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Juvenile Atlantic Salmon Densities, Miramichi River System, New Brunswick, 1969-77

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Resource Branch
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Department of Fisheries and the Environment
Halifax, Nova Scotia

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JUVENILE ATLANTIC SALMON DENSITIES,
MIRAMICHI RIVER SYSTEM, NEW BRUNSWICK, 1969-77

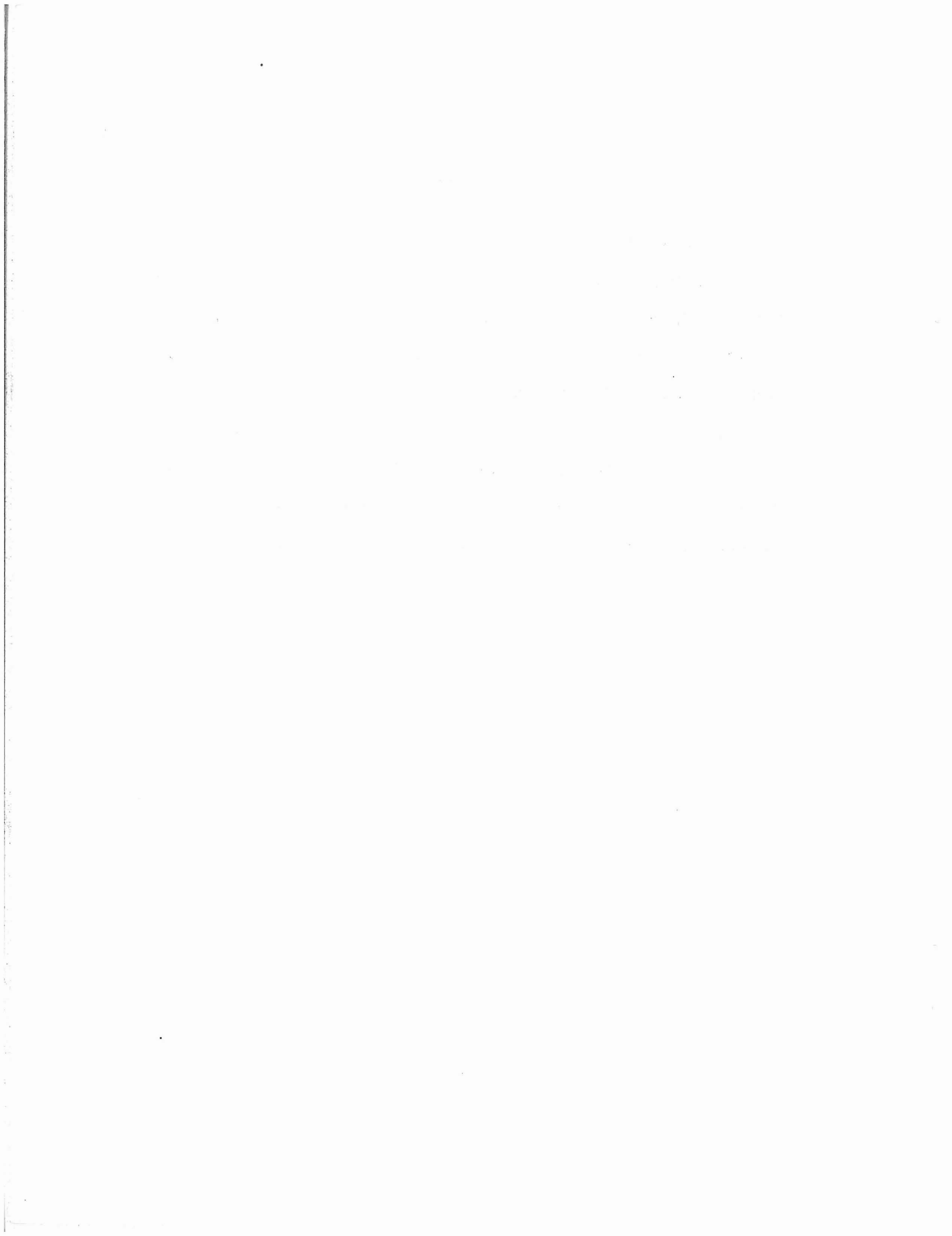
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ABSTRACT

Peppar, J.L. and E.J. Schofield. 1978. Juvenile Atlantic salmon densities, Miramichi River System, New Brunswick, 1969-77. Fish. Mar. Serv. Data Rep. No. 91, 27 p.

Electroseining operations were conducted throughout the freshwater reaches of the Miramichi River system, New Brunswick, over the period 1969-77, to determine population densities of juvenile Atlantic salmon. This report presents the calculated juvenile densities of all sites sampled.

Key words: Atlantic salmon, juvenile salmon densities, electrofishing, Miramichi River system, sampling sites.

RESUME

Peppar, J.L. and E.J. Schofield. 1978. Juvenile Atlantic salmon densities, Miramichi River System, New Brunswick, 1969-77. Fish. Mar. Serv. Data Rep. No. 91, 27 p.

Durant les années 1969 à 1977, on a effectué des opérations d'échantillonnage à la pêche électrique couvrant toutes les sections d'eau douce du réseau de la rivière Miramichi au Nouveau-Brunswick. Le fut était de déterminer la densité de la population de jeunes saumons Atlantique. Ce rapport présente les densités calculées de jeunes saumons pour tous les sites échantillonnés.

Mots-cles : Saumon Atlantique, densités de la population de jeunes saumons, pêche électrique, réseau de la rivière Miramichi, sites échantillonnage.

INTRODUCTION

Electroseining operations were conducted throughout the freshwater reaches of the Miramichi River system over the period 1969-77, to determine population densities of juvenile Atlantic salmon. These operations were conducted primarily to determine relative spawning success each year, in relation to increased or decreased escapements of adult salmon to the river system. With this objective in mind, operations each year concentrated on the repetition of sites sampled in previous years, so that consecutive-year comparisons could be drawn.

This report summarizes data obtained from these juvenile salmon population-assessment investigations. Calculated juvenile densities (numbers/83.6 m² or 100 yd²) are presented for all sites sampled by the electroseining operations.

SCOPE OF OPERATIONS

The electroseining operations were conducted on a number of selected streams throughout the Miramichi River system (Fig.). Most of the streams studied were inaccessible for much of their length; thus, sampling sites had to be selected in areas of reasonable access by standard vehicles.

METHODS AND PRESENTATION OF DATA

On each stream, sampling sites with similar physical characteristics were selected. Every attempt was made to select sites possessing all three basic kinds of habitat - pool, run and riffle. Barrier nets were employed to fence off areas in the order of 350 square metres. Each sampling site was fenced off with barriers at its upper and lower boundaries, and on one side as well, if the full width of stream could not be covered.

All sites were diagrammed on data sheets (Appendix A) at the time of sampling, indicating their location and their habitat and substrate characteristics.

