FISHERIES PROGRAM

2009 PROGRAM REVIEW

Miramichi Salmon Association

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JUVENILE ASSESSMENT – ELECTROFISHING

Introduction

The Miramichi Salmon Association (MSA) continued its electro-fishing program in 2009 to assess juvenile Atlantic salmon populations in the headwater areas Miramichi River watershed. The MSA worked co-operatively with the Department of Fisheries and Oceans (DFO) Science Branch on another survey to target sites being monitored on a yearly basis to assess Atlantic salmon on the Miramichi watershed.

The electro-fishing survey targets Atlantic salmon fry and parr in the river. All other fish species captured are recorded and fork lengths are taken. Wild fry (0+) are typically less than 60mm in length in late summer and wild parr (1+, 2+) vary in size by site but are grouped together in length by year class and generally don't exceed 120mm. Fish that are reared at the Miramichi Salmon Conservation Centre and in the MSA Satellite Rearing tanks are marked by the removal of the adipose fin (adipose clipped – AC). In many cases these fish have experienced accelerated growth due to feeding and being reared in optimal water temperatures that are conducive to growth. Generally the fish are larger than wild fish of the same age class.

There is typically a higher abundance of 0+ fish than 1+ or 2+ salmon, with fewer salmon being present in the next subsequent age class due to mortality and predation from year to year. If this trend is not observed, it could be viewed as an indication that fry survival is low and should be investigated. In this report, juveniles are listed as fry and parr, with the parr consisting of 1+ and 2+ age classes.

Sites

MSA/DFO electro-fishing sites are generally 3rd or 4th order streams which are tributaries to major rivers where salmon are historically present and spawn but also include some main river sites. Generally, swift moving water less than 60cm in depth with gravel, rocky substrate characterize juvenile salmon habitat. It is important to note that juveniles do not remain in one place. While adult salmon migrate upstream as far as possible to spawn, juveniles in their first, second or third year do move around quite extensively in search of food, avoiding predation and searching for suitable over-wintering habitat. During the warm summer months, juveniles will generally seek colder water refuge.

The tributary streams are of major focus to the MSA electrofishing as they are considered feeder streams to the major rivers. The selection of a specific stream is made to:

1. Estimate the number of juvenile salmon in the river. Work is currently being conducted collaboratively through the MSA/DFO to estimate the numbers of smolts that are produced from the Southwest Miramichi and the Cains and Dungarvon

tributaries. The estimate developed for parr through electrofishing can give us an indication of the number of smolts that could be expected for the subsequent year. Additionally the fry to parr survival, and parr to smolt survival, can be calculated to aid in determining where bottlenecks to salmon production may be.

2. Assess proper distribution of fall fingerlings. Broodstock are collected from specific rivers and their progeny must return to their native river system. Determining densities allows us to avoid overstocking and target naturally under-stocked streams in each individual river system. In terms of stocking, any site containing more than 100 fry / $100m^2$ is not considered for stocking as it appears to reflect a healthy natural population. Sites with less than 50 fry / $100m^2$ are first considered candidates for fall stocking.

3. Identify problem areas. Evidence of fry indicates evidence of adult salmon present last fall. No fry present could mean that adults were unable to access the spawning grounds. That is, the river or stream may be barricaded in some way (beaver dams) as to limit upstream migration of adults. Not only will these areas be targeted to stock but efforts may be made to identify and remove any impediments to natural spawning.

4. Evaluate the success or failure of past stocking activities by identifying and recording any adipose clipped parr found at the site. In many cases areas which have been stocked in the past couple years will show a presence of adipose clipped parr identifying that area as a successful stocking site.

Methods

Electrofishing is the use of electricity for the capture and control of fish. Electricity is generated by a battery located on the back-pack of the electrofisher. An anode wand (positive) and the cathode tail are placed in the water. The current moving between them produces an electric field that is used to stun and capture fish. When a site has been identified, a crew of three people wearing leak proof waders and rubber gloves enter the site facing upstream. The other crew members collect the fish with dip-nets and a small seine net as they are drawn up to the water surface by the electrical current. The fish are placed in a bucket of water and held until the site is completed.

