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UPDATE ON THE STATUS OF ATLANTIC SALMON (*SALMO SALAR*) IN THE RICHIBUCTO RIVER IN 1997

by

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ABSTRACT

Angling effort on the Richibucto River is low and catch estimates are not made. Aboriginal community harvest has not been reported since 1994. Anecdotal accounts of poaching are numerous but undocumented. Returns of Atlantic salmon to a portion of the main stem of the Richibucto River were determined through the operation of a counting fence. Spawning escapement above the fence was 21 large and 24 small salmon, representing only 15% of the conservation egg requirement for the area. Electroseining data suggest that significant spawning of salmon occurs only in the main Richibucto and Coal Branch rivers, and that juvenile densities there, both historically and at present, are extremely low. It is concluded that conservation spawning escapement on these two rivers was not achieved in 1997, and probably has not been in the recent past. It is therefore unlikely that conservation requirements for Atlantic salmon will be met on the Richibucto system in 1998, or that there will be an harvestable surplus.

RÉSUMÉ

L'effort de pêche dans la rivière Richibucto est peu élevé et les évaluations des prises n'ont pas été faites. Les Autochtones n'ont pas signalé leurs prises depuis 1994. Les signalements d'activités de braconnage sont nombreux mais non documentés. Il a été possible de déterminer, grâce à l'exploitation d'une barrière de dénombrement, les retours de saumon atlantique dans une partie du bras principal de la rivière Richibucto. En amont de la barrière, l'échappée des géniteurs s'établissait à 21 gros saumons et à 24 petits saumons, ce qui ne correspond qu'à 15 % des besoins en ponte aux fins de la conservation pour la région. Les données découlant de la pêche à l'électricité semblent indiquer que le saumon ne fraie pour ainsi dire que dans le bras principal de la rivière Richibucto et dans la rivière Coal Branch et que les densités des juvéniles sont extrêmement faibles, ce qui est aussi attesté historiquement. Il ressort donc que le taux minimal d'échappée des géniteurs à des fins de conservation n'a pas été atteint en 1997 et qu'il ne l'a sans doute pas été dans les dernières années. Il est donc peu probable qu'en 1998 on atteigne les exigences pour la conservation du saumon atlantique dans le réseau de la rivière Richibucto ni qu'il y ait de surplus exploitable.

SUMMARY SHEET

STOCK: Richibucto River (SFA 16)
CONSERVATION REQUIREMENT

1) All rivers draining to estuary: 2.942 million eggs (519 large salmon, 303 small salmon)
2) Richibucto main stem only: 0.764 million eggs (135 large salmon, 70 small salmon)

	1992	1993	1994	1995	1996	1997	MIN	MAX	MEAN
Aboriginal Community Harvest									
Large	452	253	113	NA	NA	NA			
Small	61	50	51	NA	NA	NA			
Spawning escapement [1]									
Large	467	Below	Below			Below			
Small	80	Below	Below			Below			
Total returns									
Large	1119	Below	Below			Below			
Small	142	Below	Below			Below			
% Egg Requirement met [2]									
Large		Below	Below			15			
All spawners	83	Below	Below			15			

1. The 1992 spawning escapement for large salmon reflects estimated poaching removals of 200 fish.

2. 1992-94, relative to conservation requirement 1: 1997 relative to conservation requirement 2.

"Below" is a qualitative assessment indicating numbers below conservation requirements..

Fishery data: None

Data and assessment: Returns of large and small salmon were counted at a fish fence on the main stem of the Richibucto River, and assessed relative to the habitat above the fence. Data from juvenile surveys are presented.

State of the stock: Spawning escapement in the main stem of the Richibucto River was not met for either large or small salmon in 1997. Total egg deposition was estimated at 15% of the conservation requirement relative to the habitat above the counting fence. Juvenile populations were low or negligible at all sites indicating that spawning has been inadequate in recent years.