All seining was performed with variable DC electrofishing generators. Two units were employed; a portable Dirigo 500 Electrofisher, and/or a larger unit produced by Nova Scotia Armature Works, Halifax. These units produced 350-750 volts, giving 0.6-2.0 amperes (usually held close to 1.0 ampere), stunning the fish but minimizing actual mortality or injury. In addition to the shocker, an apron seine and dip nets were employed.

Estimates of the number of fish within a sample area were obtained by making several uniform coverages. Electroseining was done back and forth across the area while proceeding from the upper to the lower barrier. The elapsed time for the initial "sweep" (complete coverage of an area) was adhered to closely for succeeding sweeps, so that each would approximate a similar unit

of effort. Generally, five sweeps were made at each sampling site.

All salmon taken in a sweep were measured (fork length) and sizes were recorded in a length-frequency table. Sizes recorded in this manner allowed the determination of the numbers of fry (under-yearlings), small and large parr (post-yearlings), on the basis of the mode distributions obtained. Numbers obtained were then applied to density/unit area calculations (Appendix B). The calculated juvenile densities obtained for all the individual sites over the nine years of sampling are summarized.

RESULTS

The streams and corresponding numbers of sites where electroseining operations were conducted are summarized (Table 1). The table indicates the location of each stream by specific area within the system (Main Miramichi - streams flowing into the Miramichi estuary or bay; Northwest Miramichi - streams flowing into the Northwest Miramichi River; and Southwest Miramichi - streams flowing into the Southwest Miramichi River), and presents the total area sampled and total number of juvenile salmon obtained each year.

Calculated densities of fry, small parr and large parr for each stream and individual site sampled are presented (Tables 2-10). The overall mean densities for the Miramichi River system for each year of sampling are also presented (Table 11).

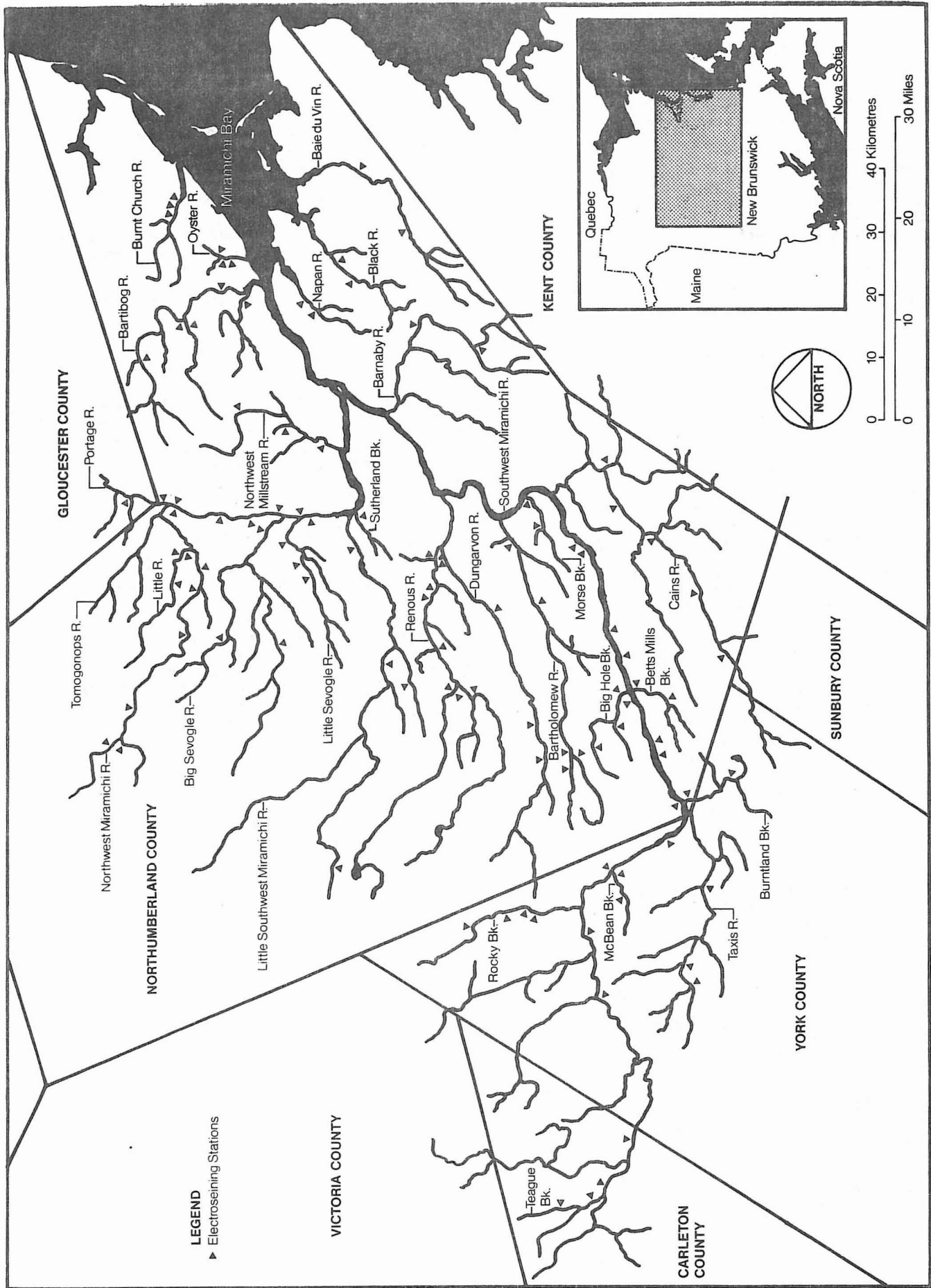


FIG. Electrosetting stations, Miramichi River system, New Brunswick.

TABLE 1. Streams and numbers of sites on the Miramichi River system where electroseining operations were conducted, 1969-77.

