EXPLOITS RIVER SALMON DEVELOPMENT PROGRAM, 1983

by

J. P. Davis and D. Riche

Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

EXPLOITS RIVER SALMON DEVELOPMENT PROGRAM, 1983

by

J. P. Davis and D. Riche

Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

CONTENTS

LIST OF TABLES

LIST OF TABLES (Cont'd)

INTRODUCTION

The Exploits River, located in the central Newfoundland area, is the largest on the island with a drainage area of 11,272 km^2 and an axial length of 237 km. Historically, anadromous Atlantic salmon penetrated the system only as far as Grand Falls. Since 1957, anadromous salmon have been successfully introduced into Great Rattling Brook (a tributary of the lower Exploits) and into the tributaries of the middle Exploits between Grand Falls and Red Indian Lake dam. Annual total production (before exploitation) prior to enhancement was 2,500-3,000 adults; present annual total production is approximately 35,000 adults. The remaining inaccessible tributaries flowing into Red Indian Lake have the potential to produce an additional 65,000 adults annually.

The strategies used by this project are: (1) developing previously unutilized habitat by construction of fishways at impassible falls or through fish traps which can be used as collecting facilities prior to active trucking above the barriers, and (2) colonization of parts of the system previously unused by Atlantic salmon by stocking unfed swim-up fry from incubation boxes and a spawning channel.

As a result of severe winter flooding in 1983, the spawning channel at Noel Paul's Brook was damaged beyond repair. To recoup the lost production of fry, a new serial upwelling incubation box was installed with a capacity to incubate 750,000 eggs.

Projects on the Exploits River for 1983 were mainly extensions of previous years with the exception that no work was carried out at Bishop's Falls due to damage which was resultant of the flood earlier in the year. Consequently, adult returns were monitored at Camp One fishway and Grand Falls collection facility only. As in previous years, broodstock for Noel Paul's were collected at Grand Falls.

A counting fence was erected at Veneer Brook (a small tributary of Noel Paul's Brook) to assess downstream movements of finclipped parr stocked there in early spring.

An angling creel was carried out on the Exploits River to gain further insight into angling pressure as well as to obtain biological data from fish angled.

Stocking of the mid-Exploits and Lloyds River continued; however, stocking was down due to loss of spawning channel.

NOEL PAUL'S BROOK INCUBATION FACILITY

All procedures for the various activities are outlined in the appendices included with this report.

EGG DEPOSITION

The egg deposition for 1982 and subsequent egg-to-fry survival in 1983 are given in Table 1. The egg-to-fry survival figure of 7% for the channel is of interest because, as a result of the scouring that occurred and redirection of part of the flow in the channel, this figure may be indicative of natural survival in flooded parts of the watershed in this year.

FRY COUNT

Preparations for the fry run at Noel Paul's Brook commenced in mid-May with the installation of wolfe traps on the lower end of the incubation boxes and at drop structure #1 (drop structure #2 was destroyed in the flood) in the spawning channel.

The first fry were enumerated from the incubation boxes on May 31; however, these fry had emerged prematurely and premature emergence was noticeable until June 5. The first fry collected from the spawning channel were enumerated on June 1 and these fry had not emerged prematurely. Table 2 gives the daily fry counts for both incubation boxes and the spawning channel for 1983. Fry were numerically and volumetrically counted with handling mortality being less than 1%. Samples of 20 fry/day/trapping site were collected from the incubation boxes for fry quality analysis. Results are summarized in Table 3 and compare favorably with data from 1981 and 1982.

Table 4 gives mean monthly temperatures and dissolved oxygen concentrations in the incubation boxes for Noel Paul's Brook incubation facility for 1983.

INCUBATION BOXES

Following the fry run (< 50 fry/day/section of box), removal of the layers of astroturf from both boxes was completed. Silting in section #2 of both boxes appeared to be heavier than normal in the upper layers (see Table 5). A total of 11,463 and 18,872 dead eggs were found in box #1 and #2 respectively. This is an increase above previous years. This is believed to be a result of extra silt being carried by flood waters earlier in the year.

FRY DISTRIBUTION

Fry were distributed by vehicle and helicopter to predetermined drop sites on tributaries of the mid-Exploits and in Lloyds River. As mentioned earlier, production of fry was down significantly due to the flood with a total production of 822,015. Of these fry, 408,211 and 385,322 went to Lloyds River and the mid-Exploits respectively.

Table 1. Egg-to-fry survivals, Noel Paul's incubation facility, 1983.

Location	Egg deposition	Fry emergence[a]	Survival %
Incubation box #1	511,000	387,372	75.8
Incubation box #2	510,688	363,384	71.2
Riffles 2-5	854,100	60,810	7.0

[a]Includes mortalities for boxes but not all mortalities for riffles.

Table 2. Daily fry counts, Noel Paul's incubation facility, 1983

Date	Incubation box #1	Incubation box #2	Spawning channel	Total	Cumulative total	No. dead (%)
June 1	4,500*	5,500*	156	10,156	10,156	6(0.0006)
2	3,000*	3,000*	200	6,200	16,356	0(0.0)
3	7,190*	6,781*	100	14,071	30,427	219(0.02)
4	10,177*	12,391*	50	22,618	53,045	130(0.01)
5	10,385*	12,755*	300	23,440	76,485	360(0.02)
6	15,495	12,049	600	28,144	104,629	844(0.03)
7	113,607	92,659	-	206,266	310,895	1,822(0.01)
8	112,510	84,984	4,875	202,369	513,264	2,427(0.01)
9	65,716	65,563	12,082	143,361	656,625	612(0.004)
10	24,508	32,478	5,770	62,756	719,381	209(0.003)
11	8,049	15,960	7,608	31,617	750,998	173(0.01)
12	4,608	10,175	5,588	20,371	771,369	94(0.005)
13	2,351	4,098	2,564	9,013	780,382	6(0.0007)
14	2,050	1,708	-	9,402	789,784	67(0.01)
15	0	0	-	0	789,784	-
16	2,035	2,073	7,873	11,981	801,765	51(0.004)
17	880	777	1,300	2,957	804,722	27(0.01)
18	101	108	1,200	1,409	806,131	4(0.003)
19	170	229	1,400	1,156	807,930	4(0.002)
20	40	96	1,000	1,136	809,066	1(0.0009)
21	-	-	-	0	809,066	0(0.0)
22	-	-	2,500	2,500	811,566	
Total	387,372	363,384	60,810	811,566	811,566	7,056(0.01)

* Fry emerged prematurely.

Table 3. Mean ± standard deviation of weights and lengths of daily fry samples from the incubation boxes at Noel Paul's Brook incubation facility, 1983.

