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Status of the Exploits River stock of Atlantic salmon (Salmo salar L.) in 1993

by

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¹La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

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Abstract

The Exploits River has been the site of enhancement activities since 1957 with stocking continuing to occur in 1993. This is an enhancement colonization project (i.e. establishment of anadromous Atlantic salmon stocks in habitat not previously utilized by anadromous salmon) with a predetermined time frame for completion. Results obtained from counts at fishways and angling data provided the basis for determining percent of target egg deposition achieved. The 1993 escapement to the Exploits was 1.7 times that of 1992 and 2.7 times the previous 5 year mean.

Résumé

La rivière Exploits est le siège d'opérations de mise en valeur du poisson depuis 1957, l'empeisonnement s'y étant poursuivi en 1993. Le programme qui y a été entrepris est un programme de colonisation (c.-à-d. d'implantation de stocks de saumon de l'Atlantique anadrome dans un habitat qui n'était pas précédemment utilisé par ce poisson), se déroulant selon un échéancier donné. Les dénombrements effectués aux passes migratoires et les statistiques sur la pêche à la ligne ont permis de déterminer quel pourcentage de la ponte-cible a été atteint. En 1993, les échappées de reproducteurs dans l'Exploits étaient 1,7 fois supérieures à celles de 1992 et 2,7 fois supérieures à la moyenne des cinq années antérieures.

Introduction

The Exploits River is the largest watershed in insular Newfoundland, encompassing a drainage area of 11,272 km² (Porter et al. 1974). The river flows in a northeasterly direction, entering the sea in SFA 4 (Fig. 1). Prior to the inception of enhancement activity (O'Connell and Bourgeois, 1987) less than 10% of watershed area was available to anadromous Atlantic salmon due to the presence of natural and man-made obstructions (Taylor and Bauld, 1973). The Exploits River requires 95.9 million eggs to meet its required target egg deposition (Table 1); however, to date, only 53% of the colonizable habitat within the watershed has been stocked.

The intent of this document is to review the status of the stock in 1993 in relation to the five-year commercial salmon fishery moratorium introduced in 1992.

Background

For details of the stocking conducted in the various sections of the Exploits River, refer to Tables 2-4. With respect to the middle Exploits, 26,612 riverine units (egg requirement 45,040,320) of habitat are not presently producing adults, thus, reducing the egg requirement to 19,131,621 eggs for this section (Note: the target in Table 3 is the total target).

Management measures implemented in 1992, which remained in place for 1993, were as follows:

1. Moratorium on commercial salmon fishing in insular Newfoundland.
2. Moratorium on the northern cod fishery affecting Salmon Fishing Areas (SFAs) 1-9 implemented on July 15, 1992. This measure eliminated by-catch of salmon in cod fishing gear.

Methods

Biological characteristic data, habitat determinations, and target spawning requirements are those determined by Bourgeois and Murray (1992).

Target egg requirement was calculated based on 240 egg/m² and 7 smolts/ha of standing water. Smolt production of 7 smolt/ha was divided by 1.9% to convert this to eggs (O'Connell et al., 1991).

In order to calculate the egg deposition in areas where fry stocking occurred, an estimate of egg-to-fry survival of 20% (Sturge, 1968) was used to back calculate fry to eggs. Sturge (1968) gave a range of 10-30% for egg-to-fry survival and indicated that a figure of 20% appeared to be a reasonable value.

Spawning escapement was calculated by subtracting angling catches from counts at fishways without inclusion of an estimate for poaching and disease.

Spawning surveys were utilized on tributaries of the lower Exploits (Stoney Brook, Little Rattling Brook and Three Brooks) to assist in determining egg depositions. These surveys covered 62%, 45% and 67% of these watersheds, respectively. An adjustment of 20%-40% was applied for human error, depending on the tributary.

Results and Discussion

Table 1 details the accessible rearing area and target egg deposition for the Exploits River. The use of fixed parameters, such as 240 eggs/m² of fluvial habitat and 7 smolts/ha of standing water habitat, has certain limitations (see O'Connell & Dempson, 1991 for discussion on this topic).

Counts at Fishways and Recreational Catches

The count at the Bishop's Falls fishway of 21,946 (21,319 small and 627 large) adults was 1.7 times that of 1992 and 2.7 times that of the previous five year mean. This increase can be attributed to the changes in commercial exploitation of salmon. It should be noted that net marks on fish at the Bishop's Falls facility were not as commonplace as in 1993, thus, suggesting suspected illegal harvest was reduced. Total returns to the Exploits River in 1993 were 22,777 (counts of large and small salmon at Bishop's Falls fishway plus angling catch below the fishway).

