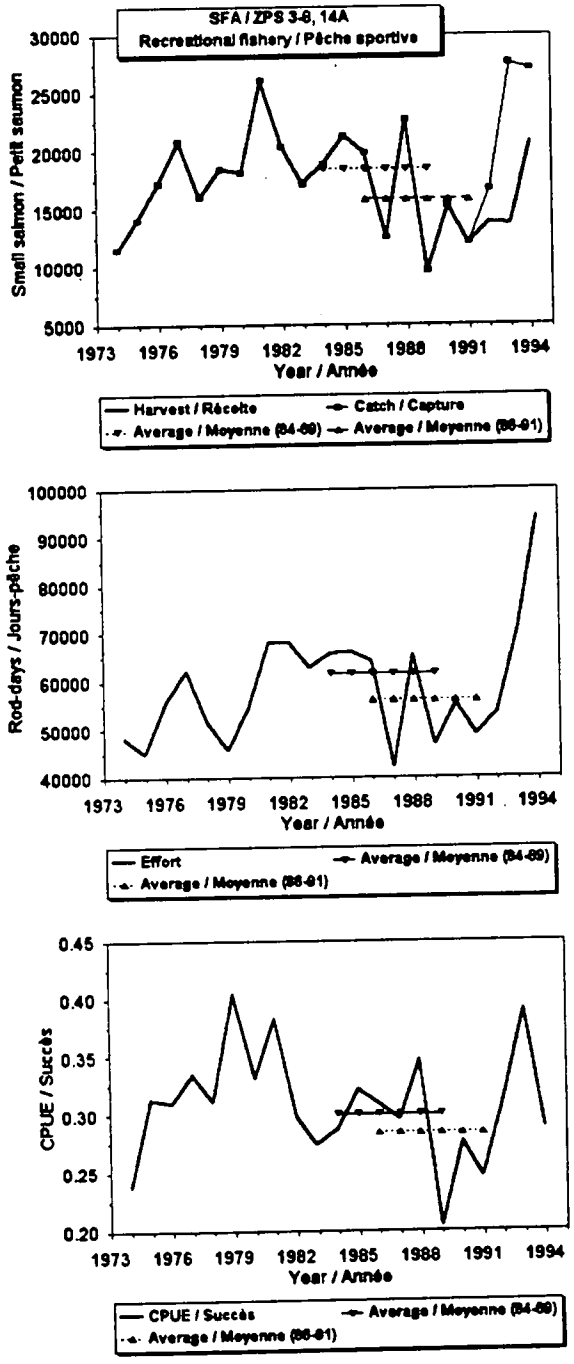


Fig. 3.10.1. Recreational catch of small salmon (harvest = retained for 1974 to 1994 and catch = retained plus released for 1992 to 1994), effort (rod-days), and catch per unit of effort (CPUE = catch of small divided by effort) during 1974 to 1994 in Northern and Eastern Newfoundland (SFAs 3-8 & 14A.

Environmental considerations

Most rivers in SFAs 6, 7, and 8 were closed to angling for most of July because of low water levels and high water temperatures.

Status of stocks

Indices of abundance were from complete counts of small and large salmon for Lomond River, Torrent River, Western Arm Brook, Exploits River, Campbellton River, Gander River, Middle Brook, and Terra Nova River and recreational fishery data (retained plus released fish, Fig. 3.10.1). Since the contribution to total area catch by rivers in SFAs 6-8 is relatively small, river closures for most of July should have minimal impact on historical comparisons. Collectively over all rivers, counts of small and large salmon during the three moratorium years increased significantly over those of the pre-moratorium years 1986-91. However, at several counting facilities, counts of small and large salmon similar to or greater than those of 1992-94 occurred in certain pre-moratorium years.

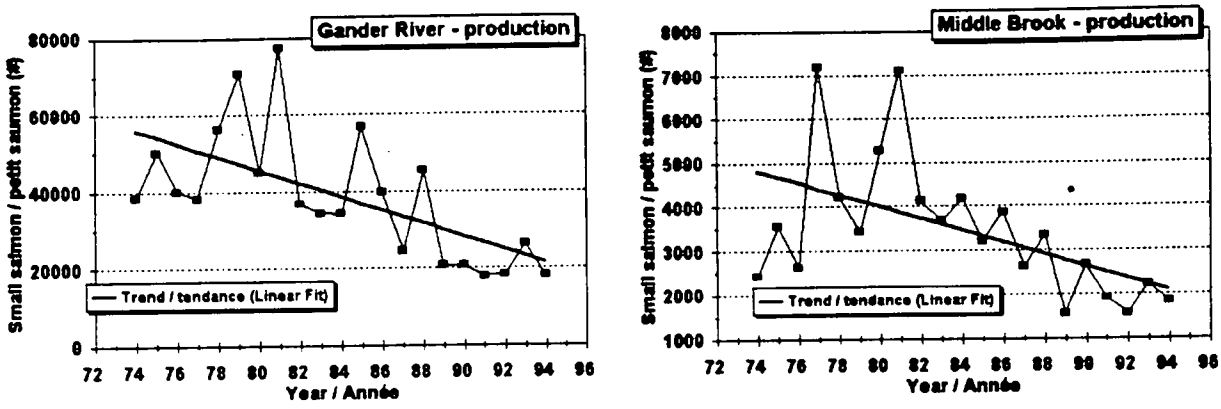
Of the rivers assessed, target egg deposition was achieved in 1994 for all except Exploits, Gander, and Terra Nova.

Percent target egg deposition achieved in rivers of SFAs 4 to 8 and 14A during the five-year period prior to the commercial salmon fishery moratorium (1987-1991) and the three years during the moratorium (1992-1994)

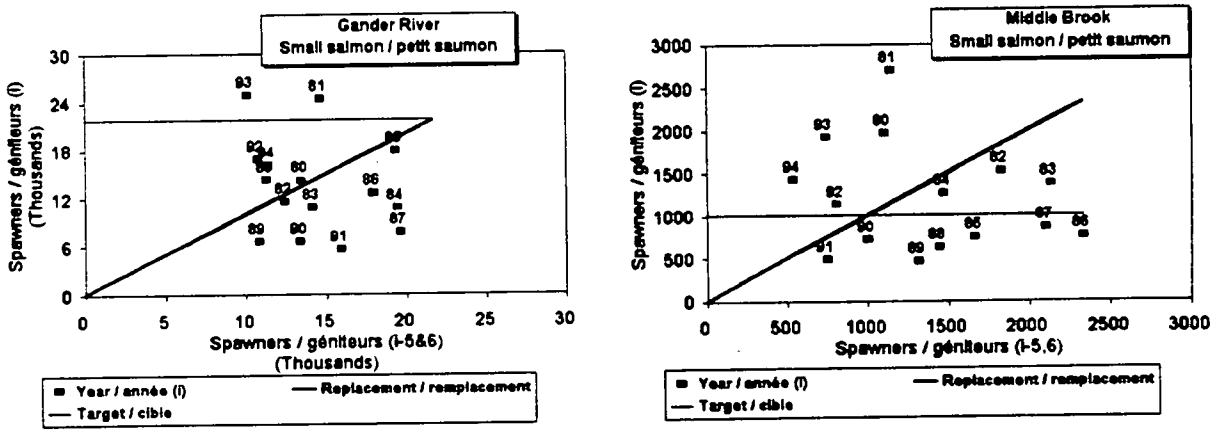
	1987	1988	1989	1990	1991	1992	1993	1994
SFA 4 - Exploits River								
Lower	65%	61%	48%	47%	35%	79%	109%	93%
Middle	9%	12%	14%	12%	14%	20%	23%	27%
Upper	97%	125%	119%	88%	0%	2%	6%	7%
SFA 4 - Gander River			35%	36%	33%	112%	136%	89%
SFA 4 - Campbellton River							274%	208%
SFA 5 - Terra Nova River	15%	30%	20%	20%	16%	29%	53%	31%
SFA 5 - Middle Brook	90%	66%	50%	75%	51%	142%	218%	171%
SFA 14A - Lomond River	56%	70%				121%	118%	143%
SFA 14A - Torrent River	201%	266%	225%	221%	176%	314%	538%	530%
SFA 14A - Western Arm Brook	103%	72%	144%	114%	68%	151%	288%	292%