Stream	Numbers of sites sampled								
	1969	1970	1971	1972	1973	1974	1975	1976	1977
<u>Main Miramichi River</u>									
Baie du Vin River	0	0	2	2	2	2	2	2	2
Black River	1	0	2	2	2	2	2	2	2
Napan River	0	0	2	2	2	2	2	2	2
Burnt Church River	0	0	2	2	2	2	2	2	2
Oyster River	0	3	3	3	3	2	2	2	2
Bartibog River	1	4	4	5	5	5	5	5	5
<u>Northwest Miramichi River</u>									
Northwest Miramichi River	0	0	0	0	0	12	11	10	11
Tomogonops River	0	0	1	0	1	1	0	0	0
Little River	0	0	1	0	2	2	2	2	2
Portage River	0	0	0	1	1	2	2	2	2
Little Sevogle River	0	3	3	3	3	3	3	3	3
Little Southwest Miramichi River	4	0	4	4	4	4	4	4	4
Sutherland Brook	0	1	1	1	1	1	1	1	1
Northwest Millstream	0	3	3	3	3	3	0	0	0
Big Sevogle River	0	0	0	0	0	3	3	3	3
<u>Southwest Miramichi River</u>									
Dungarvon River	0	0	0	0	0	3	3	2	3
Barnaby River	2	0	2	2	2	2	2	2	2
Renous River	0	5	5	4	7	6	6	5	5
Main Southwest Miramichi River	0	14	14	12	14	14	14	10	12
Bartholomew River	2	3	3	3	3	4	0	0	0
Morse Brook	0	2	2	2	2	2	2	2	1
Cains River	4	0	4	4	4	4	4	4	4
Big Hole Brook	0	3	3	3	3	3	3	3	3
Betts Mill Brook	0	2	2	2	2	2	2	2	2
Burntland Brook	0	0	2	2	2	2	2	1	2
Taxis River	0	0	0	3	3	3	3	3	3
MacBean Brook	0	2	2	2	2	2	2	2	2
Rocky Brook	0	3	4	3	3	3	3	2	4
Teague Brook	0	2	2	2	2	2	2	2	2
<u>Totals</u>	14	50	73	72	80	98	89	80	86
Total area sampled (m ²)	6,746	14,579	22,698	23,323	25,527	32,207	29,044	26,056	28,644
Total numbers of salmon captured	1,163	3,087	3,978	2,478	4,273	9,330	10,631	7,540	11,741

TABLE 2. Calculated densities of Atlantic salmon fry, as determined by electroseining in the Miramichi River system, 1969-77; sampling sites on Main Miramichi streams.

Stream	Site number	Fry density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Baie du Vin River	1	-	-	4.8	<1	10.9	6.1	<1	8.1	<1
	2	-	-	2.0	<1	10.2	<1	13.7	<1	<1
Black River	1	<1	-	10.4	<1	10.5	7.1	4.1	4.8	5.5
	2	-	-	<1	<1	<1	<1	<1	<1	1.7
Napan River	1	-	-	5.7	<1	2.0	<1	15.3	31.3	<1
	2	-	-	<1	<1	<1	<1	<1	<1	<1
Burnt Church River	1	-	-	<1	<1	<1	-	-	-	-
	2	-	-	13.5	<1	1.5	<1	<1	<1	<1
	3	-	-	-	-	-	3.0	<1	<1	<1
Oyster River	1	-	<1	45.3	<1	<1	<1	<1	1.3	31.2
	2	-	<1	20.8	<1	<1	<1	<1	<1	<1
	3	-	<1	<1	<1	<1	-	-	-	-
Bartibog River	1	4.0	3.4	16.4	<1	3.7	6.0	26.7	41.7	2.3
	2	-	26.4	17.9	1.1	12.8	8.7	6.0	5.4	1.7
	3	-	<1	16.6	<1	8.2	4.5	13.4	2.6	3.1
	4	-	<1	5.4	<1	9.3	<1	<1	<1	2.9
	5	-	-	-	<1	7.4	13.0	8.9	19.9	1.2
	6	-	-	-	<1	7.4	13.0	8.9	19.9	1.2
Overall mean		2.3	4.6	10.7	0.5	5.0	3.5	6.1	7.7	3.4
Total number of estimates		2	7	15	16	16	15	15	15	15

TABLE 3. Calculated densities of Atlantic salmon fry, as determined by electroseining in the Miramichi River system, 1969-77; sampling sites on Northwest Miramichi streams.

Stream	Site number	Fry density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Tomogonops River	10	-	-	<1	-	<1	6.8	-	-	-
	11	-	-	-	-	-	-	-	-	-
Little River	3	-	-	7.2	-	7.5	-	-	-	-
	2	-	-	-	-	65.5	15.9	<1	<1	10.1
	12	-	-	-	-	-	10.7	<1	<1	12.6
Portage River	1	-	-	-	4.5	22.1	3.2	3.0	32.6	34.9
	8	-	-	-	-	-	1.6	<1	<1	5.8
Little Sevogle River	1	-	13.9	13.5	2.4	19.6	<1	49.8	10.9	41.4
	2	-	<1	8.4	<1	4.6	<1	24.7	2.7	17.6
	3	-	<1	<1	<1	11.8	1.2	22.0	3.6	26.8
Little Southwest Miramichi River	1	<1	-	3.8	3.3	1.3	<1	28.9	11.0	14.2
	3	<1	-	<1	4.3	2.9	19.6	10.2	8.6	4.4
	4	2.8	-	9.5	<1	30.5	<1	<1	1.7	90.5
	6	<1	-	18.5	4.2	23.8	12.8	30.3	9.1	31.5
Sutherland Brook	1	-	7.7	<1	13.1	28.8	70.5	<1	<1	38.7
Northwest Millstream	1	-	<1	<1	<1	20.6	<1	-	-	-
	2	-	<1	<1	<1	<1	<1	-	-	-
	3	-	<1	<1	<1	<1	<1	-	-	-
Big Sevogle River	1	-	-	-	-	-	29.7	42.0	14.5	39.1
	2	-	-	-	-	-	37.6	30.9	6.5	44.3
	3	-	-	-	-	-	25.9	36.2	35.3	21.7
Northwest Miramichi River	2	-	-	-	-	-	-	15.2	47.0	20.7
	3	-	-	-	-	-	3.2	-	-	-
	4	-	-	-	-	-	10.6	<1	1.9	<1
	5	-	-	-	-	-	4.7	<1	4.6	11.2
	7	-	-	-	-	-	<1	<1	2.7	4.0
	9A	-	-	-	-	-	6.8	38.2	6.2	1.7
	9B	-	-	-	-	-	<1	1.1	7.7	1.8
	13	-	-	-	-	-	20.7	24.8	28.6	31.9
	14	-	-	-	-	-	12.3	-	-	-
	15	-	-	-	-	-	9.9	21.6	30.1	20.0
	17	-	-	-	-	-	8.0	54.3	-	14.2
	18	-	-	-	-	-	101.1	7.5	13.0	18.6
	19	-	-	-	-	-	43.2	80.7	106.0	28.7
Overall mean		1.1	3.4	4.9	2.9	16.0	14.9	20.2	15.4	22.6
Total number of estimates		4	7	13	12	15	31	26	25	26

TABLE 4. Calculated densities of Atlantic salmon fry, as determined by electroseining in the Miramichi River system, 1969-77; sampling sites on Southwest Miramichi streams.