Forecast for 1998: No quantitative forecast can be made. All years assessed have been below the conservation level required. Given the extremely low egg deposition and juvenile abundance observed in 1997, the stock in the Richibucto shows poor recovery potential. It is therefore considered highly unlikely that the conservation requirement will be met in 1998, or in the foreseeable future.

Management Considerations: The Richibucto salmon stock appears severely depressed with a poor outlook for recovery. It is recommended that there be no allocation of salmon in 1998.

Introduction

The Richibucto River is situated in Kent County, New Brunswick and flows in an easterly direction to Northumberland Strait in Statistical District 76, Salmon Fishing Area 16. It is a complex system of separate rivers emptying into one large estuary (Fig.1). A spawning run of Atlantic salmon enters the system during September and October, and is harvested for food by Big Cove First Nation and public recreational angling. Information on stock status is required to manage salmon harvest on the Richibucto, ensuring that adequate spawning escapement occurs on a sustainable basis.

The stock on this river has been assessed previously, in 1992, 1993, and 1994 (Atkinson and Claytor 1994, Atkinson *et al.* 1995). The 1992 assessment was based on a mark-recapture experiment in co-operation with Big Cove First Nation, under the federal government's Aboriginal Fisheries Strategy (AFS). For 1993 and 1994 returns were qualitatively compared with 1992 assuming a similar exploitation rate in the First Nation fishery for all years. Estimated spawning escapement did not meet requirements in any year. In 1997, the Richibucto Sustainable Development Project, in conjunction wth the Richibucto River Association operated a counting fence on the main stem of the Richibucto River to obtain a direct count of spawners.

Data from a juvenile spot check survey in 1997, and results of previously unpublished surveys, are documented.

Description of Fisheries

Commercial

Commercial harvesting of Atlantic salmon ceased in 1984. The harvest from 1967 to 1983 in SFA 16 was presented in Atkinson and Claytor (1994).

First Nations

Big Cove First Nation currently harvests salmon by gillnet and trapnet from the Richibucto River estuary during September and October. Allocations in 1997 were 125 large and 425 small salmon. Harvest was reported by Fisheries and Oceans officers for most years from 1982 until 1991, after which the First Nation agreed to report catches under AFS agreements. Such agreements were not concluded since 1993, and subsequent harvest has not been reported (Table 1).

Recreational

The Richibucto is not a scheduled salmon river. Recreational angling effort is low and catch estimates are not available. Prior to 1996, black salmon could be angled from April 15 through May 15, bright salmon from June 8 through the end of the season. The bright season was extended in 1993 from October 15 through the end of the month, downstream from the confluence of Kellock Brook. Beginning in 1996 the angling season for black or bright salmon was made continuous from April 15 through October 31. As of 1995 the South Branch of the St. Nicholas River and Hudson Brook have been closed to all angling in an effort to conserve trout stocks. Due to very low water conditions in 1997, the angling season was closed as of October 27. Prior to 1984 all salmon could be retained. In 1984 large black salmon could be kept but all large bright salmon had to be released. Beginning in 1985, regulations have required that all large salmon (brights and

blacks) be released and only small salmon be retained. In 1992, the season limit for small salmon was reduced from ten to eight and this regulation remains in effect to date. Little effort is devoted to angling black salmon, and almost all angling for bright salmon occurs from late September to the end of the season.

Other

Poaching has always been considered a serious problem on this river by both DFO and DNRE fishery officers. No apprehensions of individuals or gear were made in 1997. However, eyewitness (but undocumented) accounts of illegal gillnetting and shooting salmon with firearms were common. Twenty percent of salmon caught at the counting fence carried net marks.