	Box #1		Box #2	
Date	Weight (g) $\bar{x}$ ± SD (N)	Length (cm) $\bar{x}$ ± SD (N)	Weight (g) $\bar{x}$ ± SD (N)	Length (cm) $\bar{x}$ ± SD (N)
June 3	0.17 ± 0.02 (60)	2.61 ± 0.09 (60)	0.16 ± 0.02 (60)	2.56 ± 0.08 (60)
June 4	0.18 ± 0.02 (60)	2.71 ± 0.09 (60)	0.17 ± 0.02 (60)	2.60 ± 0.09 (60)
June 5	0.18 ± 0.02 (60)	2.70 ± 0.09 (60)	0.17 ± 0.02 (60)	2.62 ± 0.09 (60)
June 6	0.18 ± 0.02 (60)	2.67 ± 0.08 (60)	0.17 ± 0.03 (60)	2.65 ± 0.11 (60)
June 7	0.18 ± 0.02 (60)	2.66 ± 0.10 (60)	0.17 ± 0.02 (59)	2.65 ± 0.09 (59)
June 8	0.18 ± 0.03 (57)	2.68 ± 0.10 (57)	0.17 ± 0.02 (59)	2.66 ± 0.09 (59)
June 9	0.18 ± 0.02 (60)	2.69 ± 0.08 (60)	0.18 ± 0.02 (55)	2.65 ± 0.09 (55)

Table 3a. Breakdown by box, mean ± standard deviation of weights and lengths of daily fry samples from the incubation boxes at Noel Paul's Brook incubation facility, 1983.

Date	Chamber 1		Chamber 2		Chamber 3	
	Weight (g) $\bar{x}$ ± SD (N)	Length (cm) $\bar{x}$ ± SD (N)	Weight (g) $\bar{x}$ ± SD (N)	Length (cm) $\bar{x}$ ± SD (N)	Weight (g) $\bar{x}$ ± SD (N)	Length (cm) $\bar{x}$ ± SD (N)
			Box 1			
June 3	0.17 ± 0.02 (20)	2.58 ± 0.10 (20)	0.17 ± 0.02 (20)	2.62 ± 0.08 (20)	0.18 ± 0.02 (20)	2.75 ± 0.09 (20)
June 4	0.17 ± 0.02 (20)	2.67 ± 0.11 (20)	0.18 ± 0.02 (20)	2.70 ± 0.09 (20)	0.19 ± 0.02 (20)	2.75 ± 0.07 (20)
June 5	0.17 ± 0.02 (20)	2.66 ± 0.08 (20)	0.18 ± 0.02 (20)	2.74 ± 0.08 (20)	0.18 ± 0.02 (20)	2.69 ± 0.10 (20)
June 6	0.17 ± 0.02 (20)	2.64 ± 0.10 (20)	0.18 ± 0.02 (20)	2.66 ± 0.05 (20)	0.18 ± 0.02 (20)	2.71 ± 0.08 (20)
June 7	0.18 ± 0.01 (20)	2.70 ± 0.09 (20)	0.18 ± 0.02 (20)	2.68 ± 0.07 (20)	0.17 ± 0.03 (20)	2.60 ± 0.15 (20)
June 8	0.18 ± 0.02 (20)	2.66 ± 0.10 (20)	0.17 ± 0.02 (20)	2.65 ± 0.08 (20)	0.19 ± 0.03 (17)	2.72 ± 0.12 (17)
June 9	0.18 ± 0.02 (20)	2.68 ± 0.07 (20)	0.18 ± 0.02 (20)	2.69 ± 0.08 (20)	0.18 ± 0.02 (20)	2.66 ± 0.09 (20)
			Box 2			
June 3	0.17 ± 0.01 (20)	2.57 ± 0.08 (20)	0.16 ± 0.02 (20)	2.55 ± 0.09 (20)	0.16 ± 0.02 (20)	2.56 ± 0.08 (20)
June 4	0.17 ± 0.01 (20)	2.67 ± 0.11 (20)	0.17 ± 0.02 (20)	2.50 ± 0.09 (20)	0.17 ± 0.02 (20)	2.69 ± 0.08 (20)
June 5	0.17 ± 0.01 (20)	2.66 ± 0.10 (20)	0.16 ± 0.02 (20)	2.56 ± 0.11 (20)	0.17 ± 0.02 (20)	2.62 ± 0.07 (20)
June 6	0.17 ± 0.02 (20)	2.66 ± 0.11 (20)	0.18 ± 0.03 (20)	2.68 ± 0.13 (20)	0.17 ± 0.02 (20)	2.62 ± 0.10 (20)
June 7	0.18 ± 0.01 (20)	2.62 ± 0.06 (20)	0.16 ± 0.02 (19)	2.69 ± 0.13 (19)	0.17 ± 0.02 (20)	2.61 ± 0.09 (20)
June 8	0.17 ± 0.01 (20)	2.61 ± 0.10 (20)	0.18 ± 0.02 (19)	2.65 ± 0.09 (19)	0.17 ± 0.02 (17)	2.72 ± 0.09 (17)
June 9	0.10 ± 0.01 (20)	2.70 ± 0.09 (20)	0.16 ± 0.02 (15)	2.58 ± 0.09 (15)	0.17 ± 0.02 (20)	2.65 ± 0.12 (20)

Table 4. Mean ± standard deviation (no. of samples) of weekly temperatures and dissolved oxygen concentrations at Noel Paul's incubation facility, 1982-83.