Stream	Site number	Fry density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Dungarvon River	1	-	-	-	-	-	29.7	42.0	-	52.2
	2	-	-	-	-	-	37.6	30.9	20.1	36.4
	3	-	-	-	-	-	25.9	36.2	8.2	38.8
Barnaby River	1	1.6	-	2.7	<1	10.8	<1	3.4	<1	<1
	2	6.9	-	7.5	<1	13.6	<1	1.7	<1	2.4
Renous River	1	-	<1	7.8	-	2.2	-	-	-	-
	2	-	2.9	2.9	2.5	2.0	22.0	3.2	16.4	15.7
	3	-	6.3	11.7	15.9	6.8	40.7	24.8	19.0	26.0
	4	-	<1	-	-	-	-	-	-	-
	5	-	15.3	13.9	11.0	13.2	65.0	65.5	92.3	82.8
	6	-	-	4.0	-	9.2	11.3	14.0	-	-
	7	-	-	-	<1	3.2	64.7	30.0	4.6	32.5
	8	-	-	-	-	19.5	29.4	25.7	23.1	30.2
Main Southwest Miramichi River	7	-	9.5	10.7	-	1.1	7.3	47.4	16.2	158.8
	4	-	6.6	2.5	1.9	14.8	15.0	32.9	-	52.0
	10	-	3.3	1.3	<1	<1	<1	7.3	20.1	-
	14	-	23.9	37.0	-	18.4	60.0	42.3	2.8	41.4
	11	-	19.2	29.7	<1	18.0	34.7	20.2	21.3	37.8
	6	-	13.9	13.0	9.4	32.1	43.1	49.5	-	12.2
	5	-	15.0	14.5	1.6	1.9	1.1	38.2	21.7	9.8
	13	-	53.2	19.1	5.3	5.1	51.0	71.2	46.5	23.0
	1	-	19.8	33.6	2.5	40.1	27.0	41.6	-	49.8
	2	-	8.6	8.6	2.1	8.2	24.6	57.2	12.2	6.1
	3	-	<1	19.3	4.6	19.9	50.0	70.4	-	-
	9	-	20.1	7.6	8.3	30.1	50.7	27.6	<1	1.3
	12	-	7.7	2.0	1.4	3.4	1.8	<1	34.9	64.1
8	-	4.9	6.8	2.0	22.0	19.7	34.2	24.0	33.3	
Bartholomew River	1	<1	1.7	<1	<1	15.1	21.6	-	-	-
	2	<1	1.1	1.9	<1	6.3	13.1	-	-	-
	3	-	<1	-	-	-	-	-	-	-
	4	-	-	<1	<1	14.2	<1	-	-	-
	6	-	-	-	-	-	<1	-	-	-
	Morse Brook	1	-	<1	9.6	<1	27.0	<1	24.0	<1
2		-	<1	<1	<1	<1	<1	<1	<1	-
Cains River	3	-	-	-	24.8	22.0	45.9	39.0	12.0	27.7
	4	25.1	-	11.6	7.7	4.8	42.9	37.2	23.2	56.0
	6	7.9	-	6.1	7.3	10.2	16.3	243.1	81.5	31.9
	7	1.5	-	52.0	-	-	-	-	-	-
	8	19.8	-	10.5	3.9	26.9	32.7	43.0	20.3	69.6
Big Hole Brook	1	-	19.9	16.3	3.9	15.2	33.1	28.0	55.2	22.9
	2	-	<1	<1	<1	<1	<1	1.0	<1	<1
	3	-	<1	4.4	<1	<1	<1	<1	<1	<1
Betts Mill Brook	1	-	52.0	33.3	14.5	89.5	12.2	14.0	11.3	45.7
	2	-	<1	11.6	<1	<1	<1	6.1	2.9	8.7
Burntland Brook	1	-	-	32.0	5.7	8.8	85.4	94.2	41.3	127.9
	2	-	-	17.0	<1	7.8	5.3	6.9	-	32.3
Taxis River	1	-	-	-	<1	6.9	30.8	20.4	23.7	29.4
	2	-	-	-	7.1	3.5	25.8	66.7	45.3	46.0
	3	-	-	-	2.6	31.9	67.1	34.1	47.3	68.9
MacBean Brook	1	-	9.9	25.1	2.4	12.7	23.1	10.2	32.3	83.4
	2	-	3.4	71.0	<1	56.3	1.0	<1	1.4	95.6
Rocky Brook	1	-	3.4	25.6	20.0	3.2	34.7	49.5	-	39.7
	2	-	129.8	43.1	47.0	49.5	65.5	92.5	51.1	69.4
	3	-	<1	<1	-	-	-	-	-	38.5
	4	-	-	45.6	50.8	66.6	25.5	55.1	138.5	49.6
Teague Brook	1	-	5.2	8.9	<1	7.6	10.2	50.0	19.5	45.2
	2	-	7.1	2.0	<1	15.8	2.3	6.2	<1	31.8
Overall mean		8.0	13.0	15.3	6.3	16.3	25.5	36.7	24.8	40.6
Total number of estimates		8	36	45	44	49	52	48	40	45

TABLE 5. Calculated densities of Atlantic salmon small parr, as determined by electro-seining in the Miramichi River system, 1969-77; sampling sites on Main Miramichi streams.

Stream	Site number	Small-parr density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Baie du Vin River	1	-	-	1.6	<1	<1	5.9	<1	<1	<1
	2	-	-	1.2	2.0	<1	<1	<1	1.7	<1
Black River	1	2.1	-	<1	<1	<1	1.7	2.7	2.5	1.1
	2	-	-	<1	<1	<1	<1	<1	<1	1.7
Napan River	1	-	-	<1	1.4	<1	<1	<1	<1	<1
	2	-	-	<1	1.0	<1	<1	<1	<1	<1
Burnt Church River	1	-	-	<1	<1	<1	-	-	-	-
	2	-	-	<1	1.3	<1	<1	<1	<1	<1
	3	-	-	-	-	-	4.6	1.9	1.5	<1
Oyster River	1	-	<1	<1	3.1	<1	<1	<1	<1	<1
	2	-	<1	<1	3.4	<1	<1	<1	<1	<1
	3	-	<1	<1	<1	<1	-	-	-	-
Bartibog River	1	16.4	6.7	9.6	4.7	<1	7.5	4.4	<1	16.8
	2	-	<1	<1	<1	<1	<1	<1	16.2	6.4
	3	-	4.8	2.9	2.4	<1	53.7	1.7	9.4	1.7
	4	-	7.7	5.9	4.0	<1	<1	20.3	9.7	2.3
	5	-	-	-	<1	<1	6.3	4.4	16.4	2.7
	6	-	-	-	<1	<1	6.3	4.4	16.4	2.7
Overall mean		9.3	3.0	1.7	1.7	0.5	5.6	2.7	3.9	2.3
Total number of estimates		2	7	15	16	16	15	15	15	15

TABLE 6. Calculated densities of Atlantic salmon small parr, as determined by electro-seining in the Miramichi River system, 1969-77; sampling sites on Northwest Miramichi River.