Conservation Requirement

The calculation of the conservation requirement for the Richibucto River system is detailed in Table 2, using Method 2 recommended by Randall (MS1985) for the Miramichi River. The number of spawners needed to meet egg deposition requirements has been revised, based on more suitable stock characteristics than formerly used. All egg deposition was assumed to come from large salmon. The number of small salmon required was calculated assuming that one male spawner was needed for each female large salmon. Fecundity was considered to be equivalent to Miramichi stock, based on river proximity. Since samples from the Richibucto are small and have not been uniformly treated, stock characteristics used were the means of values observed in Buctouche River stock, from 1993-97. Sex ratios were derived based on external characteristics. The 2SW component of total large salmon requirements was calculated using the mean proportion from Buctouche aged samples (1992-96).

Richibucto system requirement:

Egg Requirement: 2.942 million eggs
Large Spawners: 519 (2SW component: 447)
Small Spawners: 303

The conservation requirement, as originally defined and revised above, has been established for the Richibucto system (all rivers draining into the estuary) based on a rearing area calculated from total drainage area (Anon. 1978, Courtenay *et al.* 1992). The Richibucto is a complex system of separate rivers emptying into one large estuary, and it is extremely difficult to assess returns relative to a single large requirement without a prohibitively complex array of mark and recapture facilities. Ideally, each river should have individual spawning requirements which would provide a more realistic basis for deciding if returns, as determined at specific trap locations, are adequate for the streams to which they are destined. Furthermore, electrofishing data (see below) suggest that only the main stem and Coal branch have significant salmon production. This being the case, the conservation requirement for the system is much too high. For the purpose of this assessment a more relevant reference point is the conservation requirement for the main stem of the Richibucto. This has been calculated as described above, relative to the specific habitat for this stream (Table 2). A habitat survey for Coal Branch was completed by the Southeastern Anglers Association in the summer of 1997. The data has not yet been compiled, but will be available to help refine future assessments.

Richibucto main stem requirement:

Egg Requirement: 0.764 million eggs
Large Spawners: 135 (2SW component: 116)
Small Spawners: 79

Research Data

Direct count of spawners

A counting fence was installed on the main stem of the Richibucto river 2.4 km upstream from the Route 116 crossing (Fig. 1). The fence, consisting of a trapnet about 6m (20') long by 3m (9') wide and connected to the shore by two downstream-angled leaders, trapped fish moving upstream only. The trap and leaders were constructed with 5.7 cm (2.25") knotless nylon mesh, held in place with steel rods driven into the stream bed. The fence was operated from September 30 to November 5 by the Richibucto River Association. Each fish was measured, sexed and a scale sample was taken for ageing. All untagged fish released upstream were marked by punching a 5mm (1/4') hole in the caudal fin. Water levels were very low from the time of installation until October 28. Consistent rain after this date maintained the river at levels adequate for fish to run, but not interrupt continuous operation of the fence. A total of 21 large and 24 small salmon were counted through the fence between October 28 and November 5, when operations ceased (Table 3).

Biological Characteristics

A length-frequency histogram for all adult salmon caught at the counting fence on the Richibucto River for 1997 indicates modal values of 76 cm and 58 cm for large and small fish, respectively (Fig. 2). The mean length of large salmon was 77.2 cm; 67% were females (mean length 76.9 cm) and 33% males. Mean length of small salmon was 56.2 cm and all were males. The large salmon proportion of the catch, as observed at the counting fence, was 47%. Ageing of the 1997 sample shows that 2 and 3 year smolts respectively comprised 63% and 37% of the sample. Of the multi-seawinter (MSW) component, 80% were maiden two-seawinter (2SW) fish and 20% were repeat spawners. No repeat one-seawinter (1SW) fish were sampled (Table 4).

The length-frequency distribution for all juveniles sampled by electroseining shows modal values for fry, small parr and large parr of 55, 95, and 135 mm, respectively (Fig. 3). Mean lengths were 54, 98, and 126 mm.