There are two methods for measuring density in a given area: Catch Per Unit Effort (CPUE) and Removal. The MSA survey uses the CPUE method exclusively. This process is continued back and forth along the stream from bank to bank, until 500 seconds has elapsed on the electro-fisher. The crew then samples the captured fish on shore for length by species. All salmon are checked for the presence of the adipose clip. The fish are then released back into the stream.

The removal method, which is done on the MSA/DFO survey is done by capturing all fish from a given section of stream rather than a timed sample as in the CPUE method. A 200 square meter section of stream is measured off and barricaded with fine nets at the upper and lower ends of the site. This ‘closed site’ is then swept three to four times removing all fish or until an acceptable reduction in fish occurs (usually four sweeps). This produces an actual density for an area and is used to calibrate the formula for the timed CPUE method. All fish are identified to species and lengths and weights are recorded. Substrate type (rocky, gravel, etc.), stream type (riffle, run, etc.), water and air temperature, and site dimensions are all recorded along with a diagram of the site.

Results

Table 1. Predicted abundance of Atlantic salmon fry and parr/100m^2, calculated by CPUE method, from MSA sites located on the Miramichi River. * indicates sites that abundances were derived from the average electrofishing time of all sites and [ac] indicates sites in which adipose clipped parr were found.

			Predicted Densities	
Site Number	Major Tributary	Site	Fry	Parr
212	Cains	Main Cain @ Ford	0.0	1.2
404		McKinley Brook	5.3	3.8
174		Otter Brook	24.3	1.2
346		Cains CN Rail	No Access	No Access
402		Bantalor Brook	0.0	0.0
430	Southwest Miramichi Tributary Brooks	2 & 1/2 Mile Brook	0.0	1.3
431		McLean Brook	28.5	9.6
329		Spider Brook	21.1	6.3
318		Betts Mills Brook @ Fork	89.3	9.7
401		Main Burntland Brook	50.9	23.9
90		Porter Brook 2	20.8	2.5
107		Porter Brook below Longs Bk	17.4	2.5
418		Porter Brook 5	No Access	No Access
579		Big Hole Brook	73.3	60.0
578		Crooked Brook @ Bridge	34.2	22.8
413		Crooked Brook	0.0	17.7
580		Big Hole Brook @ Powerline	91.8	17.3
447	S Br Southwest Miramichi	Foreston Brook	239.9	25.8
297		Upper Elliot	120.4	0.0
282		Big Teague	15.9	8.9
254		Juniper Brook	10.9	3.9
312		Little Teague	21.1	13.9
445		Simpson[ac]	12.2	6.2
297		Upper Elliot	12.0	7.4
465	Sevogle	N Br Sevogle	0.0	6.3
311		Barracks Brook	12.7	7.8
sev 4		Clearwater Brook	108.1	19.1
412		N Br S Br Sevogle	0.0	7.5
39		S Br Sevogle	82.6	3.7
sev 5		S Br Sevogle	47.4	9.7
333	Little South West	County Line Brook[ac]	0.0	7.1
332		Crooked Brook Tuadook[ac]	131.5	13.6
334		Squaw Barren Brook[ac]	0.0	17.2
337		W Br Little Southwest[ac]	19.4	2.5
159	Northwest	Northwest Millstream	1.8	9.2
581		Trout Brook	0.0	3.7
302		S Br Northwest	0.0	0.0

Table 2. Predicted abundance of Atlantic salmon fry and parr per 100m^2, calculated by CPUE method, from DFO sites located on the Miramichi River.

