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# Assessment of Margaree River Salmon Stocks in 1983

by

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## Abstract

Preliminary data indicate that an estimated 1500 MSW salmon and 2 grilse were taken in the Nova Scotia commercial fishery in 1983 which were destined for the Margaree River. 1983 salmon landings in Fisheries Statistical Districts 2 and 3 which comprise a high proportion of Margaree MSW salmon, were similar to landings in these districts in 1982. The recreational fishery harvested 108 MSW salmon and 65 grilse in 1983. This represents a significantly reduced catch of summer-run grilse compared to 1982 and reflects reduced inputs of hatchery-reared juvenile salmon in 1982. Preliminary spawning escapement requirements for 1983 were estimated to be 1011 MSW salmon and 476 grilse. The actual spawning escapement in 1983 was estimated by two methods using angling catches and angling exploitation rates. The analysis indicated that spawning escapement in 1983 was less than 50% of recommended values and could be as low as 20%. Insufficient data were available to forecast 1984 stock levels.

## Résumé

Les données préliminaires indiquent qu'en 1983 la pêche commerciale en Nouvelle-Ecosse a récolté 1 500 saumons redibermarins (plusieurs hivers en mer) et 2 madeleineaux. Ces saumons étaient en route vers la rivière Margaree. Les débarquements de saumons des districts statistiques de pêche 2 et 3, qui comprennent une forte proportion de poissons de cette rivière, étaient identiques à ceux de 1982. La pêche récréative a capturé 108 saumons redibermarins et 65 madeleineaux en 1983. Ces prises sont nettement inférieures à celles des madeleineaux des remontes d'été par rapport à 1982 et reflètent des ensemencements moindres de jeunes saumons d'élevage en 1982. Les nombres requis pour la reproduction en 1983 ont été estimés à 1 011 saumons redibermarins et 476 madeleineaux. Le nombre de géniteurs en 1983 a été estimé des prises de la pêche récréative, et les taux d'exploitation de cette même pêche. L'analyse indique qu'en 1983 le nombre de géniteurs était inférieur à 50 % des valeurs recommandées et pourrait même être aussi faible que 20 %. Nous n'avons pas suffisamment de données pour pouvoir prédire les niveaux de stock en 1984.

## INTRODUCTION

The Margaree River Basin lies in Inverness County on the west coast of Cape Breton Island, Nova Scotia. It has a total drainage area of 1178 km<sup>2</sup> comprised of the Northeast Margaree, the Southwest Margaree and its Lake Ainslie headwaters, and the Main River between the confluence of the aforementioned and the Gulf of St. Lawrence. The river has at least two major run components; one which enters the river in summer from mid-June to mid-August, and a fall migration of salmon which enter the river from mid-September to late October. Marshall (1982) describes stream characteristics of the Margaree River, reviews background biological data collected since the 1950's and discusses several management alternatives for its salmon stocks.

The purpose of this paper is to examine the status of the Margaree River salmon stock in 1983. This analysis is relevant to the apparent low returns of salmon to several major rivers in the Gulf Region in 1983 (Randall and Schofield 1983; Randall and Pickard, 1983).

This document describes: (i) a preliminary estimate of required egg deposition and spawning escapement to sustain Margaree salmon stocks at optimal harvest levels; (ii) an estimate of total homewater returns and spawning escapement in 1983. Insufficient data are available at this time to make a forecast of available harvest in 1984.

## METHODS

### Salmon Landings

Commercial salmon landings from licensed commercial salmon gear in Fisheries Statistical Districts (FSD) 11, 12, 13, 2, 3 were summarized from departmental records 1967-82 (Redbooks) and from log books submitted weekly by the fishermen in 1983.

Angling statistics for the Margaree River were taken from Smith (1981) or summarized from departmental records (Redbooks).

### Egg Deposition Requirements

Preliminary egg deposition requirements for the Margaree River were estimated from the following data:

Required egg deposition rate	= 2.4eggs/m <sup>2</sup> (Elson, 1975)
Margaree accessible rearing area	= 2,797,600 m <sup>2</sup> (Marshall, 1982)
Female salmon - fecundity	= 1764 eggs/kg (Elson, 1974)
- mean weight	= 4.9 kg (Marshall, 1982)
Female grilse - fecundity	= 1764 eggs/kg (Elson, 1974)
- mean weight	= 1.7 kg (Marshall, 1982)
Salmon sex ratio (% F)	= 75% (Marshall, 1982)
Grilse sex ratio (% F)	= 11% (Marshall, 1982)
Grilse/salmon ratio (% salmon)	= 68% (See below)

The grilse/salmon ratio in the recreational fishery from 1970-78 (Table 3) was assumed to equal that in current spawning escapements; more recent data were excluded, since beginning in 1979, sport catches were strongly influenced by hatchery stocking.

