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**Status of Atlantic Salmon (*Salmo salar* L.) in Gander River,  
Notre Dame Bay (SFA 4), Newfoundland, 1989-1990**

by

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### Abstract

The status of Atlantic salmon in Gander River in 1989 and 1990 was determined using complete counts obtained from a counting fence located on the main stem just above head of tide, recreational fishery data, and biological characteristic data. The percentage of target spawning requirement achieved was 33% in 1989 and 34% in 1990.

### Résumé

On a déterminé l'état des stocks de saumon de l'Atlantique de la rivière Gander en 1989 et en 1990 en se fondant sur des dénombrements complets effectués à une barrière de dénombrement du bras principal de la rivière, en amont de la limite des eaux de marée, sur les résultats de la pêche sportive et sur des caractéristiques biologiques. En 1989 et 1990, on a atteint 33 % et 34 % respectivement des besoins-cibles de reproducteurs.

## Introduction

The Gander River, with a drainage area of 6,398 km<sup>2</sup> (Porter et al. 1974), is the third largest in insular Newfoundland. The river is located in Salmon Fishing Area (SFA) 4 (Notre Dame Bay) (Fig. 1). On average, for the period 1985-89, Gander River recorded the highest recreational catch of Atlantic salmon of all rivers in the Newfoundland Region. The catch was 25% of the total for SFA 4 and 10% of the total for the insular Newfoundland portion of the Newfoundland Region. In addition to being one of the most important Atlantic salmon angling rivers in insular Newfoundland, the river has historically supported a relatively large angler guiding and outfitting industry.

In recent years there has been a general concern that the Gander River is underproducing with respect to Atlantic salmon. In 1989, Department of Fisheries and Oceans in cooperation with the Gander Rod and Gun Club and the Gander Bay/Hamilton Sound Development Association, initiated a 3-year study to determine the status of the Gander River Atlantic salmon population.

In this paper counts of Atlantic salmon obtained from a counting fence are used in conjunction with recreational fishery data and biological characteristic data to calculate spawning escapement and egg deposition. Status of stock is evaluated against a target spawning requirement (calculated in terms of fluvial and lacustrine habitats) derived for Gander River.

## Methods

### Recreational fishery data

Catch and effort data from the recreational fishery in Gander River were collected by Department of Fisheries and Oceans (DFO) Fishery Officers and processed by DFO Science Branch personnel.

### BIOLOGICAL CHARACTERISTIC DATA

Biological characteristic information on adult Atlantic salmon in Gander River was obtained by sampling recreational catches (Table 1). For fish < 63 cm in length (grilse), mean values for all years combined were used in the calculation of egg deposition. For fish  $\geq$  63 cm in length (large salmon), mean values for all available data for Gander River and Terra Nova River combined were used (Table 1).

Fecundity was determined from ovaries collected in the recreational fishery. Ovaries were stored in Gilson's fluid until ovarian tissue had broken down after which time eggs were transferred to 10% formalin. Eggs, which for the most part were in early stages of development, were counted directly. The relative fecundity value used to calculate egg deposition was 1,665 eggs/kg and represented all data combined for the years 1984-87 (N = 173).

## ESCAPEMENT AND EGG DEPOSITION

Escapement and egg deposition were calculated for grilse and large salmon separately. Total egg deposition was obtained by summing depositions for grilse and large salmon.

### Total River Escapement

Total river escapement (TE) was calculated as follows:

$$(1) \quad TE = RC_b + C$$

where,

$RC_b$  = recreational catch below counting fence

C = count of fish at counting fence

### Spawning Escapement

Spawning escapement (SE) was calculated as follows:

$$(2) \quad SE = FR - UM - RC_a$$

where,

FR = fish released from counting fence

UM = unrecorded mortalities

$RC_a$  = recreational catch above counting fence

Unrecorded mortalities, which include natural mortality in the river prior to spawning and illegal removals, were assumed to be 5% of the number released from the counting fence.