Electroseining

In August of 1997 eight sites were electroseined with a single upstream sweep to obtain a catch per unit effort (CPUE) index of juvenile abundance (Table 5, Fig. 1). The highest catches per 15 minutes of fishing time were obtained at main stem Richibucto sites for both fry and parr, with Coal Branch catches averaging only about half that of the main stem. No Juveniles were caught at St. Nicholas River sites, and only a few parr were found at the Bass River site. A significant relationship was found between CPUE for fry, and density determined at closed sites on the Buctouche River, which has similar juvenile habitat (fry dens. = 15 min. catch x 0.9427 + 1.1826; N=6, R^2=0.68, P=0.042). Based on this , fry densities were predicted for all sites and ranged from 1.2 to 11.1/100m^2, with a mean of only 5.3 (Table 5). This is very low with respect to Elson's (1967) "normal" value of 29 fry /100m^2 (38 parr/100m^2) on Miramichi River sites which were

unaffected by DDT spraying. It is also lower than the mean fry density (6.9/100m^2) calculated in 1997 for the Buctouche River, which was known not to have attained conservation requirements in 1996 (Atkinson et al. 1997). The available historical electroseining data is sparse but confirms findings in the current year; i.e. that salmon juveniles were common only in Richibucto main stem and Coal Branch sites, were more numerous in the former than the latter, and that with the exception of site R2 in 1982, were not encountered in anything like "normal" densities (Table 6).

Estimation of Stock Parameters

Returns to the counting fence on the main stem of the Richibucto River were considered relative to the egg requirement above it. Inferences about the rest of the system are drawn from this result and electroseining data.

Assessment Results

Spawning Escapement to the Richibucto main stem

Spawning escapement to the main stem of the Richibucto River upstream of the counting fence was 21 large and 24 small salmon. A habitat survey conducted in 1994 by the Southeastern Anglers Association measured a total area of 318,504 m^2 on the Richibucto main stem upstream from the Route 116 crossing, which is approximately at the head of tide (Atkinson *et al.* 1994). The counting fence was located 2.4 km upstream of this point, the habitat above it accounting for 276,783 m^2, or 87% of the total. The egg deposition requirement for the main stem, at 2.4/m^2, is 764,410, and for the area above the fence, 664,278. Based on fecundity values derived from stock characteristics observed at the counting fence in 1997 (4877 eggs/large salmon, 0 eggs/small salmon), the eggs deposited above (102,424) represented only 15% of the number required. A few salmon were seen upstream of the fence site before installation and some additional fish may have ascended after fence removal, but the river was walked from the fence site downstream by wardens several days later and none were seen. Egg deposition was therefore considered to be seriously deficient of the conservation requirement on at least the main stem of the Richibucto River in 1997.

Coal Branch

Coal Branch appears to be the only other stream in the system amenable to salmon, as evidenced by electroseining catches. However, these being only about half the main stem catches suggests that Coal Branch typically hosts even fewer spawners relative to the habitat available. Although at the moment there is no way to independently assess this stream quantitatively, it appears likely that returns to Coal Branch were also well below requirement, with such a low level of spawning in the adjacent main stem. Gillnetting in the upper estuary could be expected to equally affect both streams.

Ecological Considerations

As in other rivers, water levels in the Richibucto were generally too low for many fish to ascend prior to October 28. Confined to the estuary, they were more accessible to gillnets.

Forecast/Prospects

At present there is no reliable method of quantitatively forecasting returns of Atlantic salmon to the Richibucto River. All years assessed have been below the conservation level required. Given the extremely low egg deposition and juvenile abundance observed in 1997, the stock in the Richibucto is not in good condition to recover. It is therefore considered highly unlikely that the conservation requirement will be met in 1998, or in the foreseeable future.

Management Considerations

The Richibucto salmon stock appears severely depressed with a poor outlook for recovery. It is recommended that there be no allocation of salmon in 1998.

Acknowledgements

We thank the New Brunswick Department of Fisheries and Aquaculture and the Richibucto River Association for funding and operating the counting fence and collecting relevant data, and the Southeastern Anglers Association for their assistance in carrying out the electroseining program.