Stream	Site number	Small-parr density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Tomogonops River	10	-	-	<1	-	<1	<1	-	-	-
	11	-	-	-	-	-	-	-	-	-
Little River	3	-	-	<1	-	<1	-	-	-	-
	2	-	-	-	-	<1	19.1	8.3	24.8	5.7
	12	-	-	-	-	-	4.7	19.2	3.5	17.9
Portage River	1	-	-	-	<1	<1	2.6	<1	57.4	4.6
	8	-	-	-	-	-	9.2	<1	4.3	10.0
Little Sevogle River	1	-	8.2	7.8	6.0	4.9	2.5	44.2	4.4	5.2
	2	-	2.7	<1	1.7	<1	1.7	1.2	2.7	1.4
	3	-	1.7	2.7	2.1	<1	5.6	2.2	2.9	5.0
Little Southwest Miramichi River	1	10.2	-	<1	<1	<1	<1	6.1	<1	1.1
	3	13.5	-	6.5	4.8	1.0	6.5	14.6	8.0	<1
	4	42.2	-	<1	3.4	<1	28.0	1.2	3.4	2.6
	6	1.0	-	1.7	<1	2.5	<1	<1	<1	<1
Sutherland Brook	1	-	8.6	9.1	5.1	5.2	23.8	36.6	36.6	21.7
Northwest Millstream	1	-	14.0	5.4	1.1	2.7	17.6	-	-	-
	2	-	<1	<1	<1	<1	9.7	-	-	-
	3	-	<1	<1	<1	<1	<1	-	-	-
Big Sevogle River	1	-	-	-	-	-	2.6	3.1	1.7	1.0
	2	-	-	-	-	-	40.5	17.0	18.8	9.8
	3	-	-	-	-	-	28.5	12.7	9.6	14.8
Northwest Miramichi River	2	-	-	-	-	-	-	3.6	<1	<1
	3	-	-	-	-	-	<1	-	-	-
	4	-	-	-	-	-	<1	<1	7.6	<1
	5	-	-	-	-	-	2.6	<1	<1	<1
	7	-	-	-	-	-	<1	3.5	<1	25.1
	9A	-	-	-	-	-	1.6	11.3	5.5	3.5
	9B	-	-	-	-	-	<1	4.3	8.4	2.0
	13	-	-	-	-	-	14.8	15.1	20.6	24.3
	14	-	-	-	-	-	15.8	-	-	-
	15	-	-	-	-	-	24.5	23.1	42.0	37.3
	17	-	-	-	-	-	25.7	18.0	-	36.3
	18	-	-	-	-	-	26.4	16.2	3.6	18.9
	19	-	-	-	-	-	42.9	30.1	50.7	49.1
Overall mean		16.7	5.2	2.8	2.2	1.4	11.6	11.3	12.7	11.5
Total number of estimates		4	7	13	12	15	31	26	25	26

TABLE 7. Calculated densities of Atlantic salmon small parr, as determined by electro-seining in the Miramichi River system, 1969-77; sampling sites on Southwest Miramichi streams.

Stream	Site number	Small-parr density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Dungarvon River	1	-	-	-	-	-	6.8	8.8	-	6.3
	2	-	-	-	-	-	1.1	3.9	<1	2.7
	3	-	-	-	-	-	4.8	3.2	68.8	1.1
Barnaby River	1	1.3	-	<1	<1	<1	<1	<1	<1	<1
	2	<1	-	<1	6.1	<1	<1	<1	2.0	<1
Renous River	1	-	<1	<1	<1	<1	-	-	-	-
	2	-	1.8	6.1	2.3	3.1	1.3	15.5	6.9	8.1
	3	-	1.8	<1	1.7	1.2	1.7	6.8	1.2	4.5
	4	-	1.2	-	-	-	-	-	-	-
	5	-	1.8	1.4	<1	1.8	7.7	6.0	2.1	2.9
	6	-	-	1.4	-	-	1.5	7.2	-	-
	7	-	-	-	2.7	<1	<1	1.0	1.1	3.6
	8	-	-	-	-	4.1	5.1	13.9	9.7	10.4
Main Southwest Miramichi River	7	-	<1	<1	-	<1	<1	<1	11.8	14.1
	4	-	<1	<1	<1	<1	<1	2.6	-	16.5
	10	-	<1	<1	<1	<1	<1	<1	4.5	-
	14	-	2.8	6.3	-	<1	<1	2.3	<1	3.4
	11	-	<1	<1	<1	<1	<1	4.2	5.1	2.7
	6	-	1.3	26.6	1.5	<1	3.4	15.1	-	1.1
	5	-	5.9	3.4	<1	<1	<1	1.1	1.3	<1
	13	-	4.0	3.2	6.8	<1	<1	1.3	6.8	11.7
	1	-	1.5	9.4	5.2	3.7	17.4	24.1	-	8.9
	2	-	3.3	7.8	5.6	1.7	14.2	41.6	<1	<1
	3	-	<1	1.1	2.8	<1	2.4	217.5	-	-
	9	-	1.2	3.5	9.4	2.0	13.9	11.1	<1	<1
12	-	<1	<1	<1	<1	<1	<1	2.8	<1	
8	-	2.6	<1	1.1	2.9	7.4	6.4	1.1	<1	
Bartholomew River	1	2.3	<1	<1	<1	<1	<1	-	-	-
	2	1.4	<1	<1	<1	<1	<1	-	-	-
	3	-	7.0	<1	<1	<1	-	-	-	-
	4	-	-	<1	<1	<1	3.8	-	-	-
	6	-	-	-	-	-	27.7	-	-	-
Morse Brook	1	-	<1	11.0	8.3	1.7	<1	7.1	7.5	<1
	2	-	<1	<1	<1	<1	<1	<1	<1	-
Cains River	3	-	-	-	38.6	<1	10.9	2.0	24.8	9.2
	4	17.3	-	<1	<1	<1	3.2	2.8	1.6	<1
	6	14.5	-	1.2	<1	<1	3.9	6.4	3.8	1.1
	7	14.7	-	3.2	-	-	-	-	-	-
	8	17.5	-	1.9	4.8	1.2	7.5	9.9	14.6	4.2
Big Hole Brook	1	-	4.9	7.2	4.0	2.0	<1	6.7	5.2	3.9
	2	-	<1	<1	<1	<1	<1	1.9	<1	<1
	3	-	<1	<1	<1	<1	<1	<1	<1	<1
Betts Mill Brook	1	-	2.2	5.0	8.0	2.0	1.2	14.5	22.2	11.6
	2	-	<1	<1	2.8	<1	3.0	6.8	6.8	1.1
Burntland Brook	1	-	-	6.4	6.0	<1	13.4	31.6	22.7	11.1
	2	-	-	10.4	8.9	1.8	24.0	26.3	-	23.8
Taxis River	1	-	-	-	6.1	3.2	4.4	10.0	13.0	13.2
	2	-	-	-	11.7	5.7	3.0	27.0	22.3	19.5
	3	-	-	-	9.1	3.8	25.7	28.7	28.2	20.5
MacBean Brook	1	-	1.4	5.9	9.0	1.4	6.2	24.1	10.9	17.9
	2	-	1.9	12.5	16.4	2.2	24.6	8.8	18.8	23.1
Rocky Brook	1	-	10.8	45.0	23.9	5.7	30.1	60.9	-	42.2
	2	-	7.8	36.8	14.0	22.4	30.3	31.9	22.6	39.8
	3	-	<1	<1	-	-	-	-	-	1.7
	4	-	-	37.4	5.5	8.5	7.3	25.6	22.7	21.4
Teague Brook	1	-	2.7	7.4	1.3	<1	21.1	17.4	7.2	9.9
	2	-	<1	3.7	2.6	2.5	15.8	3.9	28.5	4.9
Overall mean		8.7	2.1	6.1	5.3	2.9	7.0	15.6	10.3	8.5
Total number of estimates		8	36	45	44	49	52	48	40	45