Date	Air (outside) temperature °C	Water temp. °C in boxes	Dissolved oxygen	
			Box #1	Box #2
Nov 10 - 13	2.50 ± 0.50 (2)	1.00 ± 0.00 (2)	12.90 ± 0.10 (2)	12.70 ± 0.10 (2)
Nov 14 - 20	1.00 ± 0.71 (4)	3.75 ± 0.89 (4)	12.70 ± 0.20 (2)	12.75 ± 0.50 (2)
Nov 21 - 27	4.20 ± 6.40 (5)	4.00 ± 1.00 (4)	12.25 ± 0.15 (2)	12.25 ± 0.25 (2)
Nov 28 - Dec 3	0.25 ± 10.31 (4)	1.30 ± 0.40 (5)	11.94 ± 0.46 (5)	12.02 ± 0.32 (5)
Dec 4 - 10	-10.0 ± 1.63 (3)	0.66 ± 0.48 (3)	12.43 ± 0.17 (3)	12.00 ± 0.16 (3)
Dec 11 - 17	-6.67 ± 9.57 (3)	1.00 ± 0.00 (3)	12.70 ± 0.22 (3)	12.80 ± 0.22 (3)
Dec 18 - 24	1.25 ± 1.92 (4)	1.25 ± 0.77 (4)	12.90 ± 0.52 (4)	12.65 ± 0.38 (4)
Dec 25 - 31	-2.67 ± 5.31 (3)	2.00 ± 0.81 (3)	13.46 ± 0.12 (3)	13.13 ± 0.21 (3)
Jan 1 - 7	-6.50 ± 6.22 (4)	1.00 ± 0.00 (3)	12.9 ± 0.37 (3)	12.96 ± 0.75 (3)
Jan 8 - 14	1.60 ± 7.88 (5)	2.25 ± 1.07 (4)	12.62 ± 0.36 (4)	12.85 ± 0.28 (4)
Jan 15 - 21	-3.43 ± 4.17 (7)	2.00 ± 0.00 (4)	13.27 ± 0.50 (4)	13.25 ± 0.50 (4)
Jan 22 - 28	-4.40 ± 6.37 (5)	1.50 ± 0.00 (5)	13.60 ± 0.20 (5)	13.54 ± 0.91 (5)
Jan 29 - Feb 4	-3.00 ± 2.61 (5)	1.00 ± 0.00 (1)	14.20 ± 0.38 (5)	13.92 ± 0.31 (5)
Feb 5 - 11	-1.80 ± 3.87 (5)	1.13 ± 0.21 (4)	13.18 ± 0.48 (4)	13.33 ± 0.13 (4)
Feb 12 - 18	-10.80 ± 8.35 (5)	1.00 ± 0.00 (5)	13.40 ± 0.17 (5)	13.14 ± 0.16 (5)
Feb 19 - 25	-8.80 ± 5.42 (5)	1.00 ± 0.00 (4)	13.64 ± 0.17 (5)	13.60 ± 0.35 (5)
Feb 26 - Mar 4	-4.25 ± 10.78 (4)	1.00 ± 0.00 (4)	13.68 ± 0.07 (4)	13.48 ± 0.02 (4)
Mar 5 - 11	-3.60 ± 2.94 (5)	1.10 ± 0.20 (5)	13.66 ± 0.08 (5)	13.48 ± 0.07 (5)
Mar 12 - 18	2.00 ± 3.35 (5)	2.30 ± 0.40 (5)	13.60 ± 0.20 (5)	13.40 ± 0.22 (5)
Mar 19 - 25	4.60 ± 3.93 (5)	3.00 ± 0.32 (5)	13.5 ± 0.29 (5)	13.40 ± 0.40 (5)
Mar 26 - Apr 1	2.25 ± 2.59 (4)	4.00 ± 0.71 (3)	12.96 ± 0.49 (3)	12.96 ± 0.31 (3)
Apr 2 - 8	No data for this period			
Apr 9 - 15	No data for this period			
Apr 16 - 22	12.00 ± 3.08 (1)	4.00 ± 0.00 (1)	12.20 ± 0.00 (1)	12.10 ± 0.00 (1)
Apr 23 - 29	12.06 ± 1.62 (5)	-	-	-
Apr 30 - May 6	11.80 ± 0.98 (5)	7.16 ± 1.53 (3)	11.10 ± 0.49 (3)	11.10 ± 0.29 (3)
May 7 - 13	8.00 ± 3.03 (5)	7.60 ± 3.24 (5)	11.58 ± 0.71 (5)	10.90 ± 0.73 (5)
May 14 - 20	9.80 ± 2.23 (5)	8.00 ± 1.41 (5)	12.95 ± 2.11 (5)	10.96 ± 0.55 (5)
May 21 - 27	14.40 ± 5.00 (5)	9.00 ± 1.55 (5)	10.42 ± 0.36 (5)	10.18 ± 0.50 (5)

Table 5. Astroturf box #1, June 23 - 25, 1983.

	Section #1				Section #2				Section #3			
		Dead eggs				Dead eggs				Dead eggs		
Layer	Alive	Top	Bottom	Silt	Alive	Top	Bottom	Silt	Alive	Top	Bottom	Silt
1	2	46	27	Normal	14	189	130	Heavy	16	31	27	Normal
2	-	53	21	"	1	130	67	"	3	34	5	"
3	1	45	33	"	-	101	76	"	-	20	1	"
4	-	61	34	"	-	117	67	"	2	21	18	"
5	-	82	15	"	-	86	62	"	1	59	9	"
6	-	81	28	"	-	122	32	"	-	108	69	"
7	-	63	13	"	-	110	29	"	-	138	34	"
8	-	83	18	"	-	167	71	"	-	105	29	"
9	-	153	42	"	-	332	72	"	-	187	85	"
10	-	251	75	"	-	351	59	Normal	-	93	17	"
11	-	221	60	"	-	84	73	"	-	178	63	"
12	-	262	82	"	-	145	108	"	-	260	109	"
13	-	272	82	"	-	193	75	"	-	164	104	"
14	-	193	44	"	1	167	76	"	-	292	69	"
15	-	178	58	"	-	217	61	"	-	332	80	"
16	-	198	83	"	-	83	58	"	-	300	6	"
17	-	280	62	"	-	61	300	"	-	93	200	"
18	-	212	500*	"	-	-	-	"	-	-	-	"
Total	3	2734	1277		16	2655	1416		22	2415	925	

Combined total box #1 = 11,463.

*Estimated.

Table 5a. Astroturf box #2, June 23 - 25, 1983.

	Section #1				Section #2				Section #3			
		Dead eggs				Dead eggs				Dead eggs		
Layer	Alive	Top	Bottom	Silt	Alive	Top	Bottom	Silt	Alive	Top	Bottom	Silt
1	15	8	8	Normal	-	9	5	Heavy	-	76	18	Heavy
2	4	16	13	"	-	21	22	"	-	54	39	"
3	2	140	46	"	-	58	33	"	1	330	53	"
4	1	109	35	"	-	110	44	"	1	373	35	"
5	-	136	19	"	-	194	100	"	1	241	56	"
6	1	149	52	"	-	219	69	"	2	260	81	"
7	-	228	39	"	-	233	85	"	-	171	41	Normal
8	-	150	83	"	-	133	64	"	-	177	43	"
9	-	178	137	"	-	220	76	"	-	201	148	"
10	-	255	198	"	-	320	88	"	-	500*	188*	"
11	-	326	133	"	-	247	89	"	-	284	163	"
12	-	202	147	"	-	170	129	Normal	-	217	154	"
13	-	178	34	"	-	231	69	"	-	336	118	"
14	-	182	36	"	-	252	51	"	-	276	74	"
15	-	226	46	"	-	276	83	"	-	271	132	"
16	-	230	45	"	-	266	81	"	-	257	146	"
17	-	134	150	"	-	1000*	3000*	"	-	500	500*	"
18	150	66		"	-	-	-	"	-			"
Total	173	2913	1221			3959	4088		5	4524	1989	

Combined total box #2 = 18,872.

*Estimated.

Silt very heavy in middle chamber.

Stocking in the mid-Exploits is carried out on four main tributaries of the main stem: (1) Noel Paul's Brook, (2) Badger Brook, (3) Little Red Indian Brook, and (4) Tom Joe Brook.

Noel Paul's Brook has been divided into five sections for convenience of stocking. Section 1 - outlet of Snowshoe Pond to the inlet of Lake Douglas; Section 2 - outlet of Haven Steady to the inlet of John Paul Steady; Section 3 - outlet of John Paul Steady to the smolt counting facility, 8 km (5 mi) upstream from the mouth of Noel Paul's Brook; Section 4 - tributaries of Noel Paul's Brook; Section 5 - the smolt enumeration facility downstream to the mouth of Noel Paul's Brook. In 1980, Section 6 was added, including John Paul Steady, Shoulder Blade Brook, Lake of the Woods Brook, Haven and Mill Pond steadies.

Badger Brook has been divided into three sections: Section 1 - Rocky Brook; Section 2 - Mary Ann Brook; Section 3 - remaining tributaries (Powerhorn Brook, North Twin Brook, and Rocky Pond Brook). In 1980, Section 4 was added, including the area between Joes Lake and Mary Ann Brook. Table 6 gives the number of fry and distribution sites on the mid-Exploits as well as number of units stocked and density of stocking/unit.