Table 5 details the angling statistics for the Exploits watershed.

Egg Deposition and Percent of Target Egg Achieved

Lower Exploits

Table 2 details the number of spawners and subsequent egg deposition and % target egg deposition achieved for Great Rattling Brook and for other section tributaries (combined) of the lower Exploits for the period 1957-1993.

Spawning surveys of tributaries of the lower Exploits, other than Great Rattling Brook, revealed a total of 669, 59, and 564 redds in Stoney Brook, Little Rattling Brook and Three Brooks, respectively, for 1992. The respective redd counts for 1993 are as follows: 344, 162 and 680 (Note: less area was covered in Stoney Brook). Large landlocked salmon are known to inhabit these tributaries and it is likely some of the redds enumerated were theirs. Pratt (1968) showed that, on average, redds counted in such surveys were equivalent to .97-1.25 redds per female, depending on the time that surveys were conducted. Assuming a previously used 1:1 redd:female ratio (Pratt, 1968) and a sex ratio of 2.7:1 (as recorded for 1992 broodstock, based on 1008 observations) in favour of females, then the 1992 survey accounted for 3,666 adults. The findings of this survey are considerably lower than the 5,975 adults assumed to have spawned in the lower Exploits, exclusive of the area above Camp 1 fishway on Great Rattling Brook.

The redd counts for 1993 were adjusted upwards for the percentage of the watershed covered and adjusted for human error. Stoney Brook was adjusted by 40% for human error, due to high water conditions, while Three Brooks and Little Rattling Brook were adjusted upwards by 20%, as in 1992. The adjusted redd counts were 925, 304 and 1889 for Stoney Brook, Little Rattling Brook and Three Brooks, respectively. Using the assumptions of Bourgeois et al. (1993), these 3,118 redds translate into 4,273 adult spawners. These 4,273 adults represent only 45% of the adults that were presumed to have spawned in these tributaries. The authors have difficulty explaining the disappearance of these fish. However, poaching is one possibility.

The escapement to the lower Exploits in 1993 (incorporating results from spawning survey) was 1.2 times that of 1992 escapement and 1.7 times that of the previous 5 year mean.

The returns of virgin fish to Camp 1, that were of freshwater age 3⁺ and 4⁺ are the results of 270 and 896 natural spawners in 1987 and 1988 and 870,979 and 990,614 stocked fry in 1988 and 1989, respectively, and comprised 4,386 adults (see Table 2).

Middle Exploits

The middle Exploits requires a deposition of 64.2 million eggs to meet its total seeding requirement (Table 3); however, it only requires 19.2 million eggs to meet the seeding requirements of the areas stocked.

The middle Exploits received an egg deposition of 14.8 million eggs from natural spawning. This is 77% of its required 19.2 million target (excluding the main stem of the river) and 23% of the total target (including the main stem). With respect to the above-referenced egg depositions, they have to be considered as overestimates

as angling occurs in this section, although no fish were officially reported as being angled in 1993.

The returns to Grand Falls in 1993 are the offspring of 0, 80 and 5 naturally spawning adults in 1986-1988, respectively, plus fry stocking in 1987-1989 (see Table 3).

Upper Exploits

The upper Exploits requires an egg deposition of 15.4 million eggs but only received 6.4% of this target in 1993 (Table 4). With the cessation of stocking in 1991, the future of this area, in terms of its seeding rate, is of great concern.

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Table 1: Rearing area and target egg deposition for sections of the Exploits River.

Exploits River	Riverine Habitat (m ²)	Lacustrine Habitat (ha ²)	Target egg Deposition
Lower	57,552	6,915	16,360,112
Middle	234,873	21,178	64,171,941
main stem	187,668	0	45,040,320
tributaries	47,205	21,178	19,131,621
Upper	55,437	5,665	15,384,617
Total	347,862	33,758	95,916,670

Table 2. Details of egg deposition Lower Exploits(G.R.B. = Great Rattling Brook; Other = Other Tributaries)