TABLE 8. Calculated densities of Atlantic salmon large parr, as determined by electro-seining in the Miramichi River system, 1969-77; sampling sites on Main Miramichi streams.

Stream	Site number	Large-parr density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Baie du Vin River	1	-	-	<1	1.2	<1	2.2	<1	<1	5.1
	2	-	-	1.1	2.3	<1	1.9	<1	5.7	<1
Black River	1	6.2	-	1.3	<1	<1	1.5	2.5	5.2	1.6
	2	-	-	<1	<1	<1	<1	<1	<1	<1
Napan River	1	-	-	<1	<1	<1	<1	<1	4.2	10.9
	2	-	-	<1	<1	<1	<1	<1	4.2	5.8
Burnt Church River	1	-	-	<1	<1	<1	-	-	-	-
	2	-	-	3.9	5.0	<1	6.2	<1	1.1	<1
	3	-	-	-	-	-	<1	<1	1.9	<1
Oyster River	1	-	<1	<1	1.5	2.1	<1	<1	<1	1.4
	2	-	<1	<1	<1	<1	<1	<1	<1	<1
	3	-	<1	<1	<1	<1	-	-	-	-
Bartibog River	1	1.4	6.7	2.1	<1	<1	<1	1.9	3.4	<1
	2	-	<1	<1	1.6	<1	<1	<1	3.2	1.4
	3	-	<1	<1	<1	<1	<1	<1	<1	<1
	4	-	2.3	2.8	1.5	1.9	5.2	3.7	2.3	1.4
	5	-	-	-	<1	<1	<1	1.5	2.1	<1
	6	-	-	-	<1	<1	<1	1.5	2.1	<1
Overall mean		3.8	1.6	1.1	1.1	0.7	1.5	1.0	2.3	1.9
Total number of estimates		2	7	15	16	16	15	15	15	15

TABLE 9. Calculated densities of Atlantic salmon large parr, as determined by electro-seining in the Miramichi River system, 1969-77; sampling sites on Northwest Miramichi streams.

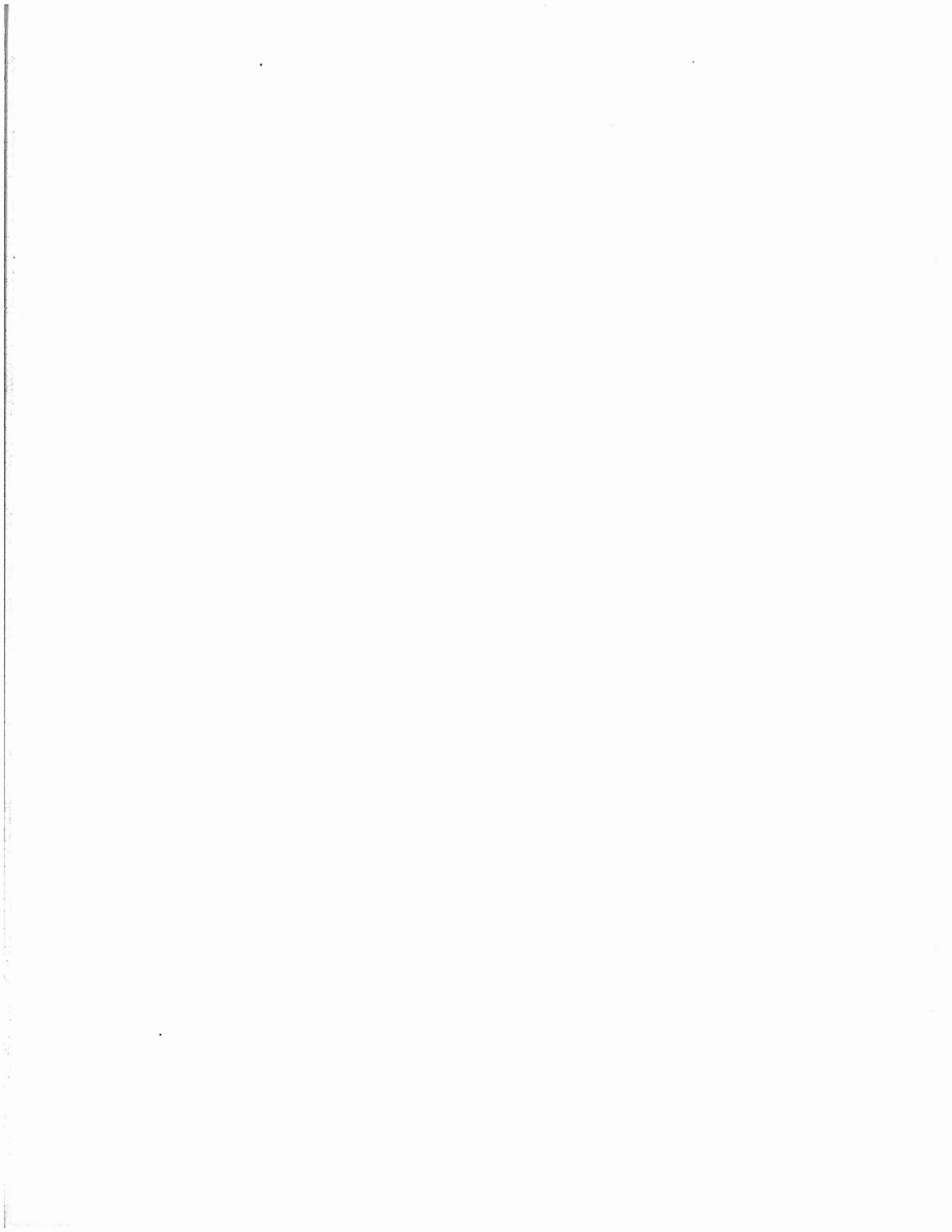
Stream	Site number	Large-parr density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Tomogonops River	10	-	-	<1	-	<1	<1	-	-	-
	11	-	-	-	-	-	-	-	-	-
Little River	3	-	-	1.8	-	1.5	-	-	-	-
	2	-	-	-	-	1.2	<1	<1	3.6	4.7
	12	-	-	-	-	-	<1	<1	2.5	6.2
Portage River	1	-	-	-	<1	<1	<1	<1	1.2	<1
	8	-	-	-	-	-	1.8	<1	<1	1.2
Little Sevogle River	1	-	7.4	1.9	1.1	3.0	<1	1.9	<1	3.1
	2	-	5.0	1.6	<1	<1	<1	<1	<1	1.3
	3	-	4.1	2.1	1.2	<1	1.4	1.2	1.3	1.4
Little Southwest Miramichi River	1	<1	-	<1	<1	<1	<1	<1	<1	<1
	3	1.3	-	<1	4.7	<1	<1	1.7	1.1	<1
	4	1.1	-	4.1	3.5	<1	<1	10.3	1.4	3.0
	6	<1	-	<1	<1	<1	<1	<1	<1	<1
Sutherland Brook	1	-	14.3	4.2	3.5	2.1	2.4	25.5	20.1	15.7
Northwest Millstream	1	-	3.8	8.3	1.4	1.7	<1	-	-	-
	2	-	<1	<1	<1	<1	<1	-	-	-
	3	-	<1	<1	<1	<1	<1	-	-	-
Big Sevogle River	1	-	-	-	-	-	<1	<1	<1	<1
	2	-	-	-	-	-	5.0	6.3	6.6	6.9
	3	-	-	-	-	-	9.6	7.2	8.1	1.8
Northwest Miramichi River	2	-	-	-	-	-	-	<1	<1	<1
	3	-	-	-	-	-	<1	-	-	-
	4	-	-	-	-	-	<1	<1	<1	<1
	5	-	-	-	-	-	<1	<1	<1	<1
	7	-	-	-	-	-	<1	<1	<1	<1
	9A	-	-	-	-	-	<1	1.3	1.1	<1
	9B	-	-	-	-	-	<1	<1	7.0	<1
	13	-	-	-	-	-	<1	2.3	3.1	4.2
	14	-	-	-	-	-	3.6	-	-	-
	15	-	-	-	-	-	<1	10.3	7.2	18.7
	17	-	-	-	-	-	<1	13.3	-	14.0
	18	-	-	-	-	-	<1	6.5	<1	1.4
	19	-	-	-	-	-	2.4	8.1	8.9	7.9
Overall mean		<1	5.1	2.0	1.5	1.0	1.2	3.6	3.1	3.7
Total number of estimates		4	7	13	12	15	31	26	25	26