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Table 1. Big Cove First Nation allocation and reported harvest of Atlantic salmon on the Richibucto River.

	Allocation		Harvest	
Year	Large	Small	Large	Small
1982	-	-	84	20
1983	-	-	64	25
1984	-	-	44	47
1985	-	-	99	23
1986	-	-	69	76
1987	-	-	NA	NA
1988	-	-	32	19
1989	-	-	32	16
1990	-	-	73	93
1991	-	-	82	51
1992	NA	NA	452	61
1993	NA	NA	253	50
1994	125	425	113	51
1995	125	425	NA	NA
1996	125	425	NA	NA
1997	125	425	NA	NA

Table 2. Calculation of the conservation requirement for the Richibucto system and main stem.

TOTAL HABITAT - sq.m	Richibucto system	Richibucto main stem
Richibucto R. System (Anon 1978)	1226000	
Richibucto R. main, hd. tide to 29.5 km upstream (Atkinson *et al.* 1994)		318504
STOCK CHARACTERISTICS: (mean for Buctouche R., 1993-97)		
Male proportion of large salmon	0.24	0.24
Female proportion of large salmon	0.76	0.76
Mean length of large female salmon (cm)	78.2	78.2
Eggs per large female (1.4132 x LN(FL) + 2.7560)(Randall 1989)	7454	7454
Eggs per large salmon (eggs / lg female x lg female proportion)	5665	5665
Male proportion of small salmon	0.89	0.89
Female proportion of small salmon	0.11	0.11
Mean length of small female salmon (cm)	54.7	54.7
Eggs per small female (3.1718 x LN(FL) - 4.5636)(Randall 1989)	3393	3393
Eggs per small salmon (eggs / sm female x sm female proportion)	373	373
SPAWNING REQUIREMENTS:		
Egg deposition rate (no. / sq.m) (CAFSAC MS1991)	2.4	2.4
EGG REQUIREMENT (millions) (Total area x deposition rate)	2.942	0.764
TOTAL LARGE SALMON (egg target / eggs per lg salmon)	519	135
Large females (total large x lg female proportion)	395	103
Large males (total large - large females)	125	32
Small males needed (large females - large males)	270	70
TOTAL SMALL SALMON (sm males needed / sm male proportion)	303	79
2SW COMPONENT:		
Proportion 2SW (of total large salmon: mean for Buctouche R., 1992-1996)	0.86	0.86
TOTAL 2SW (total large x proportion 2SW)	447	116

Table 3. Salmon catches by day and standard week at the Richibucto R. counting fence, 1997. Shaded figures indicate days when the facility was not operating.

Standard Week	Date Mo/Da	Daily catch Large	Small
39	930	0	0
40	1001	0	0
40	1002	0	0
40	1003	0	0
40	1004	0	0
40	1005	0	0
40	1006	0	0
40	1007	0	0
41	1008	0	0
41	1009	0	0
41	1010	0	0
41	1011	0	0
41	1012	0	0
41	1013	0	0
41	1014	0	0
42	1015	0	0
42	1016	0	0
42	1017	0	0
42	1018	0	0
42	1019	0	0
42	1020	0	0
42	1021	0	0
43	1022	0	0
43	1023	0	0
43	1024	0	0
43	1025	0	0
43	1026	0	0
43	1027	0	0
43	1028	1	2
44	1029	0	0
44	1030	0	2
44	1031	0	3
44	1101	0	0
44	1102	7	8
44	1103	10	7
44	1104	2	0
45	1105	1	2

Std. Week	Weekly total Large	Small
39	0	0
40	0	0
41	0	0
42	0	0
43	1	2
44	19	20
45	1	2

Std. Week	Weekly cumulative total Large	Small
39	0	0
40	0	0
41	0	0
42	0	0
43	1	2
44	20	22
45	21	24

Standardized weeks

Week	Month	Days
39	September	24-30
40	October	01-07
41	October	08-14
42	October	15-21
43	October	22-28
44	October	29-04
45	November	05-11

Table 4. Age distribution of Richibucto River salmon, 1997. SW = sea winter; repeat spawner categories indicate total sea age followed by sea ages at which fish spawned.