Year	No. fry released G. R. B.	No. Spawners G.R.B.	No. Spawners Other	Total Eggs G.R.B.	Total Eggs Other	% Target Egg G.R.B.	% Target Egg Other	% Target Egg Total
1957	0	610	*	103240	*	10	*	*
1958	0	786	*	133027	*	13	*	*
1959	0	329	*	556819	*	5	*	*
1960	0	771	892	130488	150967	12	28	18
1961	0	624	577	105609	976549	10	18	13
1962	0	1212	*	205126	*	20	*	*
1963	0	577	691	976549	116949	9	22	14
1964	0	1886	*	319198	*	31	*	*
1965	0	777	594	131504	100532	13	19	15
1966	0	1412	+ 228	238975	385881	23	7	18
1967	0	1204	829	203772	140304	20	26	22
1968	0	2021	*	342046	*	33	*	*
1969	0	1182	272	200048	460349	19	9	16
1970	0	1222	*	206818	*	20	*	*
1071	0	1163	66	196833	111702	19	2	13
1972	0	+ 729	114	123380	192940	12	4	9
1973	0	*	*	0	*	*	*	*
1974	0	*	2692	0	455610	*	85	*
1975	0	5121	3499	866708	592191	83	110	92
1976	0	2016	1027	341199	173815	33	32	33
1977	0	3576	1390	605223	235251	58	44	53
1978	0	2065	711	349493	120333	33	22	30
1979	0	3102	2465	525001	417191	50	78	60
1980	0	4556	*	771084	*	74	*	*
1981	0	4763	+ 1535	806118	259792	77	48	67
1982	0	2918	2218	493859	375387	47	70	55
1983	0	+ 3252	*	550388	*	53	*	*
1984	0	+ 6178	5696	104526	964025	100	179	127
1985	0	5952	3712	100735	628241	96	117	103
1986	0	2742	3026	561636	512138	54	95	68
1987	195127	230	3236	474416	547680	45	102	65
1988	870979	896	+ 1900	646951	321567	62	60	61
1989	990614	46	2562	321547	433608	31	81	48
1990	627525	11	2313	348317	391466	33	73	47
1991	692911	1086	1993	183801	375547	18	70	35
1992	76480	3762	3666	636703	620455	61	115	79
1993	0	+ 5927	4273	100312	723188	96	134	109

* indicates no data

+ indicates incomplete data (i.e. partial count)

Table 3. Details of egg deposition Middle Exploits.

Year	No. Fry Released	Spawners Released	Natural Egg Deposition	Fry to Egg Equiv.	Total Eggs	%Target Egg Achieved
1967	0	0	0	768600	768600	1.2
1968	153720	0	0	841700	841700	1.3
1969	168340	0	0	1644600	1644600	2.6
1970	328920	0	0	1479730	1479730	2.3
1971	295946	0	0	1612530	1612530	2.5
1972	322506	0	0	2053445	2053445	3.2
1973	410689	0	0	1779000	1779000	2.8
1974	355800	31	88491	1063050	1151541	1.8
1975	212610	650	1855455	6463125	8318580	13.0
1976	1292625	79	225509	6733930	6959439	10.8
1977	1346786	27	77073	6832050	6909123	10.8
1978	1366410	0	0	3628785	3629785	5.7
1979	725757	47	134164	9352470	9486634	14.8
1980	1870494	2246	6411309	4513470	10924779	17.0
1981	902694	2586	7381855	3941270	11323125	17.6
1982	788254	1229	3508236	1926610	5434846	8.5
1983	385322	810	2312182	3960965	6273147	9.8
1984	792193	3750	10704545	2539510	13244055	20.6
1985	507902	2981	8509400	2558670	11068070	17.2
1986	511734	0	0	5333120	5333120	8.3
1987	1066624	80	228364	5243995	5472359	8.5
1988	1048799	5	14273	7854460	7868733	12.3
1989	1570892	0	0	8758425	8758425	13.6
1990	1751685	2	5709	7436240	7441949	11.6
1991	1487248	267	762164	9304990	10067154	15.7
1992	1605761	1441	4113400	8464850	12578250	19.6
1993	1692970	5174	14769418	0	14769418	23.0

Note: Egg target is 64 million (45 for main stem and 19 for tributaries)

Table 4. Details of egg deposition Upper Exploits.

