An Update on the Biological Characteristics and Status of Atlantic Salmon in the Morell River, Prince Edward Island

by

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ABSTRACT

An update of enhancement activities, fisheries trends, and biological characteristics for the Morell River Atlantic salmon resource is presented. Current return rates indicate that there is no surplus in the wild (1SW & MSW) and hatchery return MSW component of the Morell salmon run. A surplus of hatchery return grilse has been realised since 1986. It is suggested that, until wild populations reach a level that exceed minimum spawning requirements, harvest of salmon from the Morell River be restricted to adipose clipped (hatchery) grilse.

RÉSUMÉ

Le document présente un bilan des activités de mise en valeur, des tendances de la pêche et des caractéristiques biologiques du saumon de l'Atlantique dans la rivière Morell. Les taux de retour du saumon dans la rivière Morell indiquent qu'il n'y a actuellement aucun surplus de saumons unibermarins et pluribermarins sauvages ni de saumons pluribermarins d'élevage. Depuis 1986, on a constaté un surplus dans le nombre de madelaineaux d'élevage qui reviennent à la rivière. Il est suggéré que jusqu'à ce que les populations sauvages atteignent un niveau qui dépasse les exigences minimales du frai, la pêche du saumon dans la rivière Morell soit limitée au madelaineaux (d'élevage) ayant subi l'ablation de la nageoire adipeuse.

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Introduction

The Morell River is historically and currently the most important Atlantic salmon river in Prince Edward Island (P.E.I). The Morell River system (Figure 1) discharges into St. Peter's Bay and has a drainage basin of 171 km^2. It is comprised of two main branches, the East Branch and the West Branch, which have a total stream length of 140 km. and whose confluence is 6.4 km. above the head of tide.

By the early 1800's salmon had been extirpated from many P.E.I. streams (Dunfield, 1985). Commercial landings in all rivers flowing into St. Peter's Bay averaged only 200-600 fish annually thereafter (Table 1). The salmon population on the Morell River had been reduced to the point where angling catches averaged only 16 fish per year in the 1960's and 3 fish per year in the 1970's (Table 2).

Enhancement Activities

Despite limited prior attempts to rehabilitate P.E.I.'s salmon stocks and rivers (Ducharme, 1977), the first comprehensive effort to restore the Morell River began in 1982 (Bielak et al., 1991). Federal, Provincial and volunteer groups combined their efforts and developed and instituted an enhancement plan for the Morell River which included habitat improvement, selective breeding of "early run" salmon, and the development of semi-natural rearing ponds for the production of high quality salmon smolts for enhancement purposes.

Two semi-natural rearing pond facilities have been constructed and are currently being operated by non-government organizations (NGOs) in conjunction with the Department of Fisheries and Oceans (DFO). The production from these facilities has augmented the production capacity of the DFO's Cardigan Salmonid Enhancement Centre (SEC) and contributed greatly to smolt stocking activities on the Morell River (Table 3).

Results of Enhancement Efforts

In 1986 the Morell River experienced the largest salmon return in decades. The Leard's pond fishway on the West Branch of the Morell passed 626 multi-seawinter (MSW) salmon* and grilse* in 1986, compared to only 15 in 1985 (Table 4). In addition, DFO angling statistics placed the number of salmon angled in the river at 236 grilse, with an unknown number of MSW salmon released as required by law (Table 2).

Angling catches and returns to the Leard's Pond fishway since 1986 have generally shown an increasing trend (Tables 2 & 4). The availability of early-run salmon in the Morell created tremendous recreational opportunities as anglers fished a total of over 2,700 rod days in 1986 and almost 9,000 in 1990 (Table 2), compared with the annual average of 118 rod days from 1976-1980 when only late run salmon entered the river.

Stock Management and Harvest

Currently, harvest of Atlantic salmon from the Morell River is limited to recreational angling for grilse only. The angling season on the Morell is from May 1 - October 31. Angling is restricted to flyfishing only from June 15 onward. The river is closed to angling for a period in May each year to prevent fishing mortality of smolts migrating downstream.