### Egg deposition

Egg deposition (ED) was calculated as follows:

$$(3) \quad ED = S \times PF \times RF \times MW$$

where,

S = number of spawners

PF = proportion of females

RF = relative fecundity (No. eggs/kg)

MW = mean weight of females

The phenomenon of atresia has been reported to occur in Atlantic salmon in the Soviet Union (Melnikova 1964) and in France (Prouzet et al. 1984). Recently there is evidence to show that it can occur to varying degrees in insular Newfoundland (O'Connell and Dempson, unpublished data). Since the egg deposition calculations above were based on eggs in early stages of development, they should be regarded as potential egg depositions.

## TARGET SPAWNING REQUIREMENT

The target spawning requirement for Gander River was developed by O'Connell and Dempson (1991). Estimates of smolt production from classical fluvial parr rearing habitat (Elson 1957) and lacustrine habitat were converted to eggs using an egg-to-smolt survival rate of 1.25% for fluvial habitat and a value of 1.9% for lacustrine habitat. Smolt production from fluvial habitat was determined on the basis of 3 smolts/unit (a unit = 100 m<sup>2</sup>) of fluvial habitat and 7 smolts/ha of lacustrine habitat (O'Connell et al. 1991). It should be noted that Gander Lake was not included in the calculation of the egg deposition requirement.

## Results and Discussion

### Recreational catch

The recreational catch in 1990 (Table 2) was similar to 1989 (previously the lowest catch since 1974) but decreased by 60% from the 1979-83 mean and by 50% from the 1984-89 mean. The 1984-89 mean corresponds to years under major management changes introduced in 1984 (see O'Connell et al. 1990). The 1989 and 1990 catches were approximately 20% below that of 1987 in which year drought conditions resulted in the closure of the major tributaries entering Gander Lake to angling from July 14 to September 7 (end of the angling season). In 1990, out of the total catch of grilse presented in Table 2, an estimated 220 were caught below the counting fence. Negligible catch occurred below the fence in 1989.

Effort in 1990 increased by 13% over 1989, was similar to that for the 1974-89 (-2%) mean and decreased from the 1984-89 mean (-15%). Catch per unit of effort in 1990 decreased from 1989 (-16%) and the 1974-83 (-63%) and 1984-89 (-41%) means.

### Counting fence and fishway counts

The counting fence on the main stem of Gander River was operated from June 20 to September 4, 1989 and in that period 7,685 grilse and 451 large salmon were counted. In 1990, the fence was operated from June 18 to September 4 and 7,513 grilse and 508 large salmon were counted.

Counts of grilse and large salmon at the fishway located in Salmon Brook tributary for the period 1979-90 are shown in Table 3. Only partial counts were obtained in 1987 and 1990. This was because extremely low water levels prevented fish from entering the fishway throughout most of August and at the time counting operations ceased.

Target spawning requirement

Accessible rearing habitat and estimated potential smolt production calculated for Gander River was as follows (from O'Connell and Dempson 1991):

	<u>Lacustrine</u>	<u>Fluvial</u>	<u>Total</u>
Accessible habitat	21,488 ha	159,560 units	-
Smolt production (No.)	150,416	478,680	629,096

The corresponding target spawning requirement in terms of eggs was as follows:

	<u>Lacustrine</u>	<u>Fluvial</u>	<u>Total</u>
Eggs (No. x 10 <sup>6</sup> )	7.917	38.294	46.211

Total escapement and spawning escapement

Total escapement, spawning escapement, and egg deposition for grilse (G) and large salmon (LS) for Gander River in 1989 and 1990 were as follows:

Year	Total escapement		Spawning escapement		Egg deposition (No. x 10 <sup>6</sup> )		% Target achieved
	G	LS	G	LS	G	LS	
1989	7,685	451	6,128	428	12.972	2.141	33
1990	7,733	508	6,202	483	13.130	2.411	34

The percentage of target spawning requirement achieved was 33% in 1989 and 34% in 1990.

In 1990 the commercial fishery in SFA 4 was limited by a quota for the first time. The commercial fishery closed on July 25 when the quota (92 t) was taken. Also in 1990, caution notices were moved farther out in Gander Bay than in previous years. In spite of such restrictions, the total escapement to Gander River in 1990 remained similar to that of 1989. This suggests that had the restrictions in the commercial fishery not been in place, escapement in 1990 might have been lower than in 1989.