Site #	Watershed	Major Tributary	Site Location	Fry	Parr
43	Northwest	Little Southwest	Little Southwest	12.2	6.3
44	Northwest	Little Southwest	Little Southwest	78.1	136.7
45	Northwest	Little Southwest	Little Southwest	59.2	12.4
46	Northwest	Little Southwest	Little Southwest	20.6	8.7
107	Northwest	Little Southwest	Tuadook River	3.2	1.1
145	Northwest	Little Southwest	North Pole Stream	22.8	37.7
147	Northwest	Little Southwest	Lower North Branch	47.3	21.5
217	Northwest	Little Southwest	LSW Miramichi	36.0	15.0
218	Northwest	Little Southwest	LSW Miramichi River	30.1	15.2
20	Northwest	Northwest	Little River	39.4	19.7
23	Northwest	Northwest	Sutherland Brook	55.8	63.1
30	Northwest	Northwest	Northwest Miramichi	24.3	7.0
31	Northwest	Northwest	Northwest Miramichi	75.9	31.5
33	Northwest	Northwest	Northwest Miramichi	52.1	46.1
34	Northwest	Northwest	Northwest Miramichi	65.7	66.0
35	Northwest	Northwest	S Br Northwest Miramichi	126.9	85.8
113	Northwest	Northwest	Tomogonops River	48.8	18.8
115	Northwest	Northwest	Northwest Miramichi	27.9	32.3
135	Northwest	Northwest	Northwest Millstream	14.8	2.4
215	Northwest	Northwest	Northwest Miramichi	78.4	79.8
216	Northwest	Northwest	Northwest Miramichi	17.0	0.9
38	Northwest	Sevogle	N Br Sevogle	110.1	42.2
39	Northwest	Sevogle	B Br Sevogle	98.5	36.6
40	Northwest	Sevogle	Little Sevogle	8.5	15.7
103	Northwest	Sevogle	Mullin Stream	38.5	21.2
153	Northwest	Sevogle	S Br Sevogle	88.3	27.8
190	Northwest	Sevogle	Sevogle River	32.0	2.6
98	Southwest	Barnaby	Barnaby River	39.9	15.0
131	Southwest	Barnaby	Barnaby River	11.1	2.6
119	Southwest	Bartholomew River	Bartholomew River	45.4	15.1
74	Southwest	Cains River	Sabbies River	43.1	47.1
75	Southwest	Cains River	Cains River	21.6	1.4
77	Southwest	Cains River	Cains River	15.5	10.0
78	Southwest	Cains River	Cains River	46.0	11.0
110	Southwest	Cains River	Muzroll Brook	63.9	20.2
212	Southwest	Cains River	Bantalor Brook	14.3	0.0
213	Southwest	Cains River	Cains River	17.1	3.3
220	Southwest	Cains River	Six Mile Brook	45.0	23.6
55	Southwest	Dungarvon	Dungarvon	47.8	20.6
57	Southwest	Dungarvon	Dungarvon	86.7	19.2
117	Southwest	Dungarvon	Dungarvon River	22.1	29.4
186	Southwest	Dungarvon	Dungarvon River	69.0	18.5
188	Southwest	Dungarvon	Dungarvon River	80.2	53.4
210	Southwest	Dungarvon	Dungarvon River	56.0	49.0
221	Southwest	Dungarvon	Dungarvon River	84.5	8.3
79	Southwest	MSW	Big Hole Brook	81.0	18.1
82	Southwest	MSW	Betts Mill Brook	76.6	26.4

84	Southwest	MSW	Burntland Brook	55.4	40.5
129	Southwest	MSW	McKiel Bk	51.6	35.8
48	Southwest	Renous	Renous River	74.8	16.4
54	Southwest	Renous	N Br Renous	63.6	23.9
116	Southwest	Renous	Renous River	34.5	53.4
214	Southwest	Renous	Renous River	69.6	9.2
92	Southwest	Rocky Brook	Rocky Brook	97.7	32.6
121	Southwest	Clearwater Brook	Clearwater Brook	91.0	17.5
120	Southwest	Burnthill Brook	Burnthill Brook	55.3	44.9
206	Southwest	S Br SW	Elliott Brook	162.1	14.5
65	Southwest	S Br SW	S Br Southwest Miramichi	107.6	2.4
95	Southwest	S Br SW	Teague Brook	38.1	8.7
58	Southwest	Southwest Miramichi	Southwest Miramichi	151.7	21.0
60	Southwest	Southwest Miramichi	Southwest Miramichi	61.1	21.3
61	Southwest	Southwest Miramichi	Southwest Miramichi	8.1	0.0
62	Southwest	Southwest Miramichi	Southwest Miramichi	54.2	6.3
68	Southwest	Southwest Miramichi	Southwest Miramichi	143.3	12.5
69	Southwest	Southwest Miramichi	Southwest Miramichi	23.4	49.1
70	Southwest	Southwest Miramichi	Southwest Miramichi	147.4	29.8
71	Southwest	Southwest Miramichi	Southwest Miramichi	90.8	0.0
200	Southwest	Southwest Miramichi	Southwest Miramichi	38.8	29.0
59	Southwest	Southwest Miramichi	Southwest Miramichi	66.5	18.8
86	Southwest	Taxis	Taxis River	30.4	19.4
88	Southwest	Taxis	Taxis River	27.1	30.9