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* - based on forklength: MSW > 63 cm.
grilse < 63 cm.

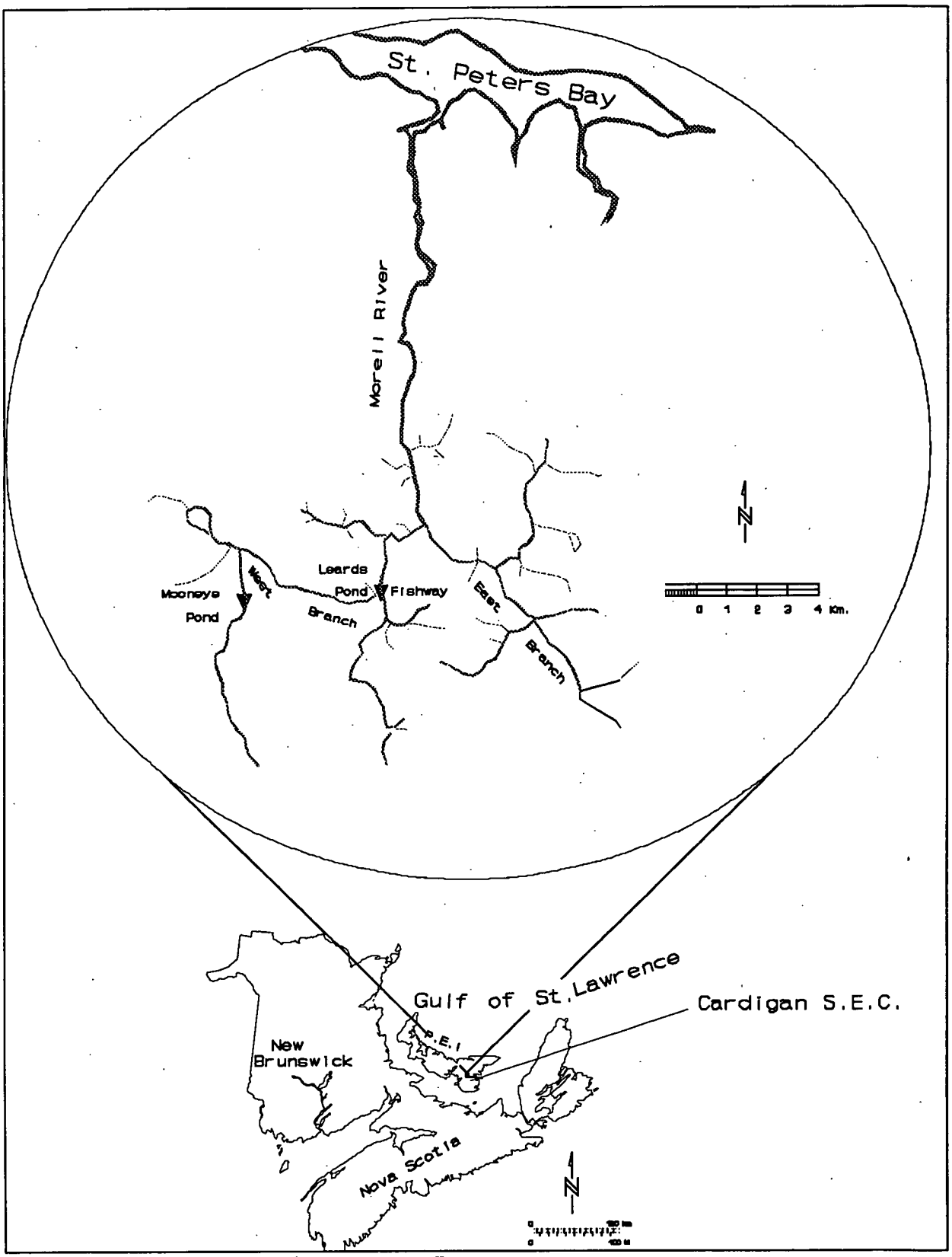

Figure 1 - Morell River, Prince Edward Island

A management plan for the river is currently being developed. In addition to the recreational demand on the resource, there is the possibility of a renewed commercial fishery (there is still one licensed commercial salmon fisherman in the Morell area) and increasing demands by P.E.I.'s aboriginal peoples for access to the resource.