Cautions associated with the parameter values used to calculate smolt production and the target spawning requirement have been discussed previously by O'Connell et al. (1991) and O'Connell and Dempson (1991) and will not be dealt with here. For Gander River, these calculations assume that the locations of spawning substrate and nursery areas are such that under natural

mechanisms of distribution, juveniles will have access to all the specified fluvial and lacustrine rearing habitat. The relative amounts and distribution of accessible rearing, spawning, and nursery habitats available in the Gander River are currently being reassessed. The egg deposition requirement value presented above therefore is an interim value which could be subject to change pending the outcome of the habitat assessment.

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Table 1. Biological characteristic data for female grilse (data for years 1975-87 combined) from Gander River and for female large salmon from Gander River and Terra Nova River (separately and combined).

Year	Length of females				Weight of females (kg)				River age				Sex ratio	
	N	$\bar{X}$	SD	Range	N	$\bar{X}$	SD	Range	N	$\bar{X}$	SD	Range	N	% Female
Grilse														
Gander River	928	52.2	38.6	39.0-62.1	941	1.63	0.37	0.68-3.68	944	3.74	0.57	3.00-6.00	1,217	78
Large Salmon														
Gander River	8	69.2	80.6	63.0-82.6	8	3.66	1.81	2.38-7.71	8	3.50	0.53	3.00-4.00	10	80
Terra Nova River	6	68.3	38.4	63.0-73.5	6	3.08	0.60	2.27-3.70	6	4.00	0.63	3.00-5.00	6	100
Gander and Terra Nova rivers combined	14	68.8	63.9	63.0-82.6	14	3.41	1.41	2.27-7.71	14	3.71	0.61	3.00-5.00	16	88



Table 2. Recreational catch of grilse as well as effort and catch per unit of effort (CPUE) for Gander River, Notre Dame Bay (SFA 4), Newfoundland, 1974-90.

Year	Catch (No.)		Effort (rod days)	CPUE
	Grilse	Large Salmon		
1974	2,270	19	5,153	0.44
1975	2,976	38	6,670	0.45
1976	2,374	132	6,633	0.38
1977	2,269	927	6,939	0.46
1978	3,332	389	8,322	0.45
1979	4,199	318	7,217	0.63
1980	2,664	268	6,384	0.46
1981	4,578	249	10,643	0.45
1982	2,176	205	8,026	0.30
1983	2,033	239	6,934	0.33
1984	2,028	13	7,590	0.27
1985	3,358	*	10,207	0.33
1986	2,361	*	9,740	0.24
1987**	1,444	*	6,384	0.23
1988	2,686	*	7,943	0.34
1989	1,173	*	6,290	0.19
1990	1,155	*	7,118	0.16
<hr/>				
1974-83				
Mean	2,887.1	3165.5	7,292.1	0.43
SD	888.0	918.4	1,464.7	0.03
N	10	10	10	10
1984-89				
Mean	2,321.2		8,354.0	0.27
SD	808.4		1,609.9	0.03
N	5		5	5

\*Retention of large salmon prohibited.

\*\*Not included in mean.

Table 3. Counts of Atlantic salmon at Salmon Brook fishway, 1979-90.

Year	Grilse	Large salmon
1979	404 <sup>1</sup>	6 <sup>1</sup>
1980	997	15
1981	2,459	33
1982	1,425	18
1983	978	12
1984	1,081	38
1985	1,663	26
1986	1,064	12
1987	493 <sup>1</sup>	9 <sup>1</sup>
1988	1,562	24
1989	596	24
1990	328 <sup>1</sup>	7 <sup>1</sup>

<sup>1</sup>Partial count: not included in mean.