### 1983 Escapement Estimates

The 1983 spawning escapement was estimated by two methods: The first method used an angling exploitation of 20.6% for salmon and grilse; and, the second method used a rate of 37.9% for both types of fish (Hayes, 1949).

Homewater returns were calculated from tag returns of 5,991 wild Margaree smolts and approximately 94,669 hatchery reared smolts of Margaree origin, tagged and released in the Margaree River between 1961-73. Marshall (1982) reported that 18.6-20.8% of the total stock was harvested in the Nova Scotia commercial fishery, 11.5% of the total harvest was taken in FSD #2. Elson and Gee (1962) estimated that 45% of the FSD #2 catch was of Margaree origin. Using these data an estimate of Margaree salmon in homewaters was derived.

A reliable estimate of losses due to poaching and disease was unavailable for this paper.

## RESULTS

### 1983 Salmon Landings

Commercial salmon landings for the period 1967-83 are reported in Table 1. Based on landings in FSD #2-3, 10,226 kg of salmon were harvested in 1983, up slightly from the 10,179 kg landed in these districts the previous year. FSD #2 which harvests a high proportion of MSW Margaree salmon (Marshall, 1982), reported landings of 9200 kg in 1983 compared to 8704 kg in 1982.

Assuming an average weight of 4.9 kg per salmon and that mainly two sea-winter or older salmon are exploited in the commercial fishery, approximately 1878 MSW salmon were taken in FSD #2. Based on log book data, 1871 2SW or older salmon and three 1SW salmon were taken in FSD #2 in 1983. Of these, 842 MSW salmon and one 1SW salmon or 45% of the FSD #2 catch was of Margaree origin (Elson and Gee, 1962).

Angling statistics for the period 1951-83 (Table 2) and sport catches by month for the period 1967-83 (Table 3) are summarized. A total of 108 salmon and 65 grilse were angled in 1983 compared to 117 salmon and 690 grilse taken in 1982. Effort decreased from an estimated 5160 rod days in 1982 to 3100 rod days in 1983; catch per unit effort declined from 0.156 salmon per rod day in 1982 to 0.056 in 1983 (Table 2).

### Hatchery Distributions

Hatchery-reared juvenile salmon have been released in the Margaree River since 1882. Inputs have varied from year to year in terms of the number, stage and stock origin of juvenile salmon released. Table 4 summarizes recent stockings of hatchery-reared juvenile salmon in the Margaree River.

### Egg Deposition Requirements

Egg deposition per fish using mean weight, fecundity, sex ratios and grilse/salmon ratios cited in the methods was calculated as follows:

	Eggs.kg <sup>-1</sup>		% female		Mean Wt. (kg)		% salmon or grilse		Egg deposition per fish
Salmon	1764	x	75	x	4.900	x	68	=	4408
Grilse	1764	x	11	x	1.700	x	32	=	106

Total egg deposition per fish = 4514

The total number of fish required to meet egg deposition targets can be estimated by : required egg deposition rate x rearing area ÷ egg deposition per fish

$$= 2.4 \times 2,797,600/4514$$

$$= 1487 \text{ fish.}$$

From the grilse/salmon ratio, therefore, the numbers of salmon and grilse required to meet egg deposition requirements are 1011 and 476, respectively.

### 1983 Escapement

The 1983 returns calculated from angling exploitation rates of 20.6% and 37.9% (Hayes, 1949) are summarized below: The analysis in Method I (Angling exploitation rate = 20.6%) suggests that the Margaree River is receiving less than 50% of its required spawning escapement.

Method I	Salmon	Grilse
1. River escapement (108/.206; 65/.206)	524	315
2. Losses to commercial fisheries (842 x .208; 1 x .208) .115                      .115	1523	2
3. Returns to homewaters	2047	317
4. All losses:		
Commercial fishery (N.S.)	1523	2
Angling fishery	108	65
Total	1631	67
5. Spawning escapement	416	250
6. Spawning requirements	1011	476
7. Surplus or (deficit)	(595)	(226)

The analysis from Method II (Angling exploitation rate = 37.9%) suggests that the Margaree River is receiving less than 20% of its required spawning escapement.

Method II	Salmon	Grilse
1. River escapement (108/.379; 65/.379)	285	171
2. Losses to commercial fisheries (See Method I)	1523	2
3. Returns to homewaters	1808	173
4. All losses:		
Commercial fishery (N.S.)	1523	2
Angling fishery	108	65
Total	1631	67
5. Spawning escapement	177	106
6. Spawning requirements	1011	476
7. Surplus or (deficit)	(834)	(370)

## DISCUSSION

Salmon landings in the commercial salmon fishery in FSD's 2-3 were similar to 1982 landings in these districts. Since landings in FSD #2 have a high proportion of MSW Margaree salmon (Elson and Gee, 1962), MSW salmon stock levels in 1983 in the Margaree River may have been similar to those in 1982. However, it should be noted that MSW Margaree salmon stocks were bolstered in both 1982 and 1983 by plantings of hatchery reared smolts of Rocky Brook origin in 1980-81 (Table 4). In fact, commercial landings since about 1980 have been influenced by hatchery stocking. The effect which different water levels in the river had on delaying upstream migration and consequently the commercial harvest near the river mouth between years was not studied.