For convenience in relation to stocking, Lloyds River has been divided into three sections: Section 1 - Red Indian Lake to Lloyds Lake (22,070 units); Section 2 - Lloyds Lake to King George IV Lake (11,771 units); and Section 3 - above King George IV Lake (19,840 units). Table 7 details the stocking of the Lloyds system with the number of fry stocked and density of fry per unit.

Table 6. Fry distribution sites on Noel Paul's Brook and its tributaries, 1983.

Distribution point	Date stocked	No. of fry stocked	No. of 100 m^2 units available to be stocked
Section 1	-	0	1,100
Section 2	-	112,876	1,616
Subsection			
3	June 2	6,000	
	June 4	4,000	
	June 22	1,500	
4	June 4	10,000	
5	June 1-3	10,450	
	June 22	1,000	
6	June 4	8,500	
7	June 3	13,851	
8	June 5	12,525	
12	June 19	3,210	
15	June 9	10,565	
16	June 9	10,555	
17	"	10,660	
18	"	10,060	
Section 3		62,903	3,189
Subsection			
21	June 9	10,595	
22	June 9	10,620	
24	"	11,173	
25	"	9,990	
26		9,995	
28	"	10,530	
Section 4		19,787	3,150
Lake of the Woods Brook	June 5	10,135	
19	June 10	4,357	
19A	"	5,295	

Table 6 (cont'd)

Distribution point	Date stocked	No. of fry stocked	No. of 100 m^2 units available to be stocked)
Section 5		57,349	3,463
Subsection			
68	June 6	10,126	
73	June 9	8,759	
74	"	10,360	
77	June 6	8,586	
78	June 9	11,050	
80	June 6	8,468	
Section 6		0	6,747
Grand Total		252,915	18,165

Table 6a. Fry distribution sites on Badger Brook and its tributaries, 1983.

Distribution point	Date stocked	No. of fry stocked	No. of 100 m^2 units available to be stocked
Section 1		14,860	1,159
Subsection			
1	June 17	4,940	
5	"	4,750	
10	"	5,170	
Section 2		18,342	414
Subsection			
15	June 14	4,247	
20	"	3,118	
25	"	3,745	
29	"	3,641	
33	"	3,591	
Section 3		7,770	715
Subsection			
Rocky Pond Brook	June 12	2,886 4,884	
Section 4		12,501	917
Subsection			
1		3,470	
2		3,752	
3		5,279	
Grand Total		53,473	3,205

Table 6b. Fry distribution sites on Little Red Indian Brook, 1983.

Distribution point	Date stocked	No. of fry stocked	No. of 100 m^2 units available to be stocked
Site			
1	June 10	3,386	2,628
3	"	3,759	
7	"	5,770	
9	"	5,260	
13	"	5,550	
16	"	4,137	
18	"	4,970	
21	"	5,305	
24	"	4,955	
28	"	4,398	
Total		47,490	2,628

Table 6c. Fry distribution sites on Tom Joe Brook, 1983.

Distribution point	Date stocked	No. of fry stocked	No. of 100 m^2 units available to be stocked
Site			
1	June 11	4,144	793
4	"	3,837	
7	"	5,150	
10	"	4,096	
12	"	4,887	
16	"	4,350	
23	"	4,980	
Total		31,444	793

Table 7. Fry distribution sites on Lloyds River, 1983.

Distribution point	Date stocked	No. of fry stocked	No. of 100 m^2 units available to be stocked
Section 1	June 7	207,347	22,070
Section 2	-	-	11,771
Section 3	June 8	200,864	19,840
Grand Total		408,211	

BROOD STOCK COLLECTION, HOLDING, AND EGG STRIPPING

During the summer of 1983 brood stock for Noel Paul's Brook incubation facility was obtained from Grand Falls fishway (1399). Eleven hundred and ninety-one fish were sexed, weighed, measured, and scale sampled (Table 8).

Because of loss of the spawning channel during severe flooding this past winter, a new serial upwelling incubation box was installed with a capacity to incubate 750,000 eggs. Egg deposition was confined to the three incubators having a total capacity of 1,750,000 eggs. Astroturf was used in the three boxes as the planting medium. An estimated 615,780, 576,000, and 214,475 eggs, respectively, were planted in incubators 1, 2, and 3 in 1983 (Table 9). Incubation box number 3 was seeded low to test incubation efficiency.

Table 8. Mean length and weight and sex ratio of brood stock, Noel Paul's Brook channel, 1983.

Sex	Length (cm) $\bar{x}$	Weight (g) $\bar{x}$	Number of salmon
Male	53.0	1402.0	242
Female	51.0	1334.0	949
Combined	52.0	1368.0	
Sex ratio	3.9:1 Female:Male		

Table 9. Daily spawning operations statistics, Noel Paul's Brook incubation facility, 1983.

Date	No. of females stripped	No. of eggs				Total
		Box 1	Box 2	Box 3	Other	
Oct 26	113	255,420	-	-	-	255,420
Oct 27	96	197,040	-	-	-	197,040
Oct 28	30	7,320	-	-	48,000[a]	55,320
Oct 29	80	48,000	132,000	-	-	180,000
Oct 31	79	-	180,000	-	-	180,000
Nov 1	174	108,000	264,000	-	-	372,000
Nov 2	26	-	-	49,500	-	49,500
Nov 7	65	-	-	137,375	-	137,375
Nov 9	16	-	-	27,600	-	27,600
Total	679	615,780	576,000	214,475	48,000	1,454,255

[a]Donated to Miquelon, France.

BISHOP'S FALLS FOREBAY KELT AND SMOLT ENUMERATION
BISHOP'S FALLS FISHWAY

Due to damage resultant from flooding, these areas of interest were not in operation in 1983.

CAMP ONE FISHWAY, GREAT RATTLING BROOK

Camp One fishway operated from July 20 - September 14, obtaining a partial count due to high water conditions. In addition, the fishway commenced operations late due to repairs that were a result of flood damage.

The peak of the run, July 20 - 27, saw a count of 1918 fish (1776 grilse; 142 large salmon). The cumulative total for Camp One was 3254 fish (3031 grilse; 223 large salmon). Also enumerated were 14 resident brook trout. No tagged Atlantic salmon were encountered this summer. An attempt was made to check for finclipped (cold-branded fish) fish; however this proved to be fruitless. A total of two mortalities were encountered (fish jumped out of fishway) and six fish were scale sampled.

Table 10 details the daily enumeration activities as well as water temperatures.

Table 10. Daily Atlantic salmon enumeration, Camp One fishway, Great Rattling Brook and water temperatures (°C), 1983.