TABLE 10. Calculated densities of Atlantic salmon large parr, as determined by electro-seining in the Miramichi River system, 1969-77; sampling sites on Southwest Miramichi streams.

Stream	Site number	Large-parr density per 100 yd ² (83.6 m ²)								
		1969	1970	1971	1972	1973	1974	1975	1976	1977
Dungarvon River	1	-	-	-	-	-	<1	2.6	-	3.1
	2	-	-	-	-	-	<1	<1	<1	<1
	3	-	-	-	-	-	<1	<1	<1	<1
Barnaby River	1	<1	-	<1	2.2	<1	3.9	<1	<1	<1
	2	<1	-	<1	3.4	<1	9.9	3.4	2.4	3.1
Renous River	1	-	4.0	<1	-	<1	-	-	-	-
	2	-	6.6	2.6	1.5	<1	<1	1.9	<1	<1
	3	-	1.2	<1	<1	<1	<1	<1	<1	<1
	4	-	3.8	-	-	-	-	-	-	-
	5	-	1.1	<1	<1	<1	<1	<1	<1	1.6
	6	-	-	<1	-	<1	<1	<1	-	-
	7	-	-	-	<1	<1	<1	<1	<1	1.4
	8	-	-	-	-	1.5	<1	1.5	1.2	5.5
Main Southwest Miramichi River	7	-	1.0	<1	<1	<1	<1	<1	2.6	5.0
	4	-	3.2	<1	<1	1.7	10.5	1.0	-	2.0
	10	-	<1	<1	<1	<1	<1	<1	<1	-
	14	-	1.9	<1	-	<1	<1	<1	<1	<1
	11	-	<1	<1	<1	<1	<1	<1	<1	<1
	6	-	2.8	<1	<1	<1	<1	2.5	-	<1
	5	-	3.4	4.0	<1	<1	<1	<1	<1	<1
	13	-	8.2	3.5	6.6	<1	<1	<1	1.5	<1
	1	-	1.5	<1	1.9	<1	<1	7.6	-	1.3
	2	-	8.9	2.4	2.0	<1	1.7	7.4	<1	<1
	3	-	<1	<1	<1	<1	<1	2.0	-	-
9	-	2.3	1.9	1.6	<1	<1	3.2	<1	<1	
12	-	<1	<1	<1	<1	<1	<1	<1	<1	
8	-	2.3	<1	1.7	1.1	<1	<1	<1	<1	
Bartholomew River	1	5.1	<1	<1	<1	<1	<1	-	-	-
	2	2.5	<1	<1	<1	<1	2.7	-	-	-
	3	-	2.5	-	-	-	-	-	-	-
	4	-	-	<1	<1	<1	<1	-	-	-
	6	-	-	-	-	-	<1	-	-	-
Morse Brook	1	-	15.3	1.8	2.0	2.6	8.9	3.8	6.7	8.6
	2	-	<1	<1	<1	<1	<1	<1	<1	-
Cains River	3	-	-	-	16.2	<1	<1	<1	<1	<1
	4	1.2	-	<1	<1	<1	<1	1.1	<1	<1
	6	5.3	-	<1	1.4	<1	<1	7.6	<1	<1
	7	4.8	-	<1	-	-	-	-	-	-
	8	-	-	<1	3.9	<1	6.4	1.6	7.6	3.5
Big Hole Brook	1	-	7.6	5.8	<1	<1	2.1	8.2	2.0	3.7
	2	-	5.1	<1	<1	<1	<1	<1	<1	<1
	3	-	<1	<1	<1	<1	<1	1.9	2.2	<1
Betts Mill Brook	1	-	10.2	1.3	1.1	3.3	21.0	1.1	3.4	1.4
	2	-	<1	<1	3.3	<1	1.8	1.2	1.6	1.8
Burntland Brook	1	-	-	4.2	4.3	<1	8.1	5.6	18.1	14.6
	2	-	-	6.7	5.0	<1	3.2	8.1	-	2.4
Taxis River	1	-	-	-	1.1	4.2	1.2	2.1	6.5	3.9
	2	-	-	-	3.7	37.2	<1	2.6	9.9	5.1
	3	-	-	-	<1	4.7	1.1	7.7	8.9	6.5
MacBean Brook	1	-	12.0	6.8	<1	4.0	3.2	8.7	5.7	14.7
	2	-	16.3	5.9	1.3	4.4	<1	10.5	13.9	9.2
Rocky Brook	1	-	12.8	12.7	13.2	1.9	6.8	30.6	-	28.7
	2	-	2.3	2.5	7.2	8.7	1.0	<1	5.3	14.1
	3	-	<1	<1	-	-	-	-	-	<1
	4	-	-	1.7	<1	<1	<1	6.6	2.2	6.6
Teague Brook	1	-	7.6	<1	<1	<1	3.7	7.4	3.8	3.1
	2	-	2.4	<1	2.2	2.4	9.7	9.2	4.0	11.4
Overall mean		2.8	4.2	1.8	2.2	2.0	2.2	3.5	2.9	3.7

TABLE 11. Calculated overall mean densities of Atlantic salmon juveniles per 83.6 m² (100 yd²), as determined by electroseining in the Miramichi River system, 1969-77; n = number of estimates.