The recreational fishery in 1983 harvested less than 10% of the summer-run grilse caught in 1982. The lower abundance of grilse in the Margaree River in 1983 was partly expected since only 8,481 one year smolts reared at Mersey FCS\* were released in 1982 compared to 15,950 two year smolts reared at Cobequid FCS and released in 1981 (Table 4). Recent work suggests that the two year old smolts released from Cobequid FCS in 1981 would also provide a higher survival rate ( $\approx 8\%$ ) (Marshall, 1982) than the one year smolts released from Mersey FCS in 1982 ( $\approx 1.5\%$ ) (Cutting and Gray, 1984).

The spawning requirements recommended in this paper, 1011 MSW salmon and 476 grilse are higher than those suggested by Marshall (1982). This author used a lower seeding rate ( $1.7 \text{ eggs/m}^2$ ), higher grilse fecundity rate (2205 eggs/kg) and a different grilse/salmon ratio (10:90). On the basis of more current assumptions, Marshall's spawning escapement estimates are low. However, even Marshall's values indicated that spawning requirements were not met in 1983.

Lastly, using angling exploitation rates of 20.6% and 37.9% (Hayes, 1949), we suggest that in 1983 the Margaree River received less than 50% of its required egg deposition. Higher angling exploitation rates or losses due to poaching and disease would reduce the spawning escapement further.

\*Fish Culture Station.

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Table 1. Atlantic salmon landings in licensed commercial salmon gear, 1967-83<sup>1</sup>.

Year	Licensed Commercial Atlantic Salmon Landings (kg)							Gulf N.S. Total
	Northumberland Strait-N.S.				Gulf Cape Breton-N.S.			
	Fisheries Statistical District				Fisheries Statistical District			
	11	12	13	Sub-Total	2	3	Sub-Total	
1967	1,175	10,503	29,885	40,388	10,728	2,124	12,852	53,240
1968		9,495	14,949	25,619	10,480	2,057	12,537	38,156
1969		9,968	11,050	21,018	7,831	1,598	9,429	30,447
1970		4,605	13,015	17,620	12,760	114	12,874	30,494
1971		1,689	5,597	7,286	4,485	255	4,740	12,026
1972		5,155	18,714	23,869	7,026	996	8,022	31,891
1973		2,562	15,788	18,350	8,043	1,297	9,340	27,690
1974		5,742	17,437	23,179	11,213	3,045	14,258	37,437
1975		2,080	9,824	11,904	10,670	1,057	11,727	23,631
1976		1,606	5,845	7,451	9,954	956	10,910	18,361
1977		4,137	9,171	13,308	11,490	1,423	12,913	26,221
1978		2,940	15,907	18,847	10,691	678	11,369	30,216
1979		169	4,549	4,718	3,117	82	3,199	7,917
1980		2,534	11,932	14,466	9,088	858	9,946	24,412
1981	1,822	8,283	10,105	4,978	479	5,457	15,562	
1982	2,805	13,680	16,485	8,704	1,475	10,179	26,664	
1983	1,771	9,785	11,556	9,200	1,026	10,226	21,782	

<sup>1</sup> Source: Department of Fisheries and Oceans Redbooks.

Table 2. Recreational catch of Atlantic Salmon, Margaree River, 1951-83.