Date	Grilse (< 61 cm)	Salmon (> 62 cm)	Cumulative total	Water temperature
July				
20	594	49	653(643)	18.0
21	289	25	957	17.5
22	44	1	1002	17.0
23	116	13	1131	20.0
24	140	15	1286	19.0
25	163	8	1457	18.0
26	346	28	1831	18.0
27	84	3	1918	15.0
28	69	-	1987	15.0
29	57	2	2046	15.0
30	157	10	2213	18.0
31	189	17	2419	17.0
August				
1	51	5	2475	16.0
2	41	1	2517	16.0
3	156	9	2682	17.5
4	74	2	2758	17.0
5	10	0	2768	14.0
6	85	13	2866	15.0
7	124	8	2998	17.0
8	Fishway flooded		2998	-
9	Fishway flooded		2998	-
10	Fishway flooded		2998	-
11	Fishway flooded		2998	-
12	"		2998	-
13	"		2998	-
14	"		2998	-
15	"		2998	-
16	"		2998	-
17	"		2998	-
18	22	1	3021	18.0
19	40	2	3063	16.0
20	38	7	3138	15.0
21	29	1	3138	16.0
22	Fishway flooded		3138	-
23	"		3138	-
24	"		3138	-
25	15	-	3153	13.0

Table 10 (cont'd)

Date	Grilse (< 61 cm)	Salmon (> 62 cm)	Cumulative total	Water temperature
August				
26	10	-	3163	14.0
27	7	-	3170	15.0
28	7	-	3177	14.0
29	8	-	3185	14.0
30	7	-	3192	14.0
31	-	-	3192	14.0
September				
1	4	-	3196	14.0
2	17	-	3213	14.0
3	6	1	3220	13.0
4	6	1	3227	14.0
5	3	-	3230	-
6	3	-	3233	14.0
7	3	1	3237	13.0
8	3	-	3240	14.0
9	1	-	3241	14.0
10	4	-	3245	15.0
11	4	-	3249	13.0
12	1	-	3250	13.0
13	1	-	3251	13.0
14	3	-	3254	13.0
Totals	3031	223	3,254	$\bar{x}$ = 15.4

GRAND FALLS COLLECTION FACILITY

The Grand Falls facility operated from July 8 until September 23 in 1983. A total of 2219 fish (2182 grilse and 37 large salmon) were enumerated (Table 11). The peak run of 553 fish occurred from July 31 to August 6. No other fish were enumerated while one green carlin tag was encountered (number unknown). A total of five mortalities were encountered this season. Five fish were also transported to St. John's for research purposes.

Table 11. Daily Atlantic salmon enumeration, Grand Falls collection facility and temperatures (°C), 1983.

Date	Grilse (< 61 cm)	Salmon (> 62 cm)	Cumulative total	Water temperature
July				
8	3	-	3	16.0
9	3	-	6	16.0
10	-	-	6	16.0
11	13	1	20	16.0
12	11	2	33	16.0
13	6	1	40	16.0
14	5	1	46	16.0
15	8	-	54	16.0
16	10	-	64	17.0
17	12	-	76	17.0
18	9	1	86	16.0
19	9	-	95	16.0
20	7	-	102	14.0
21	42	-	144	14.0
22	14	1	159	15.0
23	55	3	217	16.0
24	45	-	262	16.0
25	6	-	268	16.0
26	82	3	353	16.0
27	37	2	392	15.0
28	17	1	410	13.0
29	65	-	475	15.0
30	96	1	572	16.0
31	59	1	632	16.0
August				
1	94	-	726	15.0
2	114	1	841	16.0
3	87	-	928	17.0
4	86	2	1016	16.0
5	49	-	1065	15.0
6	64	-	1129	16.0
7	188	-	1317	17.0
8	11	-	1328	16.0
9	Fishway not operating - High water		1328	16.0
10	"		1328	16.0
11	"		1328	16.0
12	"		1328	15.0
13	"		1328	15.0

Table 11 (cont'd)

Date	Grilse (< 61 cm)	Salmon (> 62 cm)	Cumulative total	Water temperature
August				
14	Fishway not operating - High water		1328	15.0
15	"		1328	15.0
16	"		1328	15.0
17	"		1328	15.0
18	"		1328	15.0
19	"		1328	-
20	"		1328	-
21	"		1328	15.0
22	"		1328	15.0
23	"		1328	15.0
24	9	-	1337	14.0
25	6	-	1343	14.0
26	-	-	1343	14.0
27	-	-	1343	15.0
28	4	-	1347	15.0
29	-	-	1347	14.0
30	29	1	1377	14.0
31	144	-	1521	14.0
September				
1	172	-	1693	-
2	40	-	1733	14.0
3	24	-	1757	-
4	47	-	1804	-
5	-	-	1804	-
6	97	5	1906	14.0
7	66	1	1973	14.0
8	67	3	2043	14.0
9	38	-	2081	13.0
10	16	1	2098	15.0
11	6	-	2104	13.0
12	9	-	2113	13.0
13	9	-	2122	13.0
14	12	2	2136	13.0
15	3	-	2139	15.0
16	No checks		2139	13.0
17			2139	14.0
18			2139	13.0
19	8	1	2148	12.0

Table 11 (cont'd)

Date	Grilse (< 61 cm)	Salmon (> 62 cm)	Cumulative total	Water temperature
September				
20	10	1	2159	12.0
21	19	1	2179	12.0
22	3	-	2182	13.0
23	37	-	2219	14.0
Total	2182	37	2219	$\bar{x}$ = 14.9

VENEER BROOK COUNTING FENCE

A counting fence was erected June 2 at the mouth of Veneer Brook, a small tributary of Noel Paul's Brook. The fence consisted of a downstream V-shaped structure with three lengths (12 m) on the long wing and two lengths (8 m) on the short wing. A modified fyke net with a trap was secured to an open section of the fence located over the main channel. The purpose of this operation was to monitor downstream movements of adipose-clipped Atlantic salmon parr.

The fence operated from June 2 to August 4 (when high water conditions washed it out) with a total of 580 parr, 67 brook trout, 5 smolt, and 22 sticklebacks being enumerated. Downstream movement of parr peaked in the weeks of June 6 - 12 and June 11 - 17 (Table 12).

Table 12. Veneer Brook counting fence, 1983

Date	Water height (m)		Water temp. (°C)		Air temp. (°C)		No. of parr						Average length of parr	
	Range	Ave.	Range	Ave.	Range	Ave.	Total	Clipped	Unclipped	Trout	Smolts	Sticklebacks	Clipped	Unclipped
June 2-5	0.26-0.75	0.54	10-12	11.3	11-15	12.3	3	-	3	2	-	-	-	-
June 6-12	0.4-1.0	0.63	11-17	14.9	11-25	17.1	181	15	166	11	3	8	7.73	7.31
June 13-19	0.28-0.35	0.30	9-19	12.7	9-29	14.7	33	4	29	1	-	1	7.80	7.16
June 20-26	0.18-0.23	0.20	12-22	18.7	9-26	15.2	24	3	21	1	1	3	7.03	8.79
June 27-July 3	0.1-0.17	0.12	11-16	13.4	12-20	15.9	-	-	-	-	-	-	-	-
July 4-10	0.1-0.14	0.12	13-17	16.0	12-20	17.0	-	-	-	-	-	-	-	-
July 11-17	0.45-0.52	0.49	19-22	20.0	20-22	21.0	180	4	176	30	1	5	8.03	7.23
July 18-24	0.55-0.88	0.72	10-16	13.0	11-12	11.5	109	1	108	16	-	3	7.55	7.19
July 25-31	0.42-1.27	0.85	17-17	17	13-18	15.5	38	-	38	-	-	1	-	7.50
August 1-4	0.85-0.98	0.92	17-19	18	17-22	19.5	11	-	11	6	-	1	-	6.41
							580	27	552	67	5	22		

EXPLOITS RIVER ANGLING CREEL

A creel census utilizing the clerk census method was conducted on the lower Exploits from June 21st to August 9th and at Red Indian Lake dam in the middle Exploits from June 20th to August 31st. Within the lower Exploits there were three census locations: 1) main stem - Sir Robert Bond Bridge, 2) depot - Great Rattling Brook, and 3) main stem - Stoney Brook. The latter three locations were chosen because they were identified as the major angling areas. However, as a result of the flood earlier in the year and subsequent changes in the river bottom, angling concentrations were observed in locations previously unfished, consequently coverage was not complete.