SMOLT PRODUCTION

Introduction

Over the past three decades, there has been a continuing and recognizable need for conservation efforts to sustain Atlantic salmon stocks in the Miramichi River. Over that time, despite major management actions such as the closing of commercial fisheries in both the Maritimes and Newfoundland, annual returns have fallen below expectations. In very recent years, minimum spawning requirements for Atlantic salmon have just been met in the Miramichi River system.

An accurate estimation of the total smolt population migrating from the Miramichi River is an essential component to understanding and managing the Atlantic salmon in this watershed. Currently, work is being conducted to estimate the population of fry, 1+ and 2+ parr in the watershed using electrofishing; smolt wheels are used to estimate the number of smolts migrating from the Miramichi River; and trap nets are used to estimate an adult population. By having a population estimate for all of the different life stages it allows us to look at trends in the production of salmon between the various life stages and to pin point areas in the life cycle of Atlantic salmon where the most mortality is occurring.

Methods

The method used to obtain the smolt inventory estimates was a mark and recapture concept. On the Cains and Dungarvon Rivers, rotary screw traps (RST) or smolt wheels were used to capture smolts for tagging. The smolt wheel was strung across the river by an overhead cable and floated on the top of the water by two large pontoons. The current forced the partially submerged wheel to rotate. Any fish that entered the trap were guided into the trap's holding box which is located at the back of the smolt wheel. The rotating wheel prevented the fish from swimming out of the trap. All the fish in the live-box were collected and sorted. Each species caught was identified, counted and released, except for salmon smolts, which were measured for fork length and then tagged with streamer research tags. Scale samples were also taken from up to five smolts per day for age analysis. After the smolts were tagged they were moved upstream of the smolt wheel. The percent of tagged smolts that are recaptured at the smolt wheel allow us to estimate the number of smolts moving out of that particular tributary.

A single large trapnet was installed in the estuary of the Southwest Miramichi at Millerton to capture smolts moving from freshwater into the estuary. Tagged smolts captured at the Millerton trap net allow us to get an estimate of the smolts moving out of the Southwest Miramichi. The Millerton trapnet efficiency is calculated by the percentage of these tagged smolts that are recaptured, and this trap efficiency is then extrapolated to estimate the total smolt run from the number of untagged smolts also captured there. This latter facility was fished daily, generally at low tide, and the smolts were sorted from the rest of the species captured. Each day, sub-samples of up to 100 smolts were measured and 20 were sampled in detail for length, weight, sex and age. All smolts captured were counted and checked for missing adipose fin clips and streamer tags.

Results

The Cains smolt wheel operated from May 5 to June 2 and Dungarvon smolt wheel operated from May 6 to June 3, because of high water conditions within the tributaries. The estuary trap net at Millerton fished later, from May 14 to June 9, 2009, also because of high water conditions.

The peak of the smolt run for the Cains River was May 17 and 65 smolts were captured. The peak of the smolt run on the Dungarvon River was May 11 with 750 smolts being captured that day. The peak of the smolt run in 2009 was more than a week earlier than 2008, possibly due to the large amount of rain we received which facilitated the warming of the river and movement of smolts. This year we tagged 557 smolts on the Cains and 2187 smolts on the Dungarvon River and were able to capture approximately 646 smolts in the Cains smolt wheel and 2524 smolts on the Dungarvon smolt wheel over the entire season.