Spawning Requirements

Ducharme (1977) performed a habitat survey of the Morell River system and estimated that there were 2007 rearing units of salmon habitat (1 unit=100 m^2), 42% of which (843 units) are above the fish counting facility at Leard's Pond (Figure 1). Recent habitat improvement activities have resulted in the re-creation of salmon habitat in the river but, when the decrease in river width due to the removal of obstructions and channelization are considered, the overall change in available salmon habitat may be minimal. In any event, until a new survey of the river's habitat is completed (currently ongoing), the use of Ducharme's (1977) estimate will be used.

Assuming an egg deposition requirement of 240 eggs per rearing unit, the total egg requirement for the Morell River is:

240 eggs/rearing unit x 2007 rearing units = 481,600 eggs

Assuming all eggs are to come from multi-seawinter (MSW) females only, the required number of spawners for the Morell river is:

Number of eggs required = 481,600
Mean fecundity = 4963 eggs/female (Table 5)
Mean % female = 69.0 (Table 6)

$$\text{Number of females required} = \frac{481{,}600}{4{,}963} = 97$$

$$\text{Total number of MSWs required} = \frac{100 \times \#\text{ females required}}{\%\text{ female}} = \frac{100 \times 97}{69.0} = 141$$

Number of MSW males = 141-97 = 44
Male deficit (# of male grilse required to achieve a one male to one female sex ratio) = 97-44 = 53

$$\text{Total number of grilse required} = \frac{100 \times \#\text{ of males required}}{\%\text{ males (Table 6)}} = \frac{100 \times 53}{80.8} = 66$$

Spawning requirement = 141 MSW & 66 grilse

Spawning requirement for the portion of the river above
Leard's Pond fishway (42% of total requirements) = 59 MSW and 28 grilse.

Additional Requirements

In addition to natural spawning requirements, there is a requirement for 117 MSW and 54 1SW broodstock (400,000 eggs) for the Cardigan Salmonid Enhancement Centre (SEC) for support of salmon enhancement programmes on the Morell and other P.E.I. rivers. These fish are collected from the trap at Leard's Pond Fishway.

Discussion

Although the returns of hatchery and wild MSW's (as indicated by the returns to the Leard's Pond Fishway, Table 4) would have met the spawning requirements for the portion of the river above Leard's Pond (59 MSW & 28 grilse - see above) for the 1987-1990 period, they fell well short of meeting both spawning requirements and SEC broodstock requirements (ie. a total of 176 MSW & 82 1SW). The shortfall is far more pronounced if only

wild returnees are considered (1986-1990 average = <2 MSW/year & <17 1SW/year). It would therefore seem evident that the Morell River's wild and MSW salmon production can not currently support an appreciable harvest of any sort; at least not if the goals of establishing a healthy, self-sustaining wild population and the provision of wild broodstock for enhancement of other P.E.I. rivers are to be realized.

The scenario changes when considering the Morell's hatchery return grilse population which, despite varying return rates for smolt stocked (Table 7), can be "artificially" maintained at levels which support current recreational and other potential harvests. In 1991, 35,745 adipose clipped smolts were stocked into the Morell. Given a conservative return rate of 3.5% (the mean return rate for smolts stocked from Cardigan SEC during the 1985-1987 period - Table 7), approximately 1250 adipose clipped grilse should return to the Morell in 1992. This return would result in a harvestable surplus of over 1000 grilse. Based on the same return rate, the proposed minimum stocking rate of 55,000 smolts annually beginning in 1992 should result in a return of at least 1,900 adipose clipped grilse (with a harvestable surplus of greater than 1700) from 1993 onward.

In summary, it is suggested that, until wild populations reach a level that exceed minimum spawning requirements, harvest of salmon from the Morell River be restricted to adipose clipped (hatchery) grilse.