			Repeat Spawners			Percent of
Smolt Age	1SW	2SW	3.2	4.2	Total	known age
2	8	9	1	2	20	63
3	9	3	0	0	12	37
Total	17	12	1	2	32	

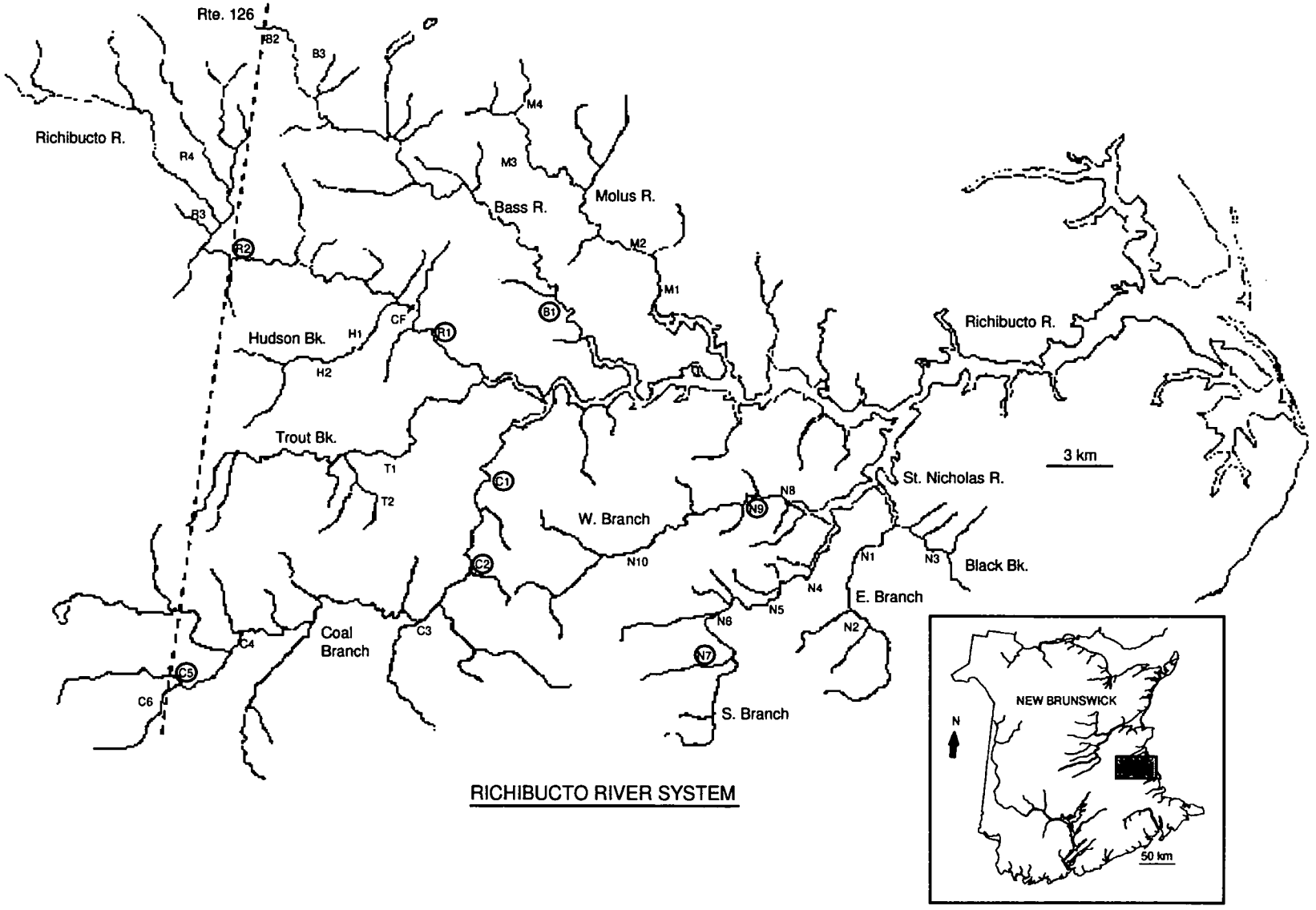
Proportion repeat spawners of MSW = 20%
Proportion repeat 1SW of MSW = 0%
Proportion 2SW of MSW = 80%