At the Millerton trap, we captured 14,000 smolts, 42,000 smelts and 3500 gaspereau as well as many other species throughout the season. We were able to recapture 43 smolts with streamer tags at the Millerton trap net which were tagged at the Cains, Dungarvon or Rocky Brook smolt wheels upstream. The smolt estimate for 2009 on the Cains River was 51,600 (CI 23,000 to 113,000), which worked out to 1.1 smolts per $100m^2$, about 1/3 of the target for the Miramichi River. The smolt estimate for the Dungarvon for 2009 was 48,700 (CI 40,000 to 59,000), which worked out to be 2.2 smolts per $100m^2$, approximately 2/3 of the Dungarvon target for the Miramichi River. Overall, smolt production on the Cains and Dungarvon Rivers was moderate in 2009. Smolt production on the Southwest Miramichi in 2009 was 1.1 millions smolts (3.1 smolts per $100m^2$). The Southwest Miramichi reached the desired smolt production in 2009 of 3.0 smolts per $100m^2$, which it has in the 4 of the last 5 years (not including 2005 in which there was no estimate as the trap was washed out). In addition, 0.6% of the Cains, 1.5% of the Dungarvon and 0.3% of the Southwest Miramichi smolt runs were comprised of salmon smolts with clipped adipose fins which were stocked by MSA a few years earlier.

The data collected from this project will be published in the Canadian Technical Report of Fisheries and Aquatic Sciences as part of two publications documenting the movements and population of Atlantic salmon smolts from two Southwest Miramichi River tributaries (Cains and Dungarvon) and the Southwest Miramichi. Data from this project is also being used to assess the survival of salmon parr (1-2+) to the smolt stage by comparing electrofishing densities the previous year and to assess the survival to the grilse and 2 sea-winter maiden salmon stage by comparing smolt estimates to the returns of grilse and salmon the following years.