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TABLE 1: HISTORICAL LANDINGS FOR COMMERCIALLY CAUGHT ATLANTIC SALMON IN ST. PETER's BAY, PRINCE EDWARD ISLAND

YEAR	LANDINGS	
	WEIGHT (KG)	NO. OF FISH[1]
1879	909	252
1883	1536	427
1888	710	197
1890	2136	593
1893	727	202
Averages	1244	334

1 Numbers based on average weight of 3.6 kg/fish

TABLE 2: SUMMARY OF SPORT CATCHES, MORELL RIVER, P.E.I. (1955-1991)

ANGLING RECORD[1]

YEAR	GRILSE	M.S.W.[2]	TOTAL	EFFORT (Rod-Days)
1955			21	18
1956			29	87
1957			3	52
1958			9	52
1959			4	34
1960			4	44
1961			15	45
1962			13	50
1963			51	280
1964			12	46
1965			12	115
1966			10	N/A
1967			26	206
1968			10	192
1969			12	214
1970	0	13	13	204
1971	0	0	0	83
1972	0	7	7	138
1973	2	0	2	168
1974	0	2	2	78
1975	0	0	0	0
1976	6	1	7	250
1977	0	0	0	105
1978	0	0	0	60
1979	1	2	3	54
1980	5	1	6	119
1981	108	4	112	914
1982	73	8	81	2088
1983	7	2	9	686
1984	7	0	7	675
1985	47	N/A[3]	47	1007
1986	236	N/A	236	2725
1987	476	N/A	476	N/A
1988	643	N/A	643	4994
1989	167	N/A	167	4506
1990	768	N/A	768	9000
1991	N/A	N/A	N/A	N/A

1 - Does not include fish hooked and released

2 - MSW: multi-seawinter salmon

3 - Introduction of mandatory hook and release for MSW salmon

TABLE 3: DISTRIBUTION OF JUVENILE ATLANTIC SALMON IN THE MORELL RIVER, P.E.I. - (1978 - 1991). (data updated from Bielak et. al. 1991)

Year of Release	Genetic Stock	Rearing Location	Juvenile Stage at Release: Parr 0+	Parr 2+	Smolt 1+	Smolt 2+	Total Number Released
1978	N.W. Miramichi	Cardigan SEC	14,943				14,943
1979	N.W. Miramichi	Cardigan SEC	23,012				23,012
	Restigouche		9,681				9,681
1981	N.W. Miramichi	Cardigan SEC				691	691
1982	Miramichi (EM)[1]	Cardigan SEC	34,764			3,645	38,409
1983	Miramichi (EM)	Cardigan SEC	9,000				9,000
1985	Miramichi Mixed[2]	Cardigan SEC				10,428	21,425
		Profitt's Pond				10,997	
1986	N.W. Miramichi(EM)	Cardigan SEC				1,529	14,058
		Profitt's Pond				12,529	
1987	N.W. Miramichi(EM)	Cardigan SEC				3,055	23,305
		Profitt's Pond				22,250	
1988	Miramichi Mixed	Cardigan SEC			5,907		20,097
		Profitt's Pond		1,208		12,982	
1989	Morell (HR) (1SW)[3]	Profitt's Pond		1,560		20,650	22,210
1990	Morell Mixed (HR)	Mooney's Pond		398		48,475	59,810
		Profitt's Pond		681		10,256	
1991	Morell Mixed (HR)	Mooney's Pond		2,051		35,745	37,796

1 EM = Early migrating stock
2 MIXED = Both early and late migrating stock were taken for transfer because of the small number of eggs available
3 HR = Progeny from previous hatchery stocking in the Morell River
1SW = Grilse