Table 5. Catch per 15 minute upstream sweep at all electroseining sites, Richibucto R., 1997.

Location	Map site	Equivalent Area (m2)	Salmon fry	Salmon parr	Chub	Dace	Eel	Lamprey	Sculpin	Shiner	Stickle-back	Sucker	Trout	Predicted fry density/100m2
Bass R.(below Rte. 116)	B1	301	0	5	35	26	0	7	25	6	1	25	5	1.2
Coal Branch (hd. tide above Fords Mills)	C1	314	6	15	2	46	0	2	1	5	0	2	0	6.5
Coal Branch (below Beersville xing)	C2	249	4	7	1	39	0	1	17	6	3	4	0	5.4
Coal Branch (below Rte. 465)	C5	167	4	8	15	32	0	1	0	0	0	7	0	4.7
St. Nicholas R. (S. Branch)	N7	172	0	0	1	0	0	3	68	0	1	0	22	1.2
St. Nicholas R. (W. Branch)	N9	142	0	0	1	0	0	6	45	2	0	2	17	1.2
Richibucto R. (below Rte. 126)	R1	301	11	11	7	27	1	2	0	0	0	1	0	11.4
Richibucto R. (above Rte. 116)	R2	226	11	33	2	89	0	1	8	0	0	0	0	11.1

Table 6. Occurrence and density data for juvenile Atlantic salmon collected by electroseining on the Richibucto River system, for all years; P - present, A - absent, * denotes minimum density = sweep catch/area, 1997 fry densities are predicted values.

		FRY				PARR			
Location	Map site	1974	1982	1994	*1997	1974	1982	1994	1997
Bass R.	B1	P	0		1.2	P	6.2		P
Bass R.	B2	A	-		-	A	-		-
Bass R.	B3	A	-		-	A	-		-
Molus R.	M1	A	*0.6		-	A	1.1		-
Molus R.	M2	A	-		-	A	-		-
Molus R.	M3	A	-		-	A	-		-
Molus R.	M4	A	-		-	A	-		-
Hudson Bk.	H1	P	0		-	P	0		-
Hudson Bk.	H2	A	-		-	A	-		-
Richibucto R.	R1	P	1.2		11.4	P	5.8		P
Richibucto R.	R2	P	45.9	1.3	11.1	P	18	11.4	P
Richibucto R.	R3	P	*0.8		-	P	0.8		-
Richibucto R.	R4	A	-		-	A	-		-
Trout Bk.	T1	P	0		-	P	-		-
Trout Bk.	T2	A	-		-	A	-		-
Coal Branch	C1	A	-		6.5	A	-		P
Coal Branch	C2	P	0		5.4	P	0.3		P
Coal Branch	C3	P	*0.3	15.2	-	P	4.1	1.8	-
Coal Branch	C4	A	-		-	A	-		-
Coal Branch	C5	P	*0.3		4.7	P	7.4		P
Coal Branch	C6	P	-		-	P	-		-
St. Nicholas R. (E. Branch)	N1	A	-		-	A	-		-
St. Nicholas R. (E. Branch)	N2	A	-		-	A	-		-
St. Nicholas R. (Black Br.)	N3	A	-		-	A	-		-
St. Nicholas R. (S. Branch)	N4	A	-		-	A	-		-
St. Nicholas R. (S. Branch)	N5	A	-		-	A	-		-
St. Nicholas R. (S. Branch)	N6	A	-		-	A	-		-
St. Nicholas R. (S. Branch)	N7	A	-		1.2	A	-		A
St. Nicholas R. (W. Branch)	N8	A	-		1.2	A	-		-
St. Nicholas R. (W. Branch)	N9	P	-		-	P	-		A
St. Nicholas R. (W. Branch)	N10	A	-		-	A	-		-