The estimated total numbers of small salmon produced in Gander River and Middle Brook(before any

The estimated total numbers of small salmon produced in Gander River and Middle Brook (before any exploitation) has declined since 1974 and levels during the moratorium years were among the lowest on record for both rivers.



The relationships between parents (small salmon) and future spawners for Gander River and Middle Brook are shown in the figures below. For both rivers, numbers of small salmon spawners were above the replacement line during the moratorium years; numbers of small salmon were below target requirement in 1992 and 1994 in Gander River but exceeded the target in all three moratorium years in Middle Brook.



Prospects

Catches of small salmon were relatively low in pre-moratorium years 1989-91, and if indicative of spawning escapements, returns in 1995-96 could be lower than in 1992-94 especially if natural survival rates are similar to recent years. The first recruitment from the increased egg depositions of the moratorium will not occur until 1997-98.

Based on a retrospective analysis of total population size and the number of small salmon produced per spawner, returns to the Gander River in 1995 are anticipated to be below target requirement, with no recreational fishery. Returns of small salmon to Middle Brook in 1995 are anticipated to be above the target. If smolt-adult survival in 1995 is similar to 1994 (7.1%), approximately 680 small salmon are anticipated to return to Western Arm Brook in 1995, well above target requirement.

Management considerations

An objective of the split in the seasonal bag limit (three retained fish prior to and after July 31) was to constrain the catch to the level achieved by quotas in 1992 and 1993. Effort and the number of small salmon retained increased markedly in 1994 compared to 1992 and 1993, which was also reflected in increased exploitation rates (double in some rivers). Some of the increase in effort could have been redirected from areas where rivers were closed due to low water levels and high water temperatures. Similar to SFA 11 (see section 3.9), there was an increase in effort after July 31 compared to previous years. **There is potential for increased exploitation for Torrent River.**

The occurrence of net marks on salmon in the Gander and Campbellton rivers was likely the result of illegal fishing below the counting fence (Gander River) and encounters with legal fishing gear such as capelin traps (both rivers).

Summary sheets

More detailed information on individual river assessments for Lomond River, Torrent River, Western Arm Brook, Exploits River, Campbellton River, Gander River, Middle Brook, and Terra Nova River are provided in the summary sheets.

STOCK: Lomond River (above the fishway) (SFA 14A)
TARGET: 1.1 million eggs (~ 653 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Returns to fishway:									
Small		....No Counts		435	526	701	1	440	224
Large		Available (89-91)		80	34	50	0	50	19
Angling catch below fishway:									
Small	270	386	328	357	275	325	203	650	366
Large	5	17	10	56	36	58	2	46	18
Approximate total returns[2]:									
Small	.	.	.	792	801	1026	259	986	590
Large	.	.	.	80	34	50	3	75	31
Known removals above fishway:									
Small	.	.	.	16	22	.	0	0	0
Large	.	.	.	0	1	.	0	0	0
Spawning escapement above fishway:									
Small	.	.	.	419	504	701	1	440	224
Large	.	.	.	80	33	50	0	50	19
% of Target eggs met (small + large)[3]:									
				121	118	143	0	74	37

[1]MIN, MAX, MEAN are for 1974-1988.
[2]Approximate because of the occurrence of spawning below the fishway. Large salmon were not retained after 1984.
[3]Egg depositions in 1992 and 1993 are based on biological characteristics for 1993.

Methodology: Fluvial habitat includes 215,600 m^2 and lacustrine habitat includes 1,570 ha of standing water. Target egg deposition is based on 2.4 eggs/m^2 of fluvial area and 368 eggs per ha of lacustrine area. Target eggs are to come from small salmon. Potential egg deposition was determined from counts of small and large salmon at the fishway and biological characteristics obtained from samples at the fishway and in the recreational fishery.

Recreational fishery: The recreational fishery above the fishway has been closed since 1978. The recreational fishery on the Lomond River has been managed by a river quota of 350 small salmon since 1986.

Data and assessment: Counts of salmon using the fishway on Lomond River are available from 1962-1994 with the exception of 1968-1970 and 1989-1991 when the fishway was not monitored.

State of the stock: The state of the stock should be assessed in terms of the whole river. The area above the fishway represents about 40% of the total river area. Potential egg depositions for 1974-1988 averaged 37% of the target above the fishway. The target was achieved for the first time in 1992 and again in 1993 and 1994.

STOCK: Torrent River (above the fishway), (SFA 14A)
TARGET: 1.5 million eggs (~ 867 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Returns to fishway:									
Small	1369	2296	1415	2347	4009	3592	38	2815	1509
Large	60	82	73	169	222	331	3	523	113
Angling catch below fishway:									
Small	143	222	150	477	179	227	0	340	118
Large	0	4	1	6	15	9	0	18	3
Approximate total returns to river[2]:									
Small	1512	2518	1565	2824	4188	3819	96	3155	1626
Large	60	82	73	169	222	331	7	525	115
Total spawners above fishway:									
Small	1369	2296	1415	2347	4009	3592	138	2815	1533
Large	60	82	73	169	222	331	3	523	113
% of Target eggs met (small + large)[3]:									
	225	221	176	314	538	530	17	360	195

[1]MIN, MAX, MEAN are for 1974-1991.
[2]Approximate because of the occurrence of spawning below the fishway.
[3]Potential egg depositions in 1990-1993 were calculated based on the 1985-1989 female mean wt. of 1.6 kg for small and 4.13 kg for large salmon.

Methodology: Fluvial habitat includes 516,800 m^2 and lacustrine habitat includes 2,323 ha of standing water. Target egg deposition is based on 2.4 eggs/m^2 of fluvial area and 105 eggs per ha of lacustrine area. Target eggs are to come from small salmon. Potential egg depositions were determined from the spawning escapement of small and large salmon based on a fecundity of 1783 eggs per kg estimated for Western Arm Brook. Biological characteristics used to calculate the potential egg depositions in 1974-1984 were the mean weight and percent female of small and large salmon in 1985-1989. Potential egg depositions in 1990-1993 were based on the 1985-1989 mean weight of 1.6 kg for small and 4.13 kg for large salmon. Biological characteristics were from samples collected at the fishway.

Recreational fishery: The river is not open to angling until 1000 salmon have passed through the fishway. Angling is currently not permitted above the fishway.