TABLE 4: SALMON RETURNS TO THE LEARD's POND FISHWAY, MORELL RIVER: 1981-1991

	TOTAL		GRILSE			SALMON				
Year	N(wild)	% wild	Total Returns	Wild Returns	% Grilse	% Wild	Total Returns	Wild Returns	% Salmon	% Wild
1981	45(6)	13.3	39	0	87	0	6	6	13	100
1982	36(7)	19.4	33	6	92	18.2	3	1	8	33.3
1983	4(1)	25	2	1	50	50	2	0	50	0
1984	9(5)	55.6	5	3	56	60	4	2	44	50
1985	15(3)	20	14	2	93	14.3	1	1	7	100
1986	626(3)	<1	620	1	99	<1	6	2	1	33.3
1987	1236(4)	<1	1168	2	96	<1	68	2	5	3.0
1988	1481(10)	<1	1394	8	94	<1	89	2	6	2.3
1989	460(12)	2.6	335	12	73	3.6	125	0	27	0
1990	472(48)	10.2	409	44	87	10.8	63	4	13	6.3
1991	366(44)	12.0	327	33	89	10.1	39	11	11	28.2
Average	432(13)	<14.6	395	10	83	15.4	37	3	17	32.4

TABLE 5: MEAN LENGTHS, WEIGHTS, AND FECUNDITIES FOR FEMALE SALMON SAMPLED FROM THE MORELL RIVER, P.E.I. - 1989

Age	Mean Length in cm. (N)	Mean Weight in kg (N)	Mean Fecundity (N)
Grilse	56.1 (68)	1.51 (17)	3143 (68)
Multi-seawinter	73.8 (24)	4.08 (24)	4963 (24)

TABLE 6: SEX RATIOS FOR MULTI-SEAWINTER SALMON (MSW) AND GRILSE SAMPLED FROM THE LEARD'S POND FISHWAY DURING 1986 - 1990.

		MALES		FEMALES	
YEAR	AGE	N	%	N	%
1986	GRILSE	520	84.8	93	15.2
	MSW	N/A	----	N/A	----
1987	GRILSE	471	82.3	101	17.7
	MSW	5	12.8	34	87.2
1988	GRILSE	547	76.0	173	24.0
	MSW	11	37.9	18	62.1
1989	GRILSE	196	87.5	28	12.5
	MSW	15	37.5	25	62.5
1990	GRILSE	131	72.8	49	27.2
	MSW	29	37.7	48	62.3
TOTAL	GRILSE	1865	80.8	444	19.2
	MSW	45	31.0	100	69.0

TABLE 7: SURVIVAL OF ATLANTIC SALMON FROM EXPERIMENTAL GROUPS OF ARTIFICIALLY (CARDIGAN) AND SEMI-NATURALLY (PROFITT'S POND) REARED SMOLTS IN THE MORELL RIVER; 1985 - 1987

			RETURNS TO LEARD'S POND FISHWAY			SPORT FISHERY*			
			1 SW			1 SW			
YEAR OF RELEASE (Yr)	REARING LOCATION	NUMBER RELEASED	2.1**(Yr +1)	3.1**(Yr +2)	2 SW (Yr +2)	2.1**(Yr +1)	3.1**(Yr +2)	TOTAL # RECAPTURES	SEA SURVIVAL %
1985	Cardigan	10,428	97	6	10	44	3	157	1.5
	Profitt's Pond	10,997	523	101	56	192	38	910	8.3
1986	Cardigan	1,529	68	0	6	20	0	94	6.1
	Profitt's Pond	12,529	993	42	79	297	3	1,416	11.3
1987	Cardigan	3,055	79	0	1	7	0	87	2.8
	Profitt's Pond	22,250	1,265	61	124	108	8***	1,565	7.0
1988	Cardigan	5,907							
	Profitt's Pond	14,190							
	(above Leard's Pond)	14,589****	262		59	121		442	3.0

* Based on estimates of the number of fish angled below Leard's Pond Fishway

** Smolt age class

*** Based on the ratio of the 1988 3.1 returns/2.1 returns X 1989 angling catch (167 grilse)

**** 10,183 smolts (2+) from Profitt's Pond and 4,406 smolts (1+) from Cardigan SEC. For the 1985 - 1987 period, all smolts had been released above Leard's Pond