Year	Salmon		Grilse		Total		Rod Days	CUE
	No.	Kg	No.	Kg	No.	Kg		
1951					553	3346.6	2610	0.212
1952					325	1311.8	2265	0.143
1953					385	1665.6	2145	0.179
1954					440	1900.1	1965	0.224
1955					345	1653.3	1650	0.209
1956					152	588.8	1380	0.110
1957					185	676.3	1215	0.152
1958					334	1677.8	1275	0.262
1959					235	1219.7	1110	0.212
1960					140	609.2	1050	0.133
1961					147	503.5	1035	0.142
1962					505	2338.3	1240	0.407
1963					335	1433.4	1190	0.281
1964					416	1691.4	2243	0.185
1965	298	1338.1	56	111.1	354	1449.2	2769	0.128
1966	196	987.5	84	155.6	280	1143.1	2482	0.113
1967	291	1381.2	81	142.0	372	1523.2	2801	0.133
1968	219	1077.7	48	88.5	267	1166.2	3274	0.082
1969	160	665.4	196	353.8	356	1019.2	2762	0.129
1970	241	1109.9	63	113.4	304	1223.3	2612	0.116
1971	95	454.5	21	34.5	116	489.0	2332	0.050
1972	116	535.7	31	55.3	147	591.0	1985	0.074
1973	125	589.7	157	291.7	282	881.4	2402	0.117
1974	111	533.0	57	109.3	168	642.3	2203	0.076
1975	69	342.9	31	49.4	100	392.3	1529	0.065
1976	83	432.7	95	154.2	178	586.9	2108	0.084
1977	143	684.0	64	109.8	207	793.8	2055	0.101
1978	161	840.1	23	41.7	184	881.8	2543	0.072
1979	88	507.6	597	894.9	685	1402.5	3733	0.183
1980	141	723.4	187	360.2	328	1083.6	2978	0.110
1981	118	705.3	932	1347.9	1050	2053.0	4936	0.213
1982	117	608.0	690	961.0	807	1569.0	5160	0.156
1983	108	603.0	65	112.0	173	715.0	3100	0.056

Table 3. Margaree River, monthly Atlantic Salmon sport catches, 1967-83.<sup>a</sup>

Year	June		July		August		September		October		Total		
	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW	1SW	MSW	Combined
1967	4	36	11	55	23	32	34	76	9	92	81	291	372
1968	1	4	4	41	17	18	10	79	16	77	48	219	267
1969	6	13	43	48	51	23	68	15	28	61	196	160	356
1970	0	6	15	21	20	37	17	102	11	75	63	241	304
1971	0	6	5	19	8	15	7	29	1	26	21	95	116
1972	0	2	7	32	9	25	10	26	5	31	31	116	147
1973	1	10	38	37	54	25	34	22	30	31	157	125	282
1974	1	0	17	21	14	9	12	19	13	62	57	111	168
1975	0	1	2	1	10	3	6	10	13	54	31	69	100
1976	0	2	3	4	40	3	40	22	12	52	95	83	178
1977	0	6	8	26	26	21	22	33	8	57	64	143	207
1978	1	3	4	15	2	4	12	47	4	92	23	161	184
1979	324	8	175	9	31	7	50	37	17	27	597	88	685
1980	4	0	71	0	48	0	42	59	22	82	187	141	328
1981	386	0	272	0	112	0	144	52	18	66	932	118	1050
1982	221	0	326	0	55	0	67	69	21	48	690	117	807
1983	4	0	17	0	14	0	24	62	6	46	65	108	173

<sup>a</sup>Margaree River was closed to angling in May, anglers required to release large salmon from June 15-August 31 1980-83 - see variation orders for detailed regulations.

Table 4. Distribution of hatchery-reared juvenile salmon in the Margaree River, 1976-83.

Year of Release	Genetic stock 1	Rearing location 2	Stage 3	Number released <sup>a</sup> 4	Equivalent smolts <sup>c</sup> 5	Sport catch -1SW (T + 1)		
						Predicted (HR) <sup>d</sup> 6	Actual (W+ HR) <sup>e</sup> 7	
1976	Margaree	Margaree FCS	2+smolt	8,971	8,971			
1977	Margaree	Margaree FCS	1+parr	5,022				
1978	Rocky Brook (ER)	Cobequid FCS	2+smolt	15,250	16,053			
1979	Millbank (LR)	Cobequid FCS	2+smolt	15,927	15,927			
1980	Rocky Brook (ER)	Cobequid FCS	2+smolt	14,960	14,960			
1981	Rocky Brook (ER)	Cobequid FCS	2+smolt	15,950	15,950			
1982	Margaree (W/HR)(ER) <sup>b</sup>	Mersey FCS	1+smolt	8,481	8,481	47	65	
	Margaree (W/HR)(ER) <sup>b</sup>	Mersey FCS	1+parr	1,098				
1983	Margaree (W)(ER)	Cobequid FCS	2+smolt	9,703	9,879			
	Margaree (W)(ER)	Cobequid FCS	0+parr	9,853				
	Margaree (HR)(ER)	Cobequid FCS	2+smolt	4,734	4,734			
	Margaree (HR)(ER)	Margaree FCS	2+smolt	3,783	3,783			
	Sub-total (1983)				18,396			

a. All hatchery-reared juvenile salmon released in the Margaree River have an excised adipose fin.

b. Margaree (W) = 56% wild; Margaree (HR) = 44% hatchery return

c. Column 5: Survival rate: 1+parr to 2+smolt = 16% (Elson, 1975)

d. Column 6: Survival rates (HR) 1+smolts (Mersey FCS) to grilse escapement = 1.45% (Cutting & Gray, 1984)  
Angling exploitation rate = 37.9% (Hayes, 1949)

e. Actual sport catch is comprised of wild and hatchery-return grilse.