The clerks were required to collect data on the number of rod days fished as well as the number of salmon angled; in addition, with the cooperation of the anglers, collect biological information on the angled fish (i.e. length, weight, sex, and scale sample), as well as getting the angler to complete a questionnaire.

The study revealed a total of 822 Atlantic salmon were angled with a mean catch per unit effort of 0.32.

Table 13 details the angling, catch per unit effort, and samples collected at each census location on the lower Exploits. Table 14 details the mean length and weight of sampled fish by census location. These data reveal that there were no significant differences in mean length or weight of fish angled between census locations. Further analysis showed no differences in length of weight between sexes. A sex ratio of 2.8:1.0 was observed favoring the females. Table 15 details the weekly catches by census location as well as water conditions.

The peak catch angled by census location is as follows: Robert Bond Bridge, July 4th - 10th; depot, July 25th - 31st; Stoney Brook, July 18th - 24th (Table 15).

The census at Millertown dam revealed a total of 78 *Salmo salar* angled with 77 being non-anadromous and one anadromous. Table 16 details the age structure and size of the angled resident salmon.

Table 17 details the angling information collected by Resource Management Division (RMD) for the Exploits watershed. The RMD figure of 1353 is 41% higher than the angling creel. Even subtracting the angling after August 9th (when the creel was concluded due to water conditions), their figure is 1337. Given the resources at their disposal in 1983-84, a true picture of the number of salmon angled is likely to be somewhere between 822 and 1353.

Table 13. Number of fish angled, catch per unit effort, and number of biological samples collected for lower Exploits, 1983.

Census location	No. of fish angled	Catch per unit effort	No. of biological samples collected
Sir Robert Bond bridge	313	0.34	166
Depot - Rattling Brook	177	0.34	140
Stoney Brook	332	0.29	309
Total	822	$\bar{x}$ 0.32	615

Table 14. Mean weight and length (± standard deviation) of biological samples collected at various census locations on the lower Exploits, 1983.

Census location	$\bar{x}$ length (mm) (± SD)	$\bar{x}$ weight (g) (± SD)
Sir Robert Bond Bridge	518.2	1652.4
Depot - Rattling Brook	527.7	1618.3
Stoney Brook	527.9	1629.0
Lower Exploits	525.1	1616.5

Table 15. Weekly catches (effort) by census location, 1983.

Week	Sir Robert Bond Bridge	Depot	Stoney Brook	Total
June 21 - 26	5 (39)	-	-	5 (39)
June 27 - July 3	38 (151)	8 (20)	23 (31)	69 (202)
July 4 - 10	92 (229)	17 (84)*	45 (134)	154 (447)
July 11 - 17	76 (206)	27 (72)*	73 (161)	176 (439)
July 18 - 24	78 (175)	52 (174)	103 (294)	233 (643)
July 25 - 31	19 (118)	59 (119)	51 (292)	129 (529)
August	5 (7)+	14 (54)	37 (222)	56 (283)
Total	313 (925)	177 (523)	332 (1134)	822 (2582)

*July 9 - 13: Rattling Brook closed due to low water and high temperatures.

+Effort known to be low.

Table 16. Age-length data for biological samples collected at Millertown dam, 1983.

Sample size	Age	$\bar{x}$ length (cm) (SD)
1	2+	18.0 (0.0)
1	3+	22.0 (0.0)
5	4+	23.0 (3.74)
13	5+	25.9 (5.28)
26	6+	32.3 (4.16)
17	7+	35.9 (5.84)
5	8+	44.5 (12.94)
4	9+	41.1 (4.77)
4	10+	51.3 (5.74)
1	11+	63.0 (0.0)

The single anadromous fish was a grilse with a freshwater age of 4+. The fish was 54.0 cm in length.

Table 17. Detailed angling information collected by Resource Management Division, 1983.

0707790

Exploits River

Observed and total (estimated+observed) angling catch, 1983.

Week end			Water	Rod days		No. grilse		No. salmon		No. fish		C/E		% Grilse	Days		
Da	Mo	Yr	level	Obs.	Tot.	Obs.	Tot.	Obs.	Tot.	Obs.	Tot.	Obs.	Tot.	Tot.	NP	CL	Data
19	06	83	Med	34	34	0	0	0	0	0	0	0.00	0.00	0.00	0	0	6
26	06	83	Med	97	107	10	10	0	0	10	10	0.10	0.09	100.00	0	0	21
03	07	83	Low	943	943	164	164	0	0	164	164	0.17	0.17	100.00	0	0	21
10	07	83	Med	614	718	101	101	0	0	101	101	0.16	0.14	100.00	0	0	21
17	07	83	Med	1311	1311	399	399	0	0	399	399	0.30	0.30	100.00	0	0	21
24	07	83	Med	553	553	160	160	0	0	160	160	0.29	0.29	100.00	0	0	21
31	07	83	Hi	875	935	377	377	0	0	377	377	0.43	0.40	100.00	0	0	21
07	08	83	Hi	262	262	126	126	0	0	126	126	0.48	0.48	100.00	0	0	21
14	08	83	Hi	161	161	7	7	0	0	7	7	0.04	0.04	100.00	0	0	21
21	08	83	Hi	50	50	4	4	0	0	4	4	0.08	0.08	100.00	0	0	21
28	08	83	Hi	5	5	5	5	0	0	5	5	1.00	1.00	100.00	0	0	21
04	09	83		0	0	0	0	0	0	0	0	0.00	0.00	0.00	2	0	1
Total			Med	4905	5079	1353	1353	0	0	1353	1353	0.28	0.27	100.00	2	0	217

APPENDIX 1: PROCEDURE FOR FRY ENUMERATION

Fry will be released from the collection boxes and placed in holding containers for enumeration. This is done by means of a syphon. When the numbers of fry are relatively small (less than 2000), they may be counted numerically. During periods of heavy migration, the volumetric estimate method is to be used. This method is as follows:

- fill a one liter graduated cylinder to the 900 ml mark with water;
- using a small sieve (wire mesh or tea strainer), dip 100 ml of fry from the collection box and place in the cylinder;
- ensure that as much water as possible is removed from the sieve and repeat the process until the level of water and fry reaches the liter mark;
- numerically count fry from every tenth cylinder and multiply the number by 10. This process is continued until all fry are counted;
- while counting of fry is in progress, they are to be separated in numbers suitable for designated distribution sites and held in holding boxes or containers while waiting for distribution;
- in addition, any large amounts of dead fry will be counted numerically or estimated by the volumetric method;
- the results are recorded on the raw data sheet.