RICHIBUCTO RIVER SYSTEM

Figure 1. Location of counting fence (CF) and electroseining sites on the Richibucto River. Circled sites were sampled in 1997.

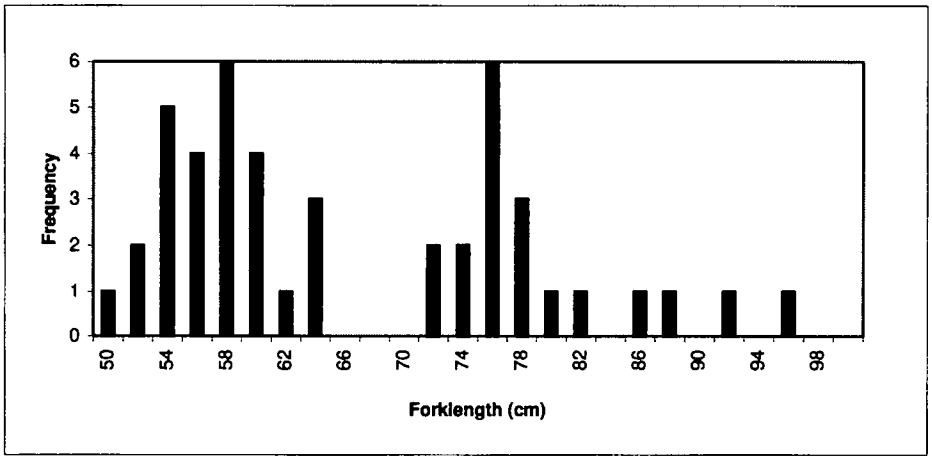


Figure 2. Length-frequencies of salmon caught at Richibucto R. counting fence, 1997; (N=45).

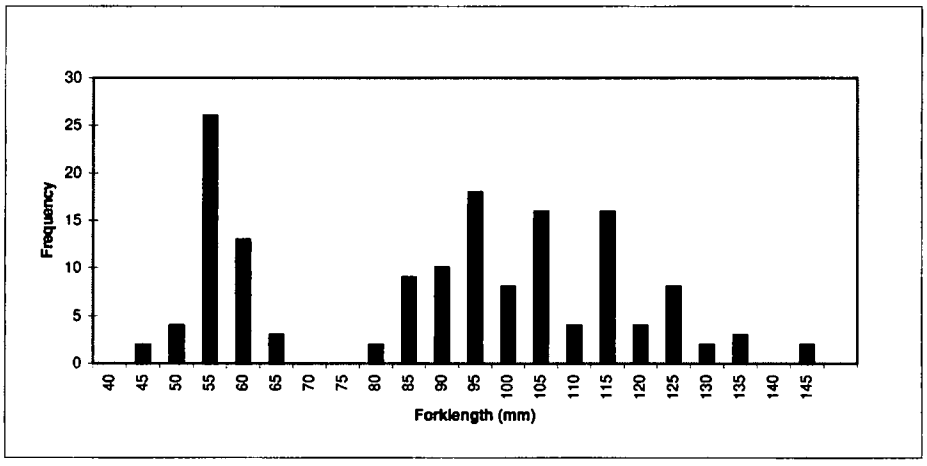


Figure 3. Length-frequencies of juvenile salmon caught at electroseining sites on the Richibucto R.,1997; (N=150).