1979-83		
Mean	1,464.7	19.5
SD	694.2	9.3
N	4	4
1984-89		
Mean	1,193.2	24.8
SD	430.9	9.2
N	5	5

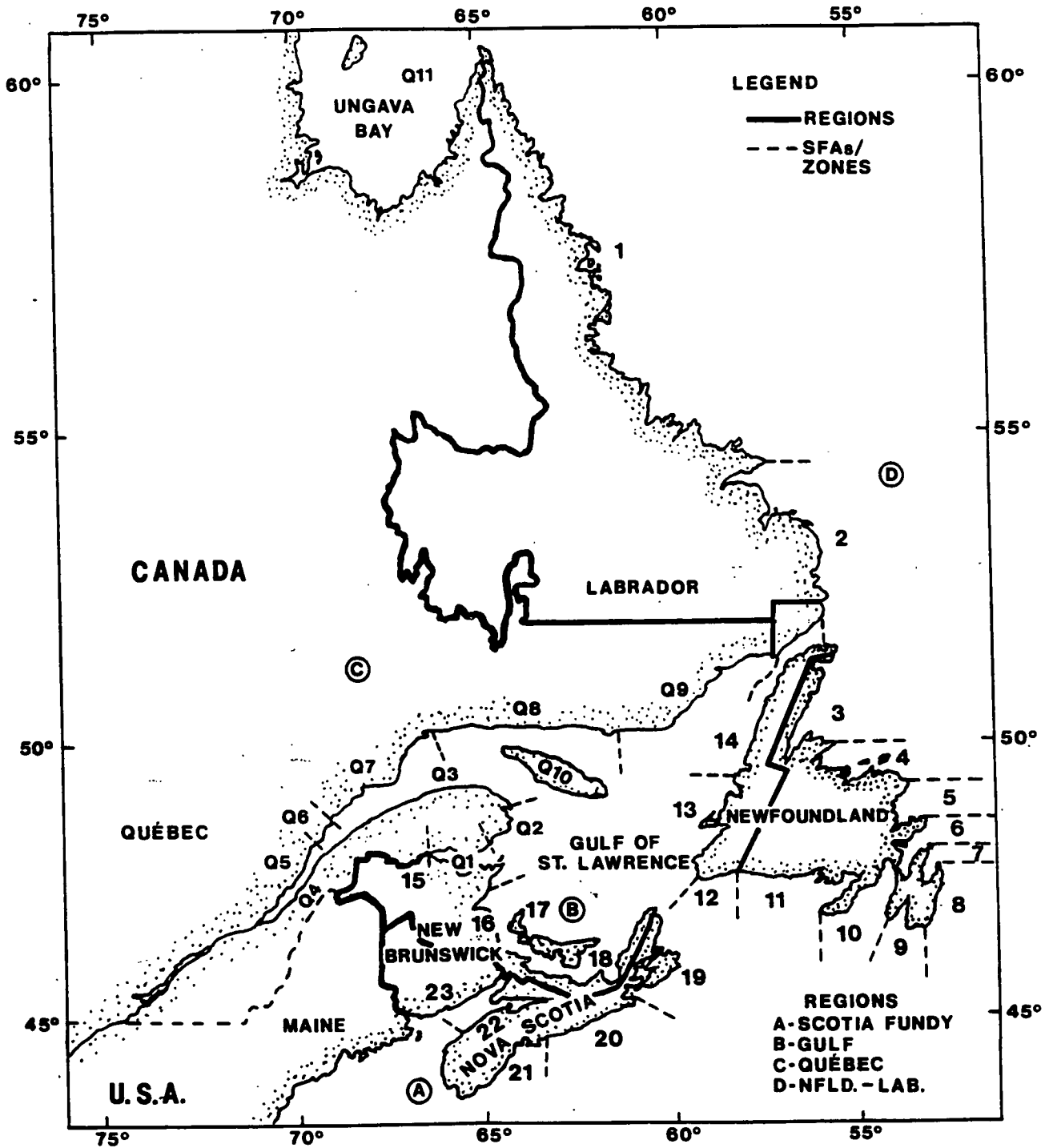


Fig. 1. Map of Atlantic Provinces of Canada showing Salmon Fishing Areas (SFAs) 1-23, Salmon Management Zones of Quebec (Qs) 1-11, and regional boundaries. The Newfoundland Region is comprised of SFAs 1-11.