APPENDIX 2: PROCEDURE FOR FRY DISTRIBUTION AT NOEL PAUL'S BROOK INCUBATION FACILITY

Following enumeration and separation of fry into required allotments for distribution:

- fry will be distributed by helicopter or in the event of inclement weather, by truck or all-terrain vehicle;
- priority should be given to stocking inaccessible areas first, thus leaving closer accessible areas in the event the helicopter is not ready;
- when using the present fry distribution system with tupperware plastic stocking trays, the maximum number of fry should be 2000 per tray, depending on distance and water temperature;
- watch carefully for symptoms of stress such as gulping for air at the surface, swimming abnormally, and overcrowding;
- if it is necessary to leave fry in containers for extended periods, occasionally remove most of the water and replace with fresh. This will help replenish the oxygen supply and aid in controlling water temperature;
- fry will be liberated at one-quarter mile intervals at predetermined drop sites;
- disperse fry evenly over the entire width of the river to avoid large concentrations. Keep bucket partially submerged while releasing;
- plot the location and number released on a map and record in the logbook;
- note any problems or mortalities in the logbook and notify the technician immediately.

APPENDIX 3: PROCEDURE FOR REMOVING ASTROTURF FROM UPWELLING INCUBATION BOXES AT NOEL PAUL'S BROOK INCUBATION FACILITY

- Close off water supply to box.

- Remove each layer of astroturf individually, being careful not to dislodge any eggs or fry. This is accomplished by lifting the four corners at the same time and preventing a sag in the centre.

- Remove very carefully any coarse gravel present on the astroturf. Normally a shovelful is present to prevent it from floating.

- Divide the layer into smaller sections for easier counting.

- Count and record the numbers and location of dead eggs, dead fry, live fry, silt conditions, and anything that is relevant.

- Turn the astroturf over and record anything attached to the reverse side.

- Occasionally turn water supply on in the event live fry are present.

APPENDIX 4: PROCEDURE FOR ALLOCATION OF SPAWNERS AT NOEL PAUL'S BROOK INCUBATION FACILITY

During September, salmon are allocated at a ratio of three females to one male. The procedure to be followed is listed:

- holding pool can be divided to hold males and females separately;

- fish are seined from the holding pool, sexed, weighed, measured, and scale sampled. Sexing is done by external characteristics, example kype for males. Weights are taken to the nearest 10th of a kilogram or 16th of a pound. Fork length is taken to the nearest half centimeter. Scale samples are taken between the lateral line and posterior to the dorsal fin and placed in separate envelopes;

- Double check for any openings through which fish may escape.

APPENDIX 5: PROCEDURE FOR HOLDING AND PREPARATION OF SALMON FOR SPAWNING

- Place sufficient numbers of male and female salmon (ratio 3F:1M) in the holding pool to yield a production of two million eggs for the incubation boxes. Base calculation on 750 eggs/lb of female fish.

- All equipment for stripping fish should be prepared. This involves thorough washing (soap and rinse) of the equipment and includes 24 egg pans, feathers (at least 30), a supply of 10% glacialacetic acid, 10 egg baskets, two holding tubs and four holding boxes, two measuring cups (four-cup size), two graduated cylinders, and pre-cut astroturf. Go through all the steps in stripping fish at this time (practice run).

- Grade the salmon in the holding pool by checking the ripeness of 25 fish.

- This can be accomplished by seining the fish from the pool. No more than five or six salmon should be taken in any one sweep. Pick up and hold each of the fish as outlined in the procedures for handling salmon prior to spawning. Check for ripeness by gently stroking the ventral surface of the fish in a head-to-tail direction -- maintain the fish in a head-up position. The stroke should begin 3-4 in from the vent -- **DO NOT press very hard.** If eggs or sperm are released the fish is ripe. Record whether or not the fish is ripe and place it in a holding box. When 25 fish have been checked, release them back to the pool. Do not put more than 10 fish in any one box.

- If eight of the 25 fish are ripe, begin stripping the following day. If fewer than eight fish are ripe, repeat step #5 every second day thereafter until eight of 25 are ripe.

Note: By following the above procedures, we will be minimizing handling of the fish and hence preventing unnecessary injury.

APPENDIX 6: PROCEDURE FOR SPAWNING OF ATLANTIC SALMON

- All necessary equipment (pans, hand towels, woolen mitts, feathers, etc.) should be cleaned and available immediately before stripping occurs. Pans should be cleaned with warm water and soap, then thoroughly rinsed.

- Ripe fish (nine females and six males) are collected and placed separately into large holding boxes outside the incubation building. No more than six fish should be collected in any one seining operation.

- Three female and two male fish are placed in small holding containers inside incubation building. These fish may be passed up to the spawning operators in the small holding containers.

- A female fish is taken from the container carefully, allowed to relax, and wiped gently on its lower surface with a hand towel. At the same time, the woolen mitt is squeezed of water and placed on the operator's left hand if right handed and vice versa. **Note**: Female fish from every third pan should be accurately weighed prior to stripping.

- The head of the female is wrapped in a hand towel and held firmly under the arm while the tail is held with the woolen mitt. Always maintain the female in a steeply inclined position with its head up, its back towards the operator, and the whole of its underside held over the pan (no more than 6" above the pan). This pan should be placed on a table at a suitable height for the operator. This position above allows the eggs to flow freely and prevents rupturing of the ovarian wall. Do not squeeze the fish at any time, particularly around the gills and pectoral fin area.

- The hand without the mitt presses the abdomen with the thumb and index finger a few inches from the vent and moves along towards the vent. These eggs are the ripest and most easily stripped. The hand moves progressively towards the head to strip eggs from farther up in the body cavity:

  - the eggs should be stripped along the sloping side of the pan, being careful not to blast them against the bottom;
  - do not press forward of the pelvic fins as this may damage internal organs;
  - in stripping the last eggs from the fish, care must be taken not to exert too much pressure or blood may mix with the eggs.

- If the fish is at the proper 'ripeness', eggs should flow continuously under a slight pressure from the fingers from the start to finish of the operation.

APPENDIX 6 (cont'd)

- When one female is finished, a ripe male fish is stripped into the pan and the milt and eggs mixed with a feather. A second female is stripped into the same pan, then a portion of milt from the second male is added, and the eggs and milt mixed with a feather. A third female is stripped and more milt is added from one or both of the two males. Mixing is again performed and then a volume of water equal to that of the eggs is added to the pan. Mixing is done quickly and carefully three or four more times with the feather and the pan is set aside for 5-10 min.

- Males are stripped in a similar manner to that of stripping females, making sure that the underside of the fish has been carefully wiped to prevent water from mixing with the milt. The underside of the fish must be turned downwards and the sides pressed, whereas with the female the abdomen is pressed.

- After the 5-10 min fertilization period above, the eggs are rinsed repeatedly to remove excess milt, bad eggs, empty shells, and other impurities which may cause fungus problems. The pan is then covered and set aside for two to three hours to allow the eggs to water harden.

  Note: Care must be taken to protect the eggs from exposure to direct rays of the sun as direct sunlight is lethal to fresh (green) eggs.