Year	No. Fry Released	Fry to egg	Adults Spawning	Total Eggs	% Target egg Deposition
1975	0	952665	0	952665	6.19
1976	190533	892390	0	892390	5.80
1977	178478	155580	0	155580	1.01
1978	31116	0	0	0	0.00
1979	0	0	0	0	0.00
1980	0	3326500	0	3326500	21.62
1981	665300	4460735	0	4460735	28.99
1982	892147	2041055	0	2041055	13.27
1983	408211	1992570	0	1992570	12.95
1984	398514	4403050	0	4403050	28.62
1985	880610	8189350	0	8189350	53.23
1986	1637870	11078265	0	11078265	72.01
1987	2215653	14895245	0	14895245	96.82
1988	2979049	19275305	0	19275305	125.29
1989	3855061	18345255	0	18345255	119.24
1990	3669051	13471645	0	13471645	87.57
1991	2694329	0	28	47389	0.31
1992	0	0	141	238637	1.6
1993	0	0	585	990089	6.4

Table 5. Angling statistics for Exploits River

Year	Main Stem	Great Rattling	Little Rattling	Stoney Brook	Mid-Brook	Total
1960	460	146		29		635
1961	255	4		4		263
1962	674	86	25	25		810
1963	469	37	10	1		517
1964	1146	171				1317
1965	363	46	4	10		423
1966	578	136	4	-11		729
1967	332	49				381
1968	899					899
1969	492	23				515
1970	373	91				464
1971	492	32				524
1972	399	64				463
1973	424					424
1974	896	238				1134
1975	1563	47		9		1619
1976	1651	222		61		1934
1977	1342	417		93		1852
1978	990	241		249		1480
1979	1431					1431
1980	1417	164		209		1790
1981	1558	303				1861
1982	1519	132		82		1733
1983	527	332		494		1353
1984	1809	398		217		2424
1985	903	560		1004	531	2998
1986	646	478		631	302	2057
1987	467	94		995	379	1935
1988	522	50		608	551	1731
1989	385	16		152	24	577
1990	366	59		454	38	917
1991	414	71		279	281	1045
1992	966	163		227	52	1408
1993	831	258		393	173	1655

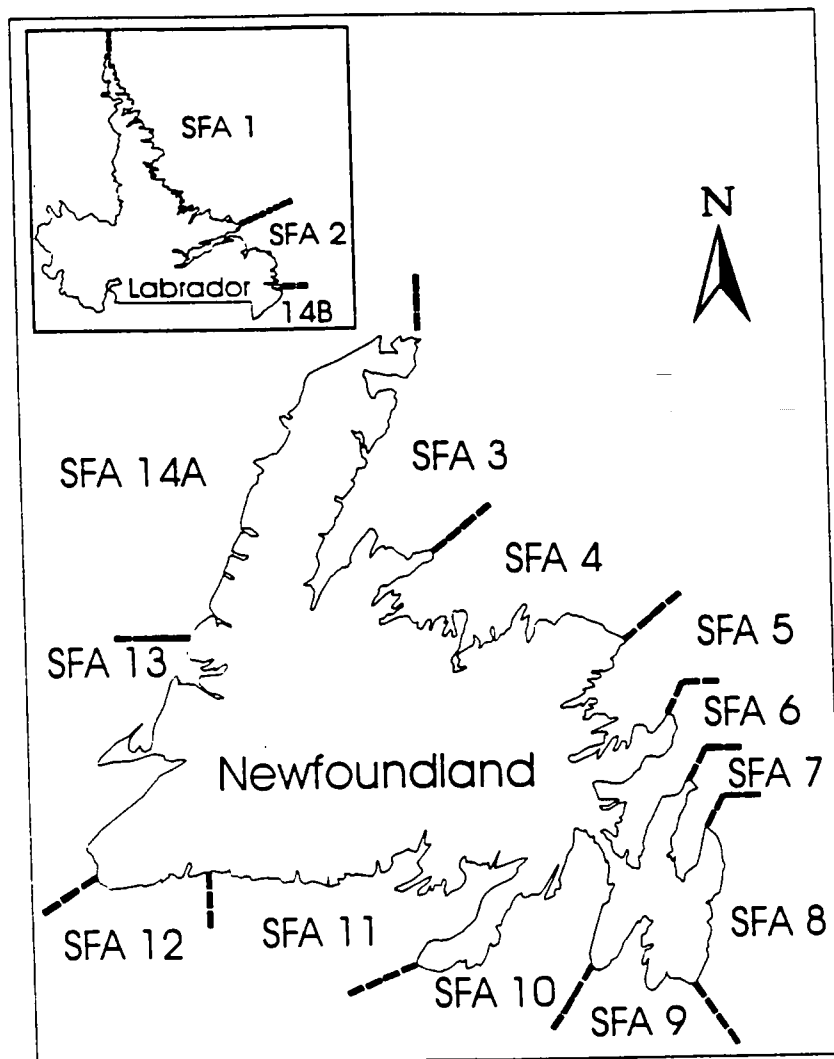


Fig. 1. Map showing the 14 Salmon Fishing Areas of the Newfoundland Region.