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Status of Atlantic Salmon Stocks
of Scotia-Fundy Region, 1987

by

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ABSTRACT

The status of 1SW and MSW salmon stocks in Salmon Fishing Areas (SFA's) 19, 20 and 22 of the Atlantic coast, Nova Scotia and SFA's 22 and 23 of the Bay of Fundy, Nova Scotia and New Brunswick, 1987, varied between SFA's.

Fishway counts at Liscomb and LaHave rivers indicated that 1SW returns increased over 1986 by 60 (SFA 21) to 120% (SFA 20). Percentage returns of hatchery smolts as 1SW fish (1.3 to 3.3%) were the highest of an 11-year record. MSW returns in 1987 were down 10 to 25% from those of 1986.

Sport catches of 1SW fish from Inner Fundy stocks of SFA's 22 and 23 were the lowest of recent record. Counts of Outer Fundy 1SW and MSW stocks of SFA 23 were down by 20% from 1986 and the lowest since 1983.

Forecasts of 1SW (Inner Fundy) and MSW (Outer Fundy and Atlantic Coast) runs in 1988, based on environmental and stock parameters, suggest increased returns