- After each fish is spawned, they are dipped into a 3% salt solution to prevent fungal growth -- this solution is maintained outside the shelter. Be very careful not to have salt come in contact with the eggs or sperm, i.e. rinse your mitts in fresh water before returning for more spawning.

- Spent fish are released gently into the main stream of the river.

PRECAUTIONS:

- Treat the fish gently -- they might come back to spawn again next year.

- Allow no water to drip into the fertilization pans.

- Keep the spawning operation out of direct sunlight.

- Mix the eggs and sperm completely with the feather but be careful not to damage them.

- Do not squeeze the fish or hold them by the tail (in tail-up position).

Note: If fish are not ripe, place them in enclosure above the incubation box -- maintain them there by having a fence above the boxes.

APPENDIX 7: PROCEDURES FOR PLANTING OF EGGS IN INCUBATION BOXES

PREPARATION:

- Ensure that incubation boxes and astroturf are scrubbed clean and free of slime and other foreign material (sawdust, etc.).

- Place 7.5 cm of coarse washed gravel (2.5-5.0 cm) on slotted false bottom, followed by 7.5 cm of washed pea gravel (0.6-0.9 cm).

- Flush the boxes several times by turning the valves on an off, hence removing any silt from the gravel.

- Before planting, flow of water through the boxes should be at a minimum.

- Ensure that astroturf is cut to desired dimensions (0.9 m x 1.5 m) and ½ inch diameter holes are punched out. Holes should be equally spaced at intervals (18/row) with rows 7.6 cm apart. Every piece of astroturf placed in the box should be put at 180° to the previous one.

EGG COUNTING:

Note: Remove any noticeable dead eggs with a pipette and squeeze bulb.

- Calculate an egg count (number of eggs/100 ml) for every third pan of eggs. Do so by filling a one liter graduated cylinder to the 900 ml mark with water and add enough eggs (using a strainer) to bring the mark to 1000 ml.

- Count the individual eggs in the cylinder and express your answer as number of eggs/100 ml.

Note: When pouring eggs into cylinder, have it standing in a pan of water to prevent loss of eggs which may spill over.

- The number of eggs/100 ml is averaged and used as the value for that day for planting.

EGG PLANTING:

- A layer of astroturf is placed in the bottom of the incubation box.

- Plant 12,000 eggs/layer in each of 14 layers in each of three sections of the box, a total of 504,000 eggs/2 boxes and 860,000 for the box.

- The number of 100 ml units of eggs/layer is calculated as:

APPENDIX 7 (cont'd)

$$\text{number of 100 ml eggs/layer} = \frac{12{,}000 \text{ (number of eggs needed/layer)}}{\text{average count of eggs/100 ml}}$$

- Divide the number of eggs needed/layer into two jugs for two men to plant in the layer of the box.

- Spread the eggs evenly over a layer of astroturf from the centre line to the edge -- pour the eggs gently just as the water surface.

- Eggs well distributed should be single, paired, or tripled in the crevices, and seldom with clusters larger than six to eight eggs.

- Fill each compartment of one incubation box at the same time as this will simplify controlling water flow while planting. As each layer of astroturf is filled, gently place a new layer on top and repeat the process. It may be necessary to place a small amount of gravel onto the astroturf to hold it down.

- When each section is filled, a top layer of astroturf is added and held in place with several shovelfuls of gravel, if necessary.

- Flow through the boxes is adjusted to 341 liters/min to the centre mark of the flow meter.

Note: At this time, the eggs are quite sensitive to mechanical shock; DO NOT BANG anything against the boxes.

APPENDIX 8: PROCEDURE FOR OPERATING CAMP ONE FISHWAY

Stop log at the fishway entrance are used to adjust attraction flow. During normal fishway operation water level is adjusted so that water spills over the baffles below the counting trap, approximately 15-30 cm. The counting trap is located in number five pool downstream, and is equipped with an elevated floor. To check the counting trap, the following steps are required:

- Place stop logs at entrance of fishway to reduce attraction flow sufficiently to enumerate salmon in counting trap.
- Remove debris from fishway.
- Drop entrance gate to trap to prevent salmon from moving down fishway.
- Remove steel pins securing elevated floor of counting trap. Lift elevated floor and brace to prevent floor from dropping during salmon enumeration.
- If fish density is too high for accurate count, dipnet fish individually and record. When numbers are reduced for accurate visual count, record number and release upstream, via exit gate. Close exit gate.
- Elevated floor is depressed and secured with steel pins. Trap cover is locked. Entrance gate is raised and blocked.
- Stop logs at fishway exit are removed to regulate correct attraction flow in fishway.

SALMON ENUMERATION:

- Record information in daily journal and follow procedure for daily trap reporting as for Bishop's Falls fishway.
- Record water temperature and water height.
- Observe fish, record numbers counted visually if fish density allows an accurate count.
- Dipnet tagged fish, record number, and release fish in first pool above the counting trap.

APPENDIX 9: PROCEDURE FOR OPERATING GRAND FALLS FISHWAY

- Two valves located at the headpond wall are turned on to provide attraction flow for the fishway. The larger valve provides an attraction flow of 200 cfs to nine diffusers at the mouth of the fishway, while the other provides a flow of 20 cfs to the fishway.

- The fishway is placed in full operation by opening the attraction valve to the brailer and closing the valve, providing flow to the transfer cage. Ideal water flow in the fishway is determined when water height in the brailer compartment covers half the finger trap.

- Because Grand Falls fishway is the broodstock collection site for Noel Paul's incubation facilities and the transfer is undertaken by means of a 4550-liter tank truck, fish are held in the brailer until sufficient numbers make up a load. This usually means holding for two days.

CLEANING OF FACILITY:

- Debris and logs are attracted to trash racks by intake flow and the position of intake entrance. Deflection booms have not been successful here in preventing debris and logs from reaching the trash racks as fluctuations in water flows and currents are not conducive to efficient operation. Cleaning is mainly done manually using pick poles and rakes; however when this is impossible, the racks are removed by a boom truck and cleaned.

SALMON ENUMERATION:

- Information recorded as per Bishop's Falls fishway.

- Attraction flow to fishway turned off by valve located near brailer. Attraction flow to transfer cage turned on, salmon are attracted, and swim unassisted into transfer-holding cage. If fish are not attracted to holding cage, hydraulic hoist of transfer truck is used to lift brailer to correct angle so fish swim into cage. Not totally successful, fish are still dipnetted and placed in cage manually.

- Salmon enumerated visually. Tagged or marked fish are removed by dip net and information recorded.

SALMON TRANSFER:

- Shut down attraction flow in fishway.

- Position transfer truck to utilize boom for loading of transfer cage from fishway and hoisting of brailer if necessary.

APPENDIX 9 (cont'd)

- Turn on attraction flow to holding-transfer cage. Remove gates to cage and fishway.

- Hoist brailer and remove remaining fish manually if not attracted by flow to holding cage.

- Release brailer and hoist transfer cage from fishway and position cage in transfer truck.

- Record water temperature. Secure tank.

- Place transfer cage back in fishway to use for holding fish for next transfer.

- Adjust flows to the fishway for normal operation.