Year	Fry			Small parr			Large parr		
	n	range	mean	n	range	mean	n	range	mean
1969	14	<1-25.1	5.2	14	<1-42.2	11.6	13	<1-6.2	2.4
1970	50	<1-129.8	10.5	50	<1-14.0	2.7	50	<1-16.3	4.0
1971	73	<1-71.0	12.5	73	<1-45.0	4.6	73	<1-12.5	1.7
1972	72	<1-50.8	4.4	72	<1-38.6	4.0	72	<1-16.2	1.9
1973	80	<1-89.5	14.0	80	<1-22.4	1.6	80	<1-37.2	1.5
1974	98	<1-101.1	18.8	98	<1-53.7	8.3	98	<1-21.0	1.9
1975	89	<1-243.1	26.4	89	<1-217.5	12.2	89	<1-30.6	3.2
1976	80	<1-138.5	18.6	80	<1-68.8	9.8	80	<1-20.1	2.8
1977	86	<1-158.5	28.7	86	<1-49.1	8.3	86	<1-28.7	3.4
Overall	642	<1-243.1	15.4	642	<1-217.5	7.0	641	<1-37.2	2.5



APPENDIX A

BIO-15

RESOURCE DEVELOPMENT BRANCH

A-

ELECTROSEINING DATA

SYSTEM

STATION

RECORDER

DATE

SWEEP # & TIME	1	2	3	4	5	6
	MIN	MIN	MIN	MIN	MIN	MIN
SPECIES						
TOTAL						
SPECIES						
TOTAL						
SPECIES						
TOTAL						
SPECIES						
TOTAL						
SPECIES						
TOTAL						
SPECIES						
TOTAL						
SPECIES						
TOTAL						

THIS SHEET TO BE USED ONLY WHEN CATCH/EFFORT CALCULATIONS WISH TO BE MADE - NOT SUITABLE FOR SCHNABEL METHOD. CALCULATIONS FOUND ON BIO-16--

BIO-15

RESOURCE DEVELOPMENT BRANCH

B-

LENGTHS		WIDTHS		RATE of FLOW	DEPTHS (IN INCHES)											
LEFT BANK	RIGHT BANK	LR. BARRIER	UP. BARRIER		1	2	3	4	AVERAGE	UPPER BARRIER						
AVERAGE		AVERAGE		AVERAGE	LOWER BARRIER						MAXIMUM DEPTH	TOTAL				
x		=		=	<div style="display: flex; align-items: center; justify-content: center;"> → ÷ n = <input style="width: 80px; height: 20px; margin-left: 10px;" type="text"/> IN. </div>						IN.	IN.				
SQ. YARDS																

SKETCH and/or NOTES - pools, %riffle, bottom type, cover, banks.

CREW		MACHINE #	
	PROBE	AIR TEMPERATURE	
	DIP	H ₂ O TEMPERATURE	
		pH	
		SPECIFIC COND.	
		WEATHER	
		BARRIERS USED	
		LOAD	
		VOLTS	AMPS
		1	
		2	
		3	
		4	
5			
6			

REMARKS

APPENDIX B

BIO-16

RESOURCE DEVELOPMENT BRANCH

A-

ELECTROSEINING CALCULATIONS

STREAM

STATION

DATE

SPECIES					
n	UNMARKED CAUGHT U	MARKED IN AREA OR REMOVED M U X	U ²	X ²	UX
1					
2					
3					
4					
5					
6					
(n)	ΣU	ΣX	ΣU ²	ΣX ²	ΣUX
(ΣU) ²	(ΣX) ²		ΣUX		

SPECIES					
n	UNMARKED CAUGHT U	MARKED IN AREA OR REMOVED M U X	U ²	X ²	UX
1					
2					
3					
4					
5					
6					
(n)	ΣU	ΣX	ΣU ²	ΣX ²	ΣUX
(ΣU) ²	(ΣX) ²		ΣUX		

$$A = n \sum UX - \sum U \sum X$$

$$B = n \sum X^2 - (\sum X)^2$$

$$\hat{k} = -A/B$$

$$\hat{kN} = (\sum U + \hat{k} \sum X) / n$$

$$\hat{N} = \hat{kN} / \hat{k} \quad \text{POPULATION ESTIMATE}$$

$$\text{ACTUAL CATCH} = \sum U$$

$$\text{ESTIMATE DENSITY / SQ. YD.}$$

SPECIES					
n	UNMARKED CAUGHT U	MARKED IN AREA OR REMOVED M U = X	U ²	X ²	UX
1					
2					
3					
4					
5					
6					
(n)	ΣU	ΣX	ΣU ²	ΣX ²	ΣUX

SPECIES					
n	UNMARKED CAUGHT U	MARKED IN AREA OR REMOVED M U = X	U ²	X ²	UX
1					
2					
3					
4					
5					
6					
(n)	ΣU	ΣX	ΣU ²	ΣX ²	ΣUX

(ΣU) ²	(ΣX) ²	ΣUΣX
-------------------	-------------------	------

(ΣU) ²	(ΣX) ²	ΣUΣX
-------------------	-------------------	------

$$A = n \Sigma UX - \Sigma U \Sigma X$$

$$B = n \Sigma X^2 - (\Sigma X)^2$$

$$\hat{k} = -A / B$$

$$\hat{kN} = (\Sigma U + \hat{k} \Sigma X) / n$$

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$$\hat{N} = \hat{kN} / \hat{k} \quad \text{POPULATION ESTIMATE}$$

--

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$$\text{ACTUAL CATCH} = \Sigma U$$

--

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$$\text{ESTIMATE DENSITY / SQ. YD.}$$

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THIS SHEET CAN BE USED ONLY WHEN CATCH-EFFORT CALCULATIONS WISH TO BE MADE - NOT SUITABLE FOR SCHNABEL METHOD. BASIC DATA IS FROM BIO-15.

CALCULATOR

NOTES

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