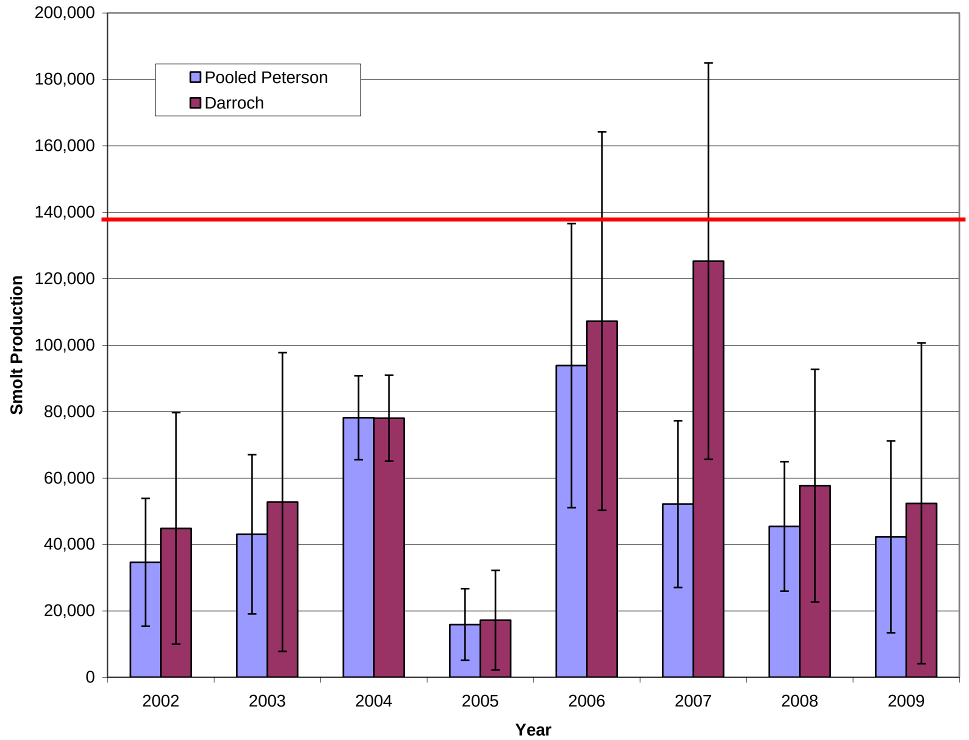
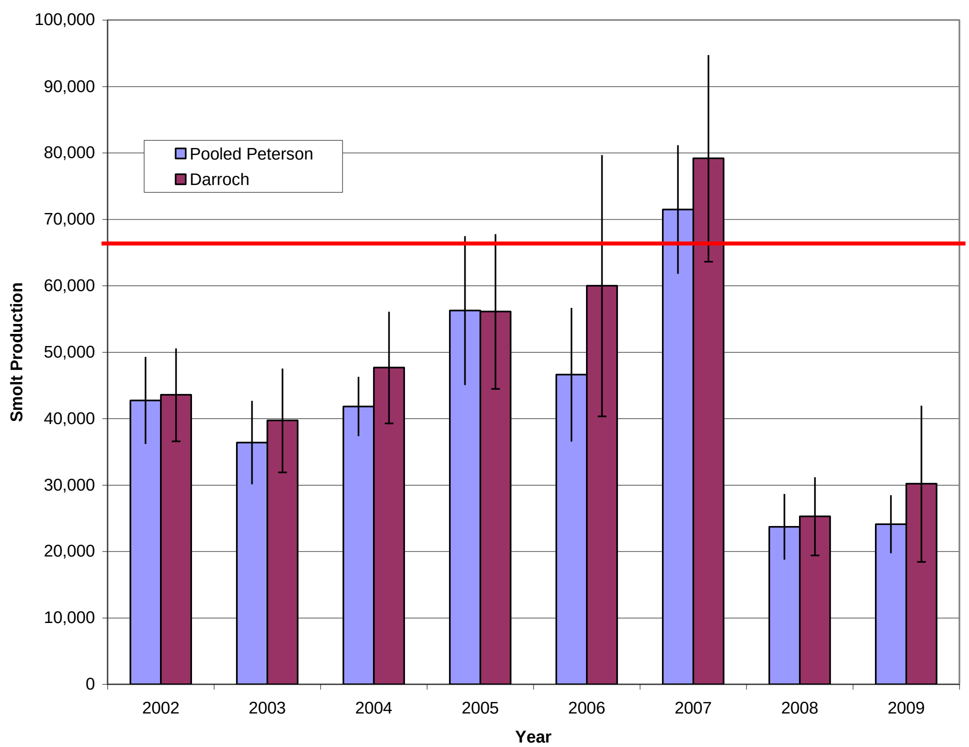


Figure _. Smolt production for the Cains River from 2002-2009. Red line indicates target levels of smolt production of 3.0 smolts per 100m^2.



Adult Assessment

The current adult assessment for Atlantic salmon on the Miramichi River is based on a mark recapture experiment. Typically the assessment is adequate for the Miramichi River as a whole, but when the assessment is broken down into two different rivers, the Northwest and Southwest Miramichi, there is less reliability in the estimates.

Currently the adult assessment for the Southwest Miramichi is done by tagging Atlantic salmon at a trap run by Eel Ground First Nation near the enclosure, and recapturing them at the DFO Millerton trap net upstream. On the Northwest Miramichi Atlantic salmon are tagged at the DFO trapnet at Cassiliss and recaptured at the food fishery traps at Redbank First Nation. The number of fish tagged, the number of fish recaptured and the total number of fish captured are used in an equation to estimate the population. In order to get a relatively accurate estimate of the population a certain number of fish must be recaptured. The problem is that the food fishery traps are not in the entire year and that trap nets must be raised during high water events or may be washed out by high water. This could mean that during periods of high water fish could move past the traps without being tagged or recaptured. In addition, many fish come in on a high tide and start going up one branch of the river, then change their mind and go up the other. For example, a fish may be tagged at Cassilis and then later recaptured at Millerton.

In order to attempt to improve the stock assessment, other methods of recapturing tagged fish were discussed. Seining is a good method because many different tributaries on the Miramichi could be sampled, it would allow fish to be recaptured, as well as capture a number of unmarked fish, which is required in order to achieve the estimate, there would be no exchange of fish moving from one tributary to the next because fish would be recaptured higher in the system, and fish could be recaptured when high water conditions had receded.