Data and assessment: The salmon stock above the fishway on Torrent River was enhanced in 1972-1976 with the transfer of over 700 adult salmon from Western Arm Brook.

State of the stock: It is estimated that the Torrent River stock has reached its target egg deposition since 1978. The potential egg depositions in 1993 and 1994 were the highest recorded.

STOCK: Western Arm Brook, (SFA 14A)
TARGET: 0.91 million eggs (~ 344 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Returns to counting fence:									
Small	455	322	233	480	947	954	120	1578	492
Large	0	0	1	8	8	31	0	4	1
Angling catch below fence:									
Small							0	171	41
Large							0	2	0
Total returns to river:									
Small	455	322	233	480	947	954	233	1578	533
Large	0	0	1	8	8	31	0	5	2
Broodstock removals[2]:									
Small							0	238	23
Large							0	0	0
Spawning escapement above fence:									
Small	455	322	233	480	947	954	120	1578	468
Large	0	0	1	8	8	31	0	4	1
% Target eggs met (small + large):									
	144	114	68	151	288	292	31	287	111

[1]MIN, MAX, MEAN are for 1974-1991.
[2]Broodstock removals for Torrent River, 1974-1976.

Methodology: Fluvial habitat includes 290,000 m^2 and lacustrine habitat includes 2,017 ha of standing water. Target egg deposition is based on 2.4 eggs/m^2 of fluvial area and 105 eggs per ha of lacustrine area. Target egg requirements are to come from small salmon. Total returns to the river are based on counts at the fence and angling catches below the fence. Potential egg depositions were calculated from the total spawning escapement of small and large salmon based on 1783 eggs per kg of females.

Recreational fishery: The recreational fishery on this river has been closed since 1987 because of high angling exploitation below the counting fence.

Data and assessment: Complete adult and smolt counts at the counting fence are available since 1971. Adult returns in 1990, 1991, 1992, 1993, 1994 were 2.8%, 2.2%, 3.6%, 6.1%, and 7.1% of the respective smolt runs.

State of the stock: Potential egg depositions in 1974-1991 averaged 111% of the target. The percentage of the target achieved in 1994 was the highest recorded since 1974.

Forecast: The number of smolt counted on Western Arm Brook in 1994 was 31% below the count in 1993. Assuming a sea-survival of 1994 smolts similar to 1993 smolts, the return of adults to the river in 1995 is expected to be about 31% below the returns in 1994 (or 680 small salmon).

STOCK: Exploits River (SFA 4)
TARGET: 95.9 million eggs (equivalent to 56,670 small salmon)
Lower Exploits 16.4 million eggs
Middle Exploits 64.2 million eggs
Upper Exploits 15.4 million eggs

Year	1989	1990	1991	1992	1993	1994	MIN	MAX	Mean[4]
Recreational catch[1] (retained only)									
Small Salmon	577	917	1045	1408	1655	3072	577	2998	1660
Brood removals[2]:	4459	3869	1408	1078	0	0	31	5111	3371
Total returns[1]:	7666	7117	5758	13818	22777	18472	3845	19557	8966
Small	7577	6995	5659	13504	22150	17556	4740	19205	8785
Large	89	122	99	314	627	916	343	352	180
% Target eggs met[3]:									
Lower Exploits	48	47	35	79	109	93	35	127	51
Middle Exploits	14	12	14	20	23	27	8	21	12
Upper Exploits	119	88	0	2	6	7	0	125	66

[1] MIN, MAX period from 1974-1991.
[2] MIN, MAX period from 1974-1992.
[3] MIN, MAX period from 1987-1991.
[4] MEAN period from 1987-1991.

Methodologies: Fluvial habitat includes 35 million m^2 units and lacustrine habitat includes 34,000 ha. Target egg requirements are to come from small salmon. Current fry releases are backcalculated to eggs for % of target egg deposition achieved in areas stocked. Total returns to the river are based on the count at Bishop Falls fishway plus angling below the fishway. Spawning escapements for the tributaries of the Lower Exploits except for Great Rattling Brook are derived from spawning surveys in 1992 and 1993.

Broodstock requirements: None at present.

Recreational catches: There are concerns that no angling statistics were reported for the area above Grand Falls. Concern is expressed over the large increase in catch on the Exploits especially below Grand Falls as this impacts the escapement to the Upper Exploits.

State of the stock: From 1987 to 1991, the Lower, Middle, and Upper Exploits have averaged 51%, 12% and 66% of their target egg requirements, respectively, based on fry releases and natural spawning. The egg requirement for the Middle Exploits includes the main stem of the river which at present is not producing adults. If this habitat is removed, then the Middle Exploits in 1994 achieved 89% of its target. The low returns to the Upper Exploits is cause for concern and every effort should be made to reduce mortality on these returning adults.

STOCK: Campbellton River (SFA 4)
TARGET: 2.916 million eggs (1480 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small salmon)	148	106	126	311	316	340	23	1547	626
Smolt counts					31577	41633	31577	41633	36605
Adult counts									
Small					4001	2857			
Large					145	191			
% Target eggs met (small + large)					274	208			

[1]Recreational catch is for the period 1974 to 1991. Catches for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Catches prior to 1992 are for retained fish for the entire angling season. Catches for 1979 and 1987 were not included in the mean since in that year the river was closed for most of the angling season due to drought conditions. Catches for 1994 are retained small salmon.

Recreational catches: Catches have ranged from 23 to 1,547 during the period 1974-93. Catches declined during 1981-91 before the salmon moratorium. Effort has remained relatively steady until 1992. The number of small salmon retained in 1994 was 340 and 4 were released.

Data and assessment: Complete counts of smolt and adult salmon migrations were obtained from portable fish counting fences in 1993 and 1994.

State of the stock: Egg deposition in 1994 was 6.08 million eggs which was in excess of target requirement.

Accessible habitat:

Fluvial = 596,000 m^2; Lacustrine = 4037.3 ha

STOCK: Gander River (SFA 4)
TARGET: 46.211 million eggs (~21,828 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small salmon)									
	1173	1155	1180	1268	1271	2123	1155	4575	2459
Counts[2]									
Small	7743	7520	6445	18179	25905	18080	6445	7743	7236
Large	473	508	670	4162	1734	1072	473	670	550
% of target eggs met									
	35	36	33	112	136	89	33	36	35

[1]Recreational fishery data are for the period 1974 to 1991. Catches for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994 are retained fish for the entire angling season. Data for 1987 are omitted from the calculation of min, max, and mean due to closure of parts of the river as a result of drought conditions. Summaries for counts and target egg deposition are for 1989-91. Target egg deposition represents the contribution of both small and large salmon.

[2]Counts for 1992 were adjusted.

Recreational catches: Catches have ranged from 1,155 to 4,578 small salmon during the period 1974-91. Catches declined during 1981-91, before the salmon moratorium. Effort has remained relatively steady. The number of small salmon retained in 1994 was 2123 (an increase of 67% over 1993) and the number released was 448 compared to 1,950 in 1993.

Data and assessment: Complete counts of salmon were obtained at a fish counting fence during 1989-94, and have historically been counted at a fishway located on a tributary, Salmon Brook.

State of the stock: Target egg deposition was not achieved in 1994 (-11%). The relative contribution of large salmon to total egg deposition was 13%, which was similar to 1993 (14%), but represented a substantial decline from 40% observed in 1992 and was also below the average for 1989-91 (17%). In contrast to 1993, target spawning requirement in terms of small salmon was not met in 1992 (-17%) and 1994 (-16%). Using Salmon Brook as an indicator of returns to the entire river, it is likely that returns of small salmon of a magnitude similar to or greater than those in 1992-94 occurred in pre-salmon moratorium years. Total population sizes of small salmon and spawning escapements for pre-salmon moratorium years 1989-91 were the lowest for the period 1974-91. Therefore, if sea-survival remains the same, returns of small salmon in 1995-96 could be lower than in 1992-94, which should be viewed with concern. Increased returns arising from the closure of the commercial fishery in 1992 are not expected until 1997 or 1998. Counts of large salmon at Salmon Brook in 1992-94 were the highest on record.

Forecast: Based on a retrospective analysis of total population size and ratio of small salmon produced per spawner, returns in 1995 are anticipated to be below target requirement, without a recreational fishery. Corroborative support for this prediction was provided by an index of juvenile production.

STOCK: Middle Brook (SFA 5)
TARGET: 2.3 million eggs (~1012 small salmon)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small salmon)									
	165	349	278	423	299	409	165	708	461
Fishway counts									
Small	496	745	562	1168	1959	1512	496	2414	1118
Large	19	13	14	43	87	90	13	91	34
% of target eggs met									
	50	75	51	142	218	171	50	134	80

[1]Recreational catch is for the period 1974 to 1991. Catches for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994 are retained fish for the entire angling season. The years 1979 and 1987 are omitted from calculations of min, max, and mean due to river closures resulting from drought conditions. Means for fishway counts are from 1980 to 1991. Summary for target egg deposition applies from 1984 to 1991 and represents the contribution of both small and large salmon.

Recreational catches: For the period 1974-91, catches ranged from 165 to 789 small salmon. Rod-days of effort peaked during the mid-1980s but declined substantially in recent years. A total of 409 small salmon was retained in 1994 and 122 were released.

Data and assessment: Complete counts are available from a fishway located on the lower river.

State of the stock: Target egg deposition requirement was exceeded in 1992, 1993, and 1994. Egg deposition was below target requirement for pre-salmon moratorium years 1985-91. Higher counts of both small and large salmon occurred in pre-salmon moratorium years than were observed in 1992-94. Total population size of small salmon during the moratorium years was substantially lower than in the late 1970s and early 1980s.

Forecast: Based on a retrospective analysis of total population size and the number of small salmon produced per spawner, returns in 1995 are anticipated to be in excess of the target requirement.

STOCK: Terra Nova River (SFA 5)
TARGET: 14.30 million eggs (~7094 small fish)

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch (small salmon)									
	357	624	448	409	484	822	243	850	559
Fishway counts									
Small	1138	1149	873	1443	2713	1570	569	1737	1087
Large	142	144	114	270	470	242	19	206	101
% of target eggs met									
	20	20	16	29	53	31	15	30	20

[1]Recreational catches are for the period 1974 to 1991. Catches for 1992 and 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Data prior to 1992 and for 1994 are retained fish for the entire angling season. Means for fishway counts are from 1979 to 1991. Summary for targets here applies from 1984 to 1991. Percentage of target egg deposition met includes the contribution from small and large salmon.

Recreational catches: For the period 1974-91, catches ranged from 243 to 850 small salmon. Catches in pre-salmon moratorium years 1989-91 were low relative to those of the late 1970s and early 1980s. Rod days of effort have generally increased over time. A total of 822 small salmon was retained in 1994, the highest since 1977, and 178 were released.

Data and assessment: Counts are available from a fishway located on the lower river. Counts of small and large salmon for 1993 are incomplete.

State of the stock: Counts of small and large salmon in 1994 decreased from 1993 (highest counts on record) and were similar to those of 1992; the proportion of target egg deposition achieved in 1994 was 31% which compares the record high of 53% recorded in 1993.

3.11 Labrador (SFAs 1, 2, and 14B)

General description

River assessments in this area are provided for Sandhill River and Forteau River. By Labrador standards, these rivers are relatively small. In general, rivers in Labrador possess a significant large salmon component (mainly maiden multi-sea-winter salmon). In 1994, 26% of the run to Sandhill River was comprised of large salmon compared to 14% for Forteau River (based on total returns to the river).

Description of fisheries

The overall commercial fishery quota for Labrador (92 t) was caught in 1994 (Table 3.11.1). The 1994 quota however was reduced considerably from 1992 and 1993 levels. The catch for SFA 1 was 2 t below the allowance catch of 24 t, SFA 2 exceeded its 60 t quota by 4t, and SFA 14B fell short of its 8 t quota by 2 t. Commercial catches of small and large salmon in 1994 continued at the low levels characteristic of recent years (Figs 3.11.1 and 3.11.2). Recreational catches of small and large salmon (retained plus released fish) in 1994 were above the means and effort expenditure was one of the highest on record; however, CPUE (for small and large salmon combined) was average (Fig. 3.11.3). The number of small salmon retained in 1994 was well below the means and comparable to levels for the quota years 1992 and 1993; the number of large salmon retained was similar to the means and 1993 but below 1992 (Fig. 3.11.3). The recreational quota for retained fish was not caught in all SFAs of Labrador in 1993.

Public consultation

Advisory meetings were held with representatives of the Government of Newfoundland and Labrador and organized angler groups. A meeting with the general public was held in Forteau. The agenda was the same as described for Southwest Newfoundland (Section 3.8). Stock assessments subjected to peer review in February, 1995.

Environmental considerations

Average conditions applied to both the marine and freshwater environments in 1994.

Status of stocks

Indices of abundance were from complete counts of small and large salmon for Sandhill River and Forteau River, commercial and recreational fishery data (retained plus released fish), and a commercial catch rate index for the Nain Region, SFA 1. Since the overall commercial fishery quota was not caught in years prior to 1994, data for these years (1990-93) are used as indices of abundance, although the decreases in licensed effort could have resulted in somewhat lower catches. In 1994, the quota was exceeded slightly in SFA 2 but not attained in SFAs 1 and 14B. Recreational catches in Labrador have historically constituted only a small proportion of total catches (recreational plus commercial) and therefore a cautious approach must be taken in interpretation of trends as representative of abundance.

Table 3.11.1. Commercial catches of small and large salmon from Labrador, SFAs 1, 2 and 14B for 1974 to 1994.

Year	Small weight	Small number	Large weight	Large number	Total weight	Total number	Quota weight
1974	113	56321	602	122765	713	179086	
1975	213	111791	492	114521	705	226312	
1976	165	78209	591	131540	756	209749	
1977	140	69602	572	116980	712	186582	
1978	64	33656	430	91473	494	125129	
1979	96	45714	230	52238	326	97952	
1980	228	103479	625	124955	853	228434	
1981	238	114680	576	112334	814	227014	
1982	159	79449	389	83243	548	162692	
1983	98	49441	272	60212	370	109653	
1984	53	25590	200	43202	253	68792	
1985	86	47359	152	33995	238	81354	
1986	141	71396	297	58565	438	129961	
1987	178	89454	385	79170	563	168624	
1988	159	83109	235	49598	394	132707	
1989	114	56486	216	47743	330	104229	
1990	67	33027	136	27487	203	60514	
1991	54	26768	66	13465	120	40233	
1992	46	24249	157	32341	203	56590	273
1993	32	17074	80	17096	112	34170	178
1994	18	8508	74	15213	92	23721	92
Period 1984 to 1989							
Mean	121.8	62232	247.5	52046	369.3	114278	
Std. Dev.	46.9	23907	82.3	15536	122.8	36859	
95% LCL	72.6	37139	161.1	35739	240.4	75590	
95% UCL	171.0	87325	333.9	68352	498.3	152966	
Period 1986 to 1991							
Mean	118.8	60040	222.5	46005	341.3	106045	
Std. Dev.	50.0	25983	113.3	23132	161.2	48180	
95% LCL	66.3	32768	103.6	21726	172.2	55475	
95% UCL	171.4	87312	341.4	70284	510.5	156615	
% Change. 1994 versus							
1993	-44	-50	-8	-11	-18	-31	
84-89	-85	-86	-70	-71	-75	-79	
86-91	-85	-86	-67	-67	-73	-78	

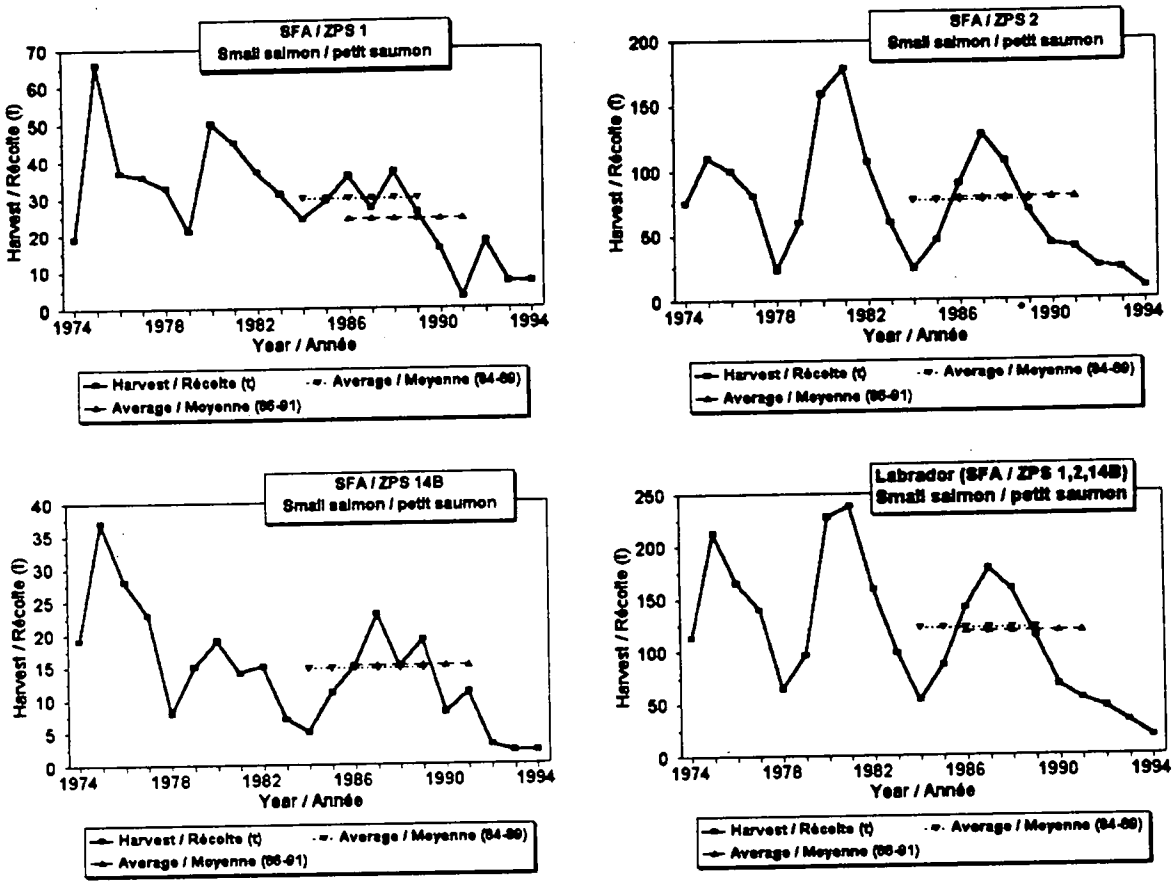


Fig. 3.11.1. Commercial harvests of small salmon (t) for Labrador SFAs 1, 2 and 14B separately and combined, 1974 to 1994.

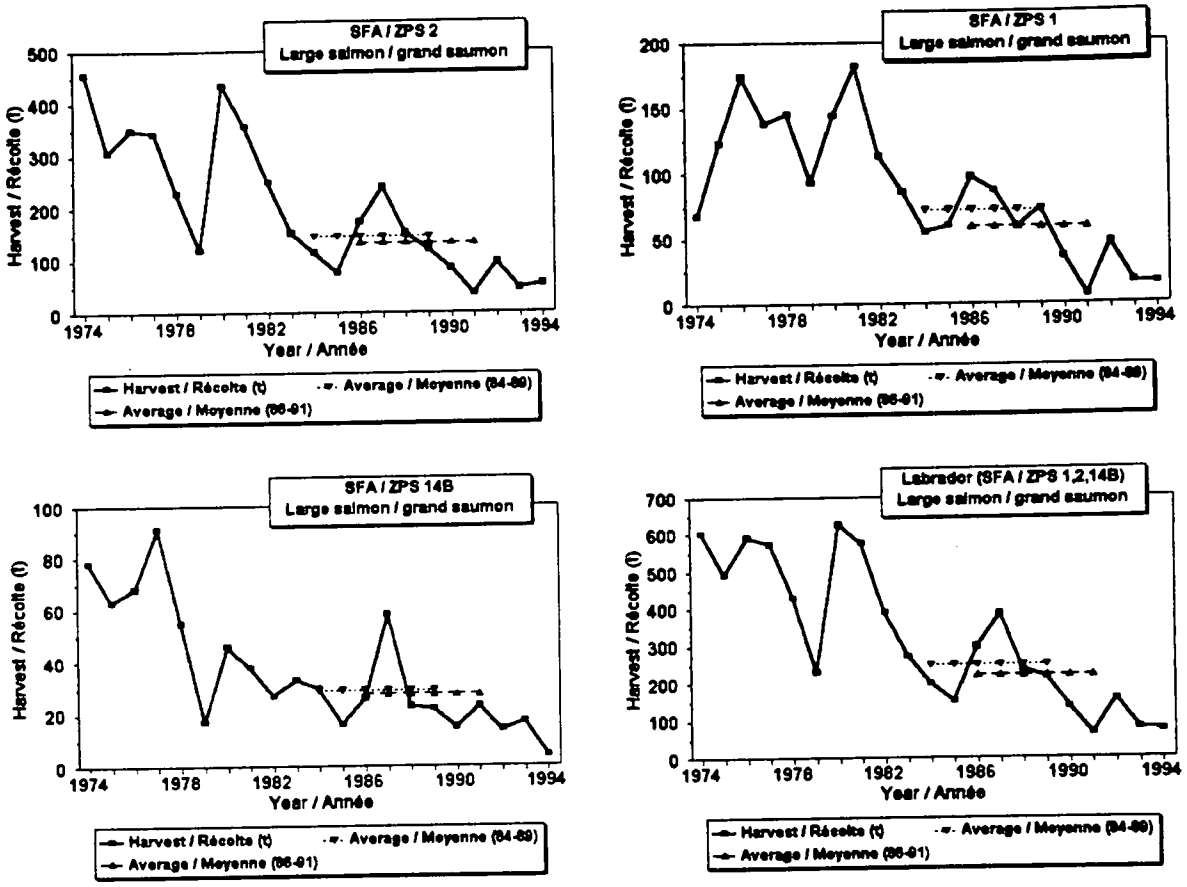


Fig. 3.11.2. Commercial harvests of large salmon (t) for Labrador SFAs 1, 2 and 14B separately and combined, 1974 to 1994.

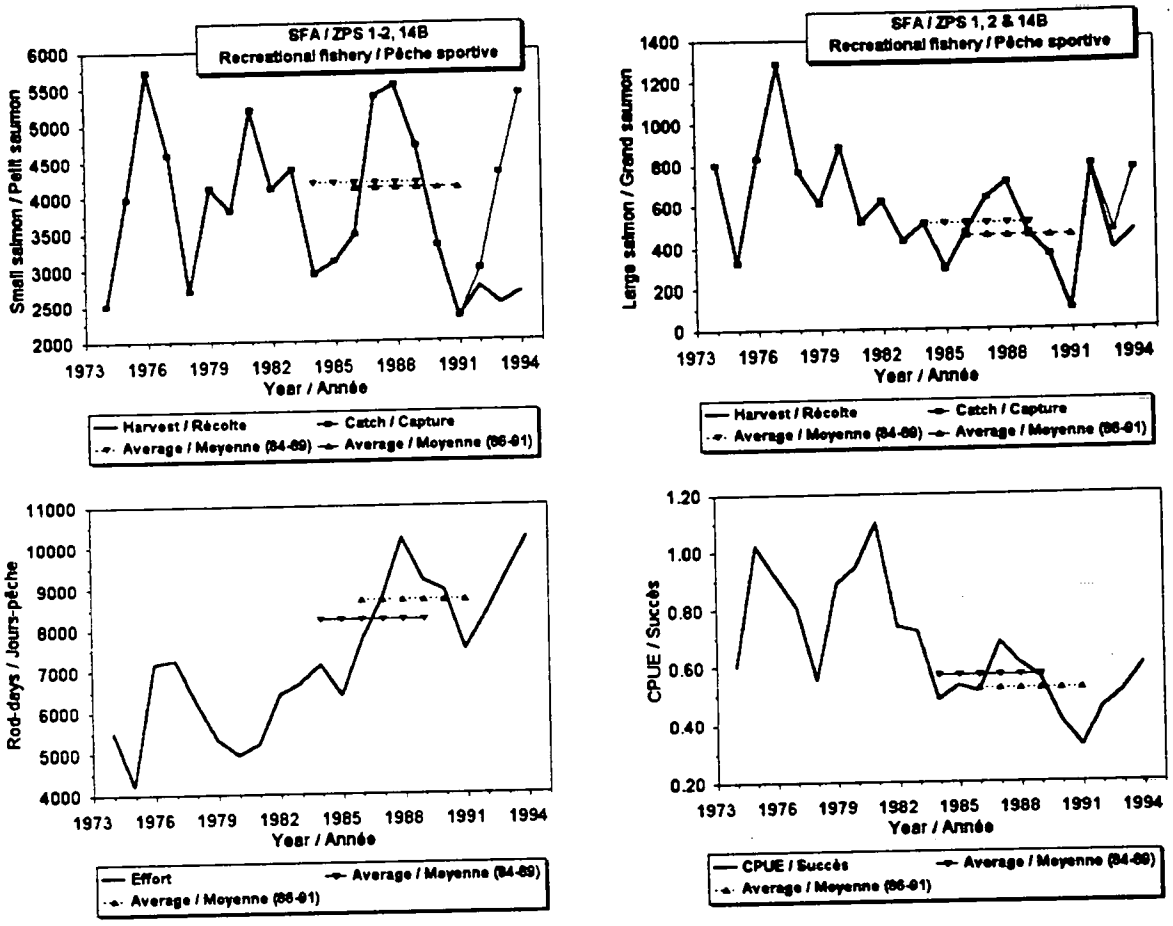


Fig. 3.11.3. Recreational catch of small and large salmon (harvest = retained for 1974 to 1994 and catch = retained plus released for 1992 to 1994), effort (rod-days), and catch per unit of effort during 1974 to 1994 for Labrador, SFAs 1, 2 and 14B.

The count of small salmon in Sandhill River in 1994 was slightly less than for 1972, which was the lowest for the period 1970-73 (the only previous data available); the count of large salmon in 1994 was substantially higher than any recorded in 1970-73. Counts were available for the first time for Forteau River (228 small salmon; 74 large salmon) and L'Anse Au Loup River (14 small salmon; 4 large salmon) in 1994. Egg depositions were below target in both the Sandhill River (54%-78%) and Forteau River (62%-96%) in 1994.

The estimates of total production of small and large salmon returning to Sandhill River in 1994 was substantially less than in the early 1970s. The production estimates include the component which would have been caught in commercial fisheries in Newfoundland, Labrador and Greenland.

	Estimate of total production from Sandhill River	
Year	Small	Large
1970	5625	1656
1971	5619	3192
1972	3184	2100
1973	7439	6048
1994	2399	973
Mean 1970-73	5467	3249

For all stocks collectively, numbers of large salmon spawning in SFA 1 were below the replacement line every year since 1983 (Fig. 3.11.4). In SFA 2, numbers in 1992 and 1994 were close to the replacement and just above it in 1993. Numbers of large salmon spawners were well below target requirement for both SFAs in all years.

Large salmon harvested in the commercial fishery in Labrador with a river age greater than three years are principally from stocks in Labrador and the Quebec North Shore. There is a relationship between catches of large salmon in Labrador and catches at West Greenland of North American salmon with a river age greater than three years. The time series of landings, for small and large salmon in SFAs 1, 2, and 14B combined and North American-origin small salmon with a river age greater than three years at West Greenland (which return to home rivers in the following year) all showed declining trends (Fig. 3.11.5). Judging from harvests of small salmon in 1994, returns of large salmon in 1995 may be less than in 1994.

Commercial catches of Atlantic salmon at Nain, northern Labrador, have been directly associated with landings for the remainder of Labrador. Trends in the catch rate index for two combinations of subareas at Nain are shown in Fig. 3.11.6. The catch rate in 1994 improved over 1992 and 1993 in the Dog Island - Black Island area but remained below the long-term average; the catch rate for the Kiglapaits - Cutthroat area in 1994 was the lowest recorded. Catch rate trends in recent years must be viewed with caution because of decreasing fishing effort directed towards salmon.

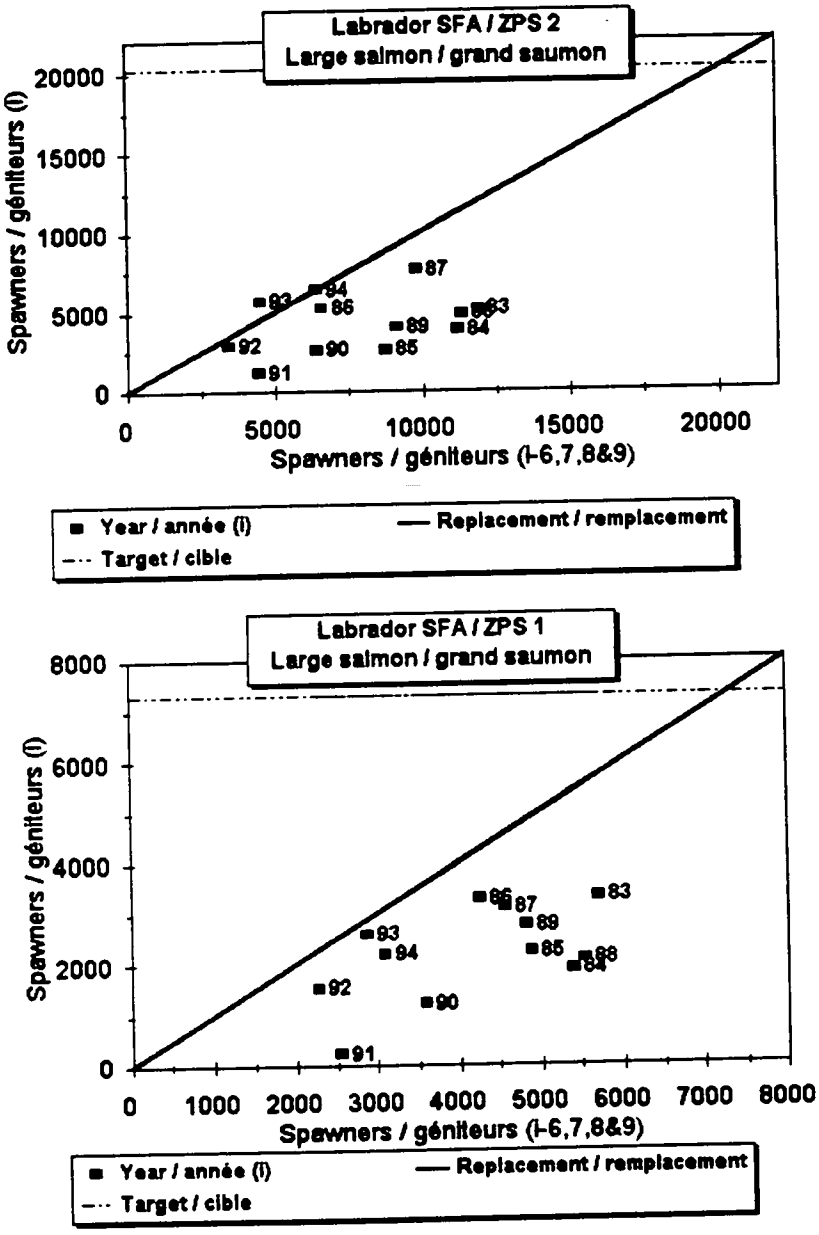


Fig. 3.11.4. The relationship between parents and spawners (after exploitation) for Labrador large salmon for SFAs 1 and 2 shown relative to the replacement line and the target spawner requirement line.

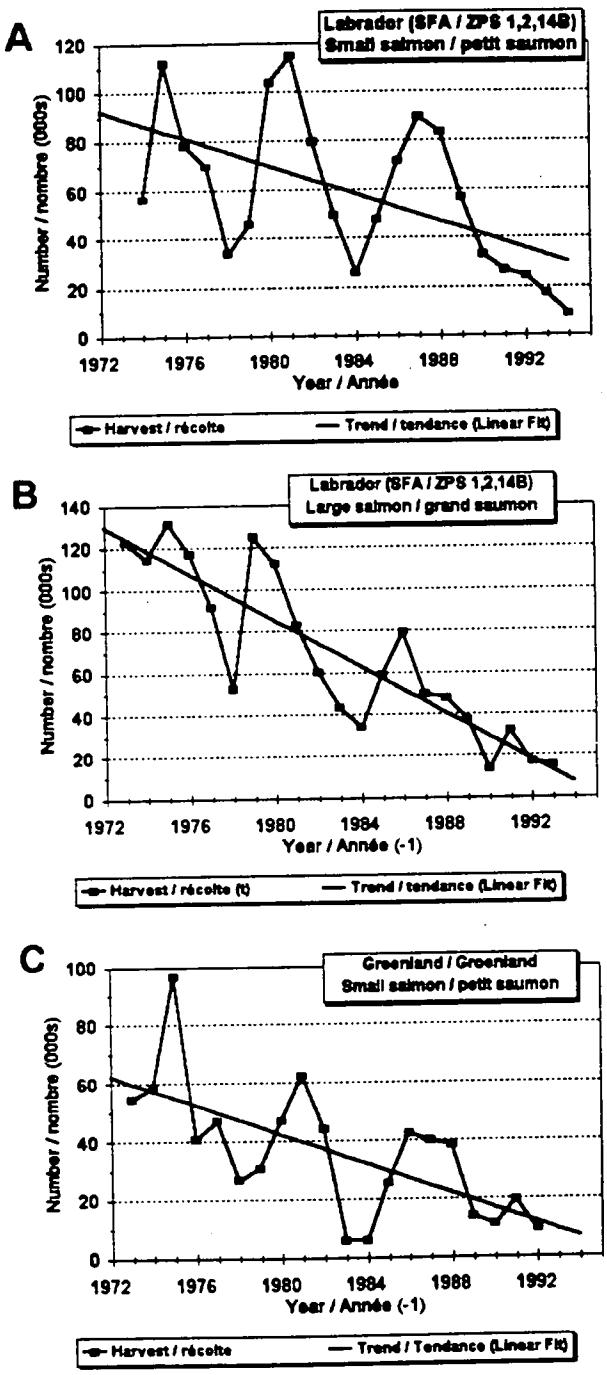
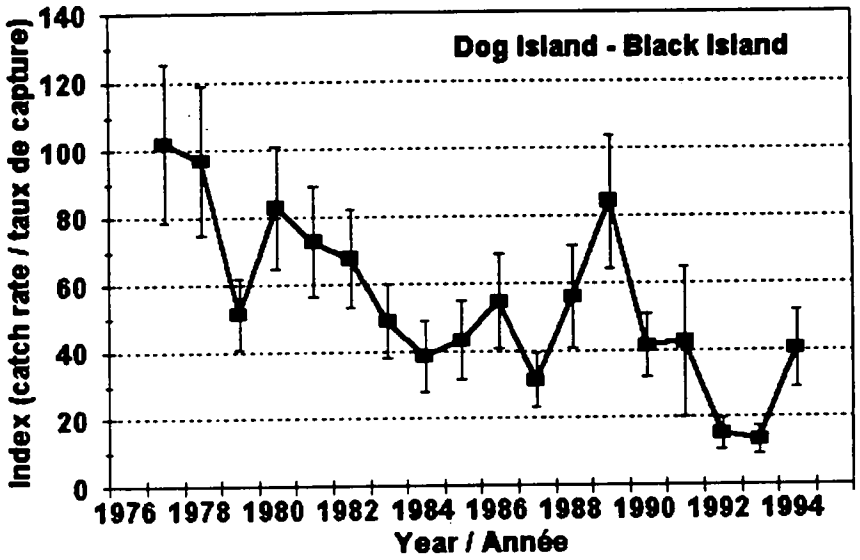


Fig. 3.11.5. Harvest and trend lines for small salmon (panel A), large salmon (panel B) in Labrador commercial fishery (SFAs 1, 2, and 14B combined) and for North American origin small salmon with river age greater than 3 years in the West Greenland harvest. Large salmon are lagged by one year (-1) so that the catches of the same smolt class are shown in the same year.



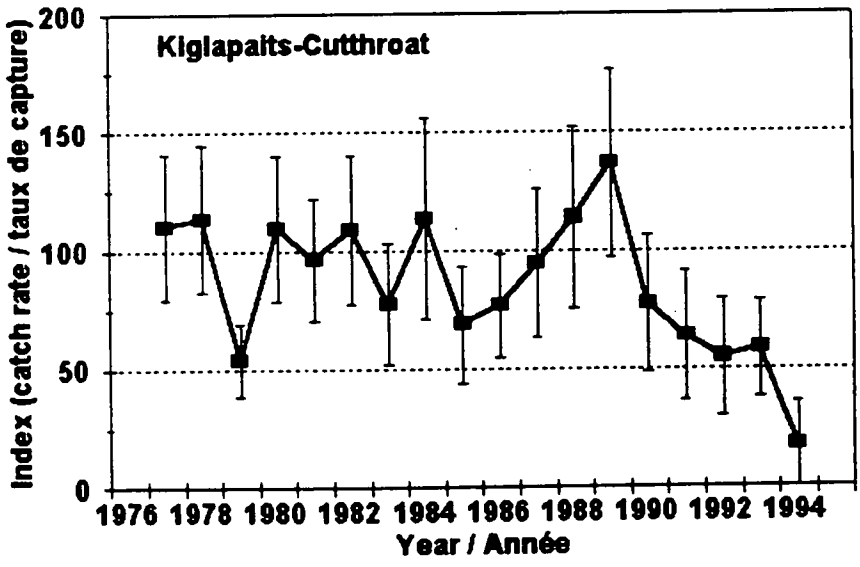


Fig. 3.11.6. Trends in the Atlantic salmon commercial catch rate index from two combinations of subareas within the Nain Fishing Region of northern Labrador, 1977 to 1994. Vertical lines indicate the 90% confidence intervals.

Prospects

In 1992-94, it is possible that fish once taken in the commercial fishery in SFA 3 and to a lesser extent in SFAs 4-7, contributed to catches in Labrador. In the past, Labrador-origin Atlantic salmon have been intercepted in these areas. In spite of this and recent reductions in the commercial fishery, compared to 1992-94, river escapements of small and large salmon for Labrador as a whole, as indicated by commercial and recreational fishery data, have been as high or higher in the past. This, and the analysis of total population sizes of small and large salmon for Sandhill River suggests that the total population sizes of small and large salmon have declined in recent years. This conclusion is corroborated by the relationships of parents to future spawners, catch rates at Nain, and trends in catches of small and large salmon in Labrador and small salmon with a river age greater than three years at West Greenland. Low population sizes of small and large salmon in 1994 correspond to years of above average commercial and recreational fishery catches in 1987 and 1988. Recreational catches and catch rates in 1990 and 1991 might be indicative of below average spawning escapements, which could contribute to lower future returns relative to 1994, should natural survival rates remain the same.

Management considerations

Although there appears to have been some improvement in returns in the past few years, the present low population sizes of small and large salmon compared to the late 1970s and early 1980s, years when there was a substantial commercial fishery, is a matter of serious concern. The marked decline in recreational catches of small and large salmon in SFA 14B in 1994 and the fact that the commercial quota for this area was not caught, is of particular concern. **Consequently, exploitation on Labrador stocks and in particular the large salmon component, which contributes substantially to egg deposition, should be as low as possible.**

Summary sheets

More detailed information on individual river assessments for Sandhill River and Forteau River are provided in the summary sheets.

STOCK: Sandhill River, SFA 2
TARGET: No. 1 - 10.079 million eggs, No. 2 - 14.439 million eggs.

Year	1989	1990	1991	1992	1993	1994	MIN[1]	MAX[1]	Mean[1]
Recreational catch									
Small	515	372	197	448	258	279	100	702	372
Large	27	38	18	25	12	29	2	94	25
Smolt counts									
Adult counts									
Small						2159	2038	4761	
Large						730	175	730	
% Target 1 eggs met (small +large)						77.9			
% Target 2 eggs met (small+large)						54.4			

[1]Recreational catch is for the period 1974 to 1991. Catches for 1992 - 1993 are retained catches to the time the SFA quota was caught and do not include hook-and-release fish. Catches prior to 1992 and for 1994 are for retained fish for the entire angling season. Counts are for the period 1970-74 & 1994.

Recreational catches: Catches have ranged from 122 to 765 during the period 1974-94. The number of small salmon retained in 1994 was 279 and 326 were released. The number of large salmon retained was 29 and 7 were released.

Data and assessment: Complete counts of smolt and adult salmon migrations were obtained from portable fish counting fences in 1970-73 and a complete count of adults was done in 1994.

State of the stock: Egg deposition in 1994 was 7.85 million eggs which was below target requirements.

Accessible habitat: Because of the unavailability of information on some of the physical parameters of this system, two different amounts of accessible habitat were calculated.

Target 1: Fluvial = 3.843 million m^2; Lacustrine = 8150 ha

Target 2: Fluvial = 5.660 million m^2; Lacustrine = 8150 ha

STOCK: Forteau River, SFA (14B)
TARGET-1 [1]: 0.5 million eggs (~ 247 small salmon)
TARGET-2 [1]: 0.7 million eggs (~ 381 small salmon)

Year	1989	1990	1991	1992	1993	1994 Target-1	1994 Target-2	MIN	MAX	Mean
Returns to counting fence:										
Small						228	228			
Large						74	74			
Angling catch below fence:										
Small						230	230			
Large						3	3			
Total returns to river:										
Small						458	458			
Large						77	77			
Spawning escapement:										
Small						149	149			
Large						73	73			
% of Target eggs met (small + large):										
						96	62			

[1] Target-1 and Target-2 refer to preliminary egg deposition targets derived for Forteau River by estimating fluvial rearing units in addition to those measured from earlier stream surveys. Earlier surveys included streams visible on 1:250,000 scale topographic maps, but additional streams were identified on currently available 1:50,000 scale maps. Rearing units for these additional streams were estimated based on their total length (SPANS GIS) and estimated average widths of 1 m (Target-1) or 3 m (Target-2). Actual stream width measurements will be conducted in 1995.

Methodology: Fluvial habitat includes 204,040 m^2 (Target-1) to 326,800 m^2 (Target-2) and lacustrine habitat includes 520 ha of standing water. Target egg deposition is based on 2.4 eggs per m^2 fluvial area and 105 eggs per ha of lacustrine area. Target eggs are to come from large and small salmon.

Recreational fishery: Regression analyses of Forteau River and Pinware River angling catches and effort indicates a significant relationship between the two rivers.

Data and assessment: An adult salmon counting fence was operated on Forteau River for the first time in 1994 from 25 June to 3 October.

State of the stock: Estimates of target egg deposition are preliminary. The potential egg deposition in 1994 was 62-96% of the target. The recreational fishery removed 59% of the returning population or 67% of the small salmon and 5% of the large salmon returns.