Assessment of the Atlantic Salmon Stock of Conne River, Newfoundland

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Abstract

An evaluation of the existing data base on Conne River was conducted to provide an estimate of Atlantic salmon spawning requirements and potential salmon production. Salmon parr in the Conne River are believed to utilize both lotic and lacustrine habitat, similar to that observed for other salmon rivers in Newfoundland. The mean annual production, 1981-85, was estimated to be 10,600-17,700 one-sea-winter (1SW) salmon. The spawner requirements to maintain this range in production is estimated to be 2,500-4,000 1SW salmon.

Résumé

On a réalisé une évaluation de la base existante de données sur la rivière Conne pour formuler une estimation des exigences relatives au frai du saumon et à la production potentielle de saumon. On croit que les tacons présents dans la rivière Conne vivent dans un habitat à la fois lacustre et lotique, semblable à celui observé dans d'autres cours d'eau de Terre-Neuve. On a estimé la production annuelle moyenne pour 1981-1985 à 10 600-17 700 saumons d'un hiver en mer (1HM). On juge que pour maintenir cette gamme de production, il faudrait que le nombre de reproducteurs atteigne 2500-4000 saumons d'un hiver en mer (1HM).

Introduction

In July, 1985 the Department of Fisheries and Oceans officially recognized the current salmon fishery of the Conne River Indian Band as a food fishery. Initial allocation would not be "greater than their usual catch over the previous years". DFO has no record of any harvest by the Conne River Band. However, the Band claims that they annually harvest 2,000-3,000 Atlantic salmon to supply food to their families. The Newfoundland Region is currently engaged in developing a management plan for the Conne River with an allocation to the Conne River Indian Band. This document reviews all available data and provides an estimated range in potential production and spawner requirements.

Background Information

Physical Description of Conne River

The Conne River is located in Bay D'Espoir, Statistical Section 36, on the south coast of Newfoundland (Fig. 1). Its drainage area is 600 km^2 with 860 km of total stream length including tributaries. Several surveys were conducted in the late 1950s and early 1960s to locate obstructions to fish passage. In 1978 a helicopter survey was carried out to map the bottom composition of Conne River. The only total natural obstruction to fish passage was at Bernards Falls on Bernards Brook. Fish passage was provided in 1962. Fish passage was improved at several partial obstructions in 1971 and 1972. Extensive logging and log driving took place in the watershed in 1942-1958 which adversely affected fish passage. Most logging dams were removed in the 1960s. The relative amount of stream and lake habitat available on the Conne River can be broken down as follows:

Total area of streams excluding lakes = 17,800 units (100 m^2)
Total parr rearing habitat = 9,500 units
Total area of all lakes in watershed = 4,620 ha
Total number of lakes and small ponds = 214

Fish Populations

The fish species known to occur in the Conne River are anadromous and non-anadromous Atlantic salmon (Salmo salar), anadromous and non-anadromous brook trout (Salvelinus fontinalis) and American eel (Anguilla rostrata). Biological characteristics are only available for anadromous Atlantic salmon. Salmon angled in the sport fishery were sampled in 1976 and 1980. Biological characteristics are as follows:

	n	% 1SW	2SW	PS	% smolt age 2+	3+	4+	5+	Mean smolt age	% female	Fork length (cm)	Whole weight (kg)
1976	95	98	0	2	0	66	33	1	3.4	-	-	1.4
1980	167	96	0	4	4	89	7	0	3.0	76	52.6	1.5
All years	262	98	0	2	2	82	16	0	3.2	76	52.6	1.5

The Atlantic salmon run to the Conne River is early compared to most rivers in the Newfoundland Region. In the early 1960s residents from the Bay D'Espoir area reported that there were three distinct runs of salmon to Conne River. They reported a run of 2.7-4.6 kg salmon, May 10-30; a run of 1.8-2.3 kg salmon, June 10-25; and, a run of small salmon 0.9-1.4 kg for July 1-30 (Mercer 1961). However, weekly angling data since 1973 indicate that very few salmon enter the river before June and that the majority of the salmon enter the river in June.

Juvenile salmon are believed to extensively utilize the streams and lakes for rearing.

The Fisheries

The sport and commercial fishing seasons are as follows:

	Sport	Commercial
Prior to 1978	May 24 - Sept 15	May 15 - Dec 31
1978-83	June 10 - Aug 31	May 20 - July 10
1984	June 10 - Aug 31	June 5 - July 10
1985	June 8 - Sept 2	June 5 - July 10

The angling catch statistics 1953-85 are shown in Table 1. There has been an increase in angling effort from less than 1,000 rod days prior to 1964 to almost 7,000 in 1983. The average effort 1981 to 1985 was 6,436 rod days. The angler catch is almost entirely grilse (one-sea-winter (1SW) salmon), although from 1953 to 1959 about 10% of the catch was recorded as multi-sea-winter (MSW) salmon (> 2.7 kg). The angler catch has increased from less than 1,000 salmon prior to 1963 to a high of 3,300 salmon in 1982. The mean catch 1981-85 was 2,661 salmon.

The landings in Statistical Sections 36 and 37 and Statistical Area J_1 are shown in Table 2. The mean landings of MSW salmon in Statistical Area J_1 (Sections 36 and 37) in 1978-85 is 73% less than the mean landings 1974-77. Similarly, the mean landings of 1SW salmon decreased by 52% from 1974-77 to 1978-85 (Table 2). The MSW salmon comprised 75% of the landings of Area J_1 in 1974-77 and 62% of the landings 1978-85. Landings have been recorded for five

communities in Bay D'Espoir (Table 3). All recorded landings except for 1975 were estimates of local sales. The average landings 1974-77 for all communities was 2.4 t and from 1978 to 1984 was 1.0 t. The decrease (58%) in landings is similar to that observed for Statistical Sections 36 and 37 (Table 2). The decrease in landings for J_1 is believed to be, to a large extent, due to the shorter fishing season 1978-85. The number of licensed commercial salmon fishermen has decreased from 176 in 1975 to 74 in 1985 (Table 4).

Methods

Present Production

There has not been any enumeration of smolts or upstream migrants in the Conne River. The only data available on the size of the salmon stock is the anglers catch. Present production was calculated using an assumed range in angling exploitation rate from 30% to 50% of the escapement into the river and a 50% exploitation rate by the commercial fishery. The angling exploitation rates were chosen because migration into the Conne River is early and salmon are available to anglers for a longer time than in most rivers, the angling effort is high, and the river is relatively accessible to anglers. The assumed angling exploitation rates were applied to the mean annual angling catch for 1981-85. The commercial exploitation rate was selected after consideration of the 62% commercial exploitation rate calculated by Reddin (1981) for Western Arm Brook stock and a probable decrease in exploitation in the commercial fisheries in Statistical Section 36 and in Bay D'Espoir since 1977 due to shortened season and reduced number of licensed fishermen.

The angling catch of 1SW salmon for the Conne River 1978-85 (Table 1) were regressed on the commercial landings of 1SW salmon in Statistical Sections 36 and 37, Statistical Area J_1 (Table 2) and in communities in Bay D'Espoir (Table 3). The total landings in Bay D'Espoir were regressed on the landings in Section 36 (excluding the landings in Bay D'Espoir).

Potential Adult Salmon Production and Spawning Escapement

Adult salmon production for the lotic portion of the Conne River was estimated by the equation:

$$A = R \times S_m \times S$$

where
A	=	adult salmon production prior to any commercial exploitation.
R	=	total stream parr rearing units in the Conne River (9,500 units).
S_m	=	number of smolts produced per 100 m^2.
S	=	survival at sea.

The smolt production was assumed to be three smolts/unit based on calculations from data on Bay du Nord River (Fortune Bay) and North Harbour River (St. Mary's Bay) (Mike O'Connell, pers comm.) A survival at sea of 0.18 was used, as derived by Reddin (1981). No production estimates were calculated for the 214 lakes on the Conne River because no data are available on which of

these lakes support sea-run Atlantic salmon parr. Also, no parameter value of smolt production/hectare has been developed and accepted by CAFSAC.

Spawning requirements for the lotic area (flowing sections of the river system) of Conne River were calculated by multiplying the total number of units in the system (9,500) by 240 eggs/unit (Elson 1975). The number of spawners was derived using the following: 76% female, mean weight of 1.5 kg, and an assumed fecundity of 1,760 eggs/kg (converted from Elson 1975).

It is obvious that the above calculations will underestimate the production potential and spawner requirements of the Conne River because it does not account for production of juvenile salmon in lakes. Another approach was therefore taken. The range in average abundance 1981-1985 was assumed to be equal to the production potential of the Conne River. The spawner requirements to maintain the production was calculated by using a ratio between the number of spawners and potential adult salmon production (recruits to fisheries) calculated for the lotic habitat. This ratio was then applied to the estimate of average production 1981-85.

Results

Present Production

The mean annual escapement of Atlantic salmon into Conne River, based on an angling exploitation of 30% to 50% and a mean annual catch of 2,661 is 5,322 to 8,870 salmon. Using a 50% exploitation rate in the commercial fisheries, the estimated total annual stock size 1981 to 1985 would be 10,644 to 17,740 salmon. No significant correlations ($P < 0.05$) were found between the angling catches and the commercial landings of 1SW salmon in Section 36 ($r = 0.11$), Section 37 ($r = 0.05$), Area J_1 ($r = 0.36$) or Bay D'Espoir ($r = 0.71$). Also no significant correlations were found between the commercial landings in Bay D'Espoir and the landings in Section 36 less the landings in Bay D'Espoir ($r = 0.51$).

Potential Adult Production and Spawning Requirements

The estimated potential production of the lotic portion of Conne River is 5,130 1SW Atlantic salmon. The required egg deposition to produce these fish would be 2.28×10^6 eggs. The number of spawners for the lotic portion of the Conne River is estimated to be 1,136 salmon. The ratio of spawners to recruits (5,130/1,136) is 1:4.5.

Assuming the total potential salmon production (lotic plus lacustrine) for the Conne River is equivalent to the estimated average production, 1981-85 (10,644 to 17,740 1SW salmon) and using the spawner-to-recruit ratio of 1:4.5, the spawner requirements would be 2,400-3,900 1SW salmon.

Discussion

There are insufficient data on the Conne River to provide accurate estimates of present production, production potential and spawner requirements

for the entire river. Average production estimates for 1981-85 of 10,600-17,700 1SW salmon and spawner requirements of 2,400-3,900 1SW salmon are weak estimates. These estimates are probably good enough to give an appreciation for stock size and spawning requirements. However, they are not sufficiently reliable to provide TAC advice. No data are available to forecast abundance in 1986. I suggest a range in spawning requirements of 2,500-4,000 1SW salmon (grilse) be used until further information becomes available. Using these values it would appear that, on average, the target egg deposition was met during the period 1981-85.

The high proportion of MSW salmon in the commercial landings at communities in Bay D'Espoir (Table 3) suggests that there may be a harvest of non-local origin salmon. Since the landings are almost all local sales (estimated by fisheries officers) the accuracy of the estimate of the proportion of MSW salmon needs to be verified. The reduced proportion of 1SW salmon after 1977 may be caused by early closure of the commercial fishery which would disproportionately reduce the harvest of 1SW salmon.

It is recommended that investigations be carried out to further define abundance of salmon in the Conne River and refine the spawner requirements before there is an increase in exploitation. It is noted that an increase in exploitation of salmon downstream from the sport fishery could reduce catches in the sport fishery.

References

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Mercer, K. M. 1961. Report on a reconnaissance survey of Salmon, Grey, and Conne Rivers, p. 95-144. Fish Culture Development Branch, St. John's, Nfld.., Progress Rep. 9: 144 p.

Reddin, D. G. 1981. Estimation of fishing mortality for Atlantic salmon (Salmo salar) in Newfoundland commercial fisheries. ICES C.M.1981/M:24. 11 p.

Table 1. Angling catch statistics for Conne River, 1953-85.

RIVER: CONNE RIVER   CODE: 36133500

YEAR	EFFORT ROD DAYS	GRILSE <2.7KG	SALMON >2.7KG	TOTAL CATCH	CUE	PERCENT GRILSE
1953	445	138	26	164	0.37	.
1954	134	120	23	143	1.07	86
1955	99	303	37	340	3.43	76
1956	308	476	36	512	1.66	89
1957	413	369	23	392	0.95	95
1958	610	480	55	535	0.88	87
1959	555	393	18	411	0.74	96
1960	89	387	0	387	4.35	100
1961	644	491	0	491	0.76	100
1962	769	873	11	884	1.15	98
1963	855	1007	10	1017	1.19	99
1964	1073	1296	25	1321	1.23	98
1965	1242	983	39	1022	0.82	97
1966	1436	879	43	922	0.64	96
1967	1629	570	3	573	0.35	100
1968	2379	1724	49	1773	0.75	92
1969	2909	1751	38	1789	0.61	98
1970	2909	1673	66	1739	0.60	96
1971	3483	1707	33	1740	0.50	98
1972	3194	2509	42	2551	0.80	98
1973	3427	2139	10	2149	0.63	100
1974	4033	1988	17	2005	0.50	99
1975	3800	1903	17	1920	0.51	99
1976	3894	1931	27	1958	0.50	99
1977	3375	1665	5	1670	0.49	100
1978	3122	1735	7	1742	0.56	100
1979	2147	1010	0	1010	0.47	100
1980	3512	2238	14	2252	0.64	99
1981	5029	2691	2	2693	0.54	100
1982	5268	3302	24	3326	0.63	99
1983	6972	2192	21	2213	0.32	99
1984	6709	2343	0	2343	0.35	100
1985	5202	2729	0	2729	0.52	100

MEANS, 95% CONFIDENCE LIMITS, N'S:

80-84	5498.0	2553.2	12.2	2565.4	0.47	99
x+95%cl	+1740.1	+573.6	+13.4	+577.9	+0.13	+0.38
N	5	5	5	5	5	5
75-84	4382.8	2101.0	11.7	2112.7	0.48	99
x+95%cl	+1124.9	+443.4	+7.3	+446.2	+0.08	+0.28
N	10	10	10	10	10	10
74-84	4351.0	2090.7	12.2	2102.9	0.48	99
x+95%cl	+1004.7	+395.7	+6.6	+398.1	+0.07	+0.26
N	11	11	11	11	11	11

PERCENT GRILSE IS CALCULATED BY SMOLT CLASS
IN THE ABOVE TABLE A PERIOD INDICATES NO DATA FOR THAT YEAR

Table 2. Commercial landings in Statistical Sections 36, 37, and Statistical Area J_1, 1974-85.

Year	Section 36 Small (t)	Large (t)	Total (t)	Section 37 Small (t)	Large (t)	Total (t)	J_1 Small (t)	Large (t)	Total (t)
1974	14.2	37.5	51.7	11.0	51.2	62.2	25.2	88.6	113.9
75	22.5	24.3	46.8	11.4	49.1	60.5	33.9	73.5	107.4
76	20.1	51.8	71.9	18.5	65.5	84.0	38.6	117.3	155.9
77	3.3	13.0	16.3	3.6	18.6	22.2	6.9	31.7	38.5
78	1.3	3.9	5.2	1.4	10.4	11.8	2.7	14.3	17.0
79	3.6	8.7	12.4	7.0	20.0	27.0	10.6	28.7	39.4
80	13.2	8.0	21.3	10.8	8.7	19.4	24.0	16.7	40.7
81	2.9	8.7	11.7	5.4	11.6	17.0	8.3	20.3	28.7
82	9.1	12.4	21.5	7.0	12.0	19.0	16.0	24.4	40.4
83	5.5	7.2	12.7	6.7	12.0	18.7	12.2	19.1	31.3
84	4.8	6.7	11.5	4.7	3.7	8.4	9.5	10.4	19.9
85	14.7	23.9	38.7	3.8	9.7	13.5	18.5	33.6	52.2
Mean									
1974-77	15.0	31.6	46.6	11.1	46.1	57.2	26.2	77.8	103.9
78-85	6.9	9.9	16.9	5.9	11.0	16.8	12.7	20.9	33.7

Table 3. Total commercial Atlantic salmon landings in five communities in Bay D'Espoir, 1974-84. The percentage 1SW and the number of licensed fishermen are also shown.

Year	Conne R. Lic. fish	Wt (t)	% 1SW	Milltown Lic. fish	Wt (t)	% 1SW	St. Albans Lic. fish	Wt (t)	% 1SW	Morrisville Lic. fish	Wt (t)	% 1SW	Head of Bay D'Espoir Lic. fish	Wt (t)	% 1SW	Total Lic. fish	Wt (t)	% 1SW
1974	–	0.0	–	–	0.3	49	–	0.4	57	–	0.0	–	–	0.0	–	–	0.7	53
1975	–	0.0	–	–	2.3	48	–	2.3	54	–	0.8	40	–	0.1	72	–	5.4	50
1976	0	0.0	–	4	0.7	59	9	1.4	62	1	0.7	66	–	0.0	–	14	2.7	62
1977	0	0.0	–	4	<0.1	27	9	0.8	27	1	0.2	27	–	0.0	–	14	1.1	27
1978	0	<0.1	27	3	0.0	–	8	0.2	26	1	0.0	–	–	0.0	–	12	0.2	26
1979	0	0.0	–	3	0.0	–	7	0.0	–	1	0.0	–	1	0.0	–	12	0.0	–
1980	0	0.1	27	1	<0.1	72	5	0.6	31	1	0.1	27	3	0.0	–	10	0.8	33
1981	0	0.0	–	1	0.0	–	5	0.1	27	1	0.0	–	4	0.0	–	11	0.1	27
1982	0	0.0	–	2	0.3	27	6	2.8	27	1	0.2	27	2	0.0	–	11	3.3	27
1983	0	0.0	–	2	<0.1	30	6	0.1	31	1	0.0	–	2	0.0	–	11	1.0	31
1984	0	0.0	–	1	0.2	31	4	0.5	31	1	0.5	30	2	0.2	30	8	1.4	31
Mean 1974-77	–				0.8	49		1.2	52		0.4	49	–				2.4	54
1978-84	–				0.1	32		0.6	27		0.1	29	–				1.0	24

Table 4. Licensed fishermen for Statistical Sections 36, 37, J_1, 1974-85.

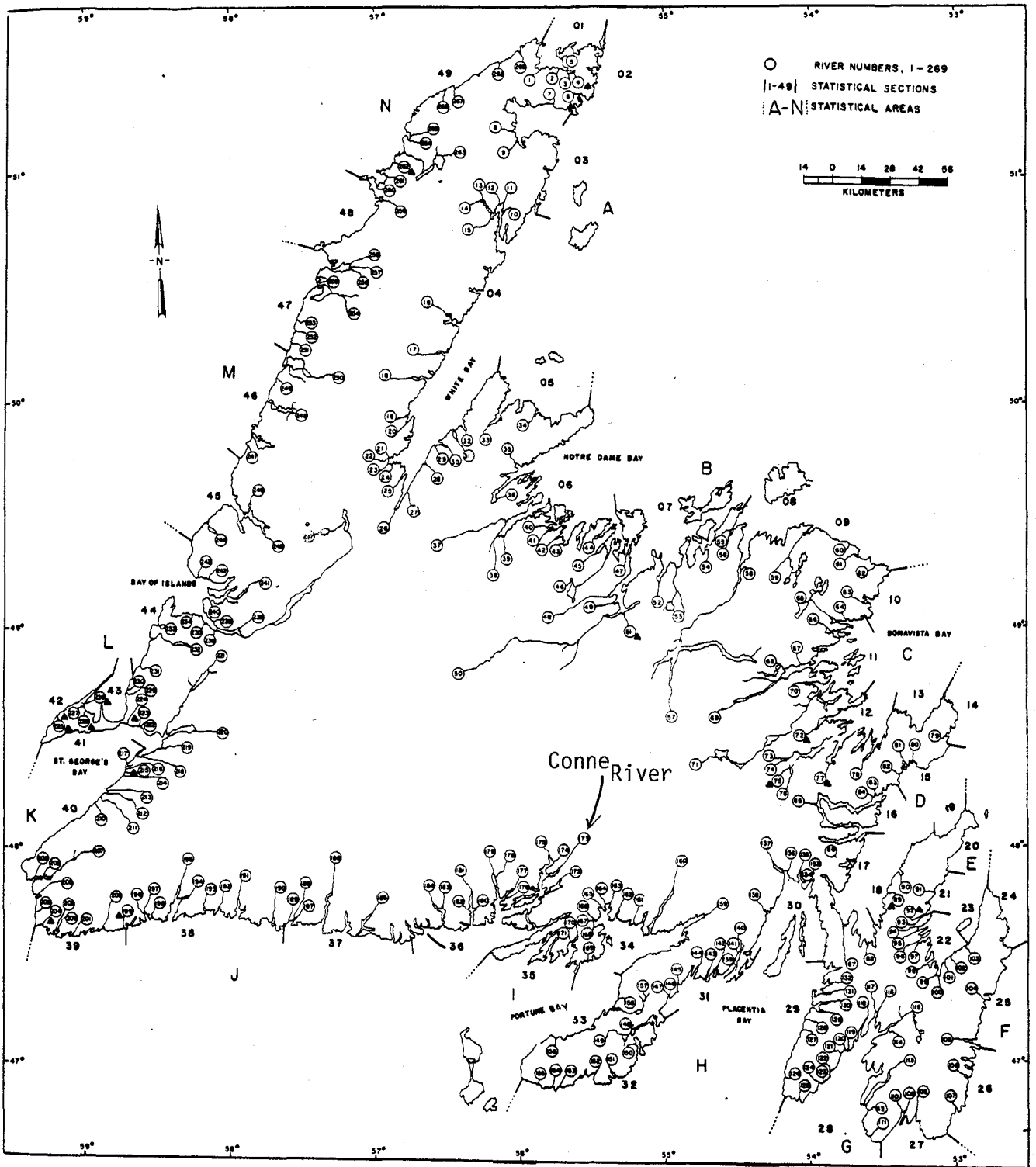|	Section 36	Section 37	J_1
1974	61	36	97
1975	112	64	176
1976	104	56	160
1977	97	49	146
1978	93	47	140
1979	88	47	135
1980	82	47	129
1981	79	47	126
1982	77	43	120
1983	73	41	114
1984	62	23	85
1985*	52	22	74

*Eligible for a license in 1985.

Fig. 1.   Location of rivers in insular Newfoundland with existing and historic ( ) Atlantic salmon populations. Boundaries of statistical areas and statistical sections are also indicated.