Methods:

Fish captured at the DFO adult traps at Cassilis and Millerton, on the Miramichi River, NB, were marked with blue carlin tags and an adipose punch. This punch allowed us to identify any fish that had previously been tagged, if the tag had been removed by an angler. If a fish was adipose clipped then it received a carlin tag and caudal punch to mark it as being tagged in 2008. In days when large amounts of grilse were caught in the trap (typically greater than 30 per day), the first 30 would receive a carlin tag and adipose punch but any additional fish would receive a caudal punch. Fish moving through the Millerton trap received an upper caudal punch and those moving through the Cassilis trap received a lower caudal punch.

Pools were selected all over the watershed based on their ability to hold fish during the seining period and their ease at being seined.   Fish were scared down into the pool and the pool was surrounded by a fine meshed net. Divers worked in deep water and lifted the net over large rocks or when it got caught on debris. The fish were corralled into a given area and sorted. Fish were identified as grilse or salmon, male or female and checked for tags, punches and adipose clips. Other species captured were also identified and counted. All fish were released except those taken for brood stock for the Miramichi Salmon Conservation Centre.

Results:

Seining pools was much easier in 2009 than in 2009, due to the low water conditions we experienced this summer and fall. Water conditions were such that we were able to seine Big Hole Pool, a large pool on the main stem of the Southwest Miramichi, which we have been unable to seine in previous years due to high water conditions. In total we seined 14 pools, 6 on the Northwest Miramichi and 8 on the Southwest Miramichi, with some pools being seined multiple times (Table 1). In total we were able to capture 131 grilse and 99 salmon on the Northwest Miramichi and 230 grilse and 820 salmon on the Southwest Miramichi (Table 1). Included in those numbers we captured 6 marked grilse and 2 salmon on the Northwest Miramichi, and 12 grilse and 23 salmon on the Southwest Miramichi that were tagged and/or punched (Table 2). In 2009 more large salmon were captured more frequently than grilse at all sites except the Little Southwest Miramichi. In addition we captured other species such as white sucker and brook trout.

Table _. Grilse and salmon captured by seine at pools on the Northwest and Southwest Miramichi Rivers.

		Grilse			Salmon		
Branch	Tributary	Male	Female	Total	Male	Female	Total
Northwest	Little Southwest	19	16	35	3	5	8
Northwest	Little Southwest	41	23	64	13	35	48
Northwest	Northwest	2	4	6	1	3	4
Northwest	Northwest	5	2	7	2	6	8
Northwest	Northwest	10	6	16	2	21	23
Northwest	Sevogle	3		3		8	8
Northwest Total		80	51	131	21	78	99
Southwest	Southwest Miramichi	69	5	74	71	482	553
Southwest	Burnthill	8	2	10		1	1
Southwest	Cains	6		6	9	10	19
Southwest	Clearwater	12	1	13	8	74	82
Southwest	Dungarvon	79	30	109	17	126	143
Southwest	Dungarvon	16	2	18	1	21	22
Southwest Total		190	40	230	106	714	820
Miramichi Total		270	91	361	127	792	919

Table _. Numbers of grilse and salmon recaptured by seine at pools on the Northwest and Southwest Miramichi Rivers. Recaptured fish were marked by either a carlin tag and a punch or just an adipose punch indicating tag loss occurred.

		Grilse		**Salmon**	
Branch	**Tributary**	**Tag and Punch**	**Punch**	**Tag and Punch**	**Punch**
Northwest	Little Southwest	4	2	2	
Northwest	Northwest	0	0	0	0
Northwest	Sevogle	0	0	0	0
Southwest	Main Southwest	2	0	15	2

Southwest	Dungarvon	8	1	4	
Southwest	Clearwater				1
Southwest	Cains			1	
Southwest	Juniper	1			
Southwest	Burnthill	0	0	0	0
Southwest	Rocky Brook	0	0	0	0
	Total	**15**	**3**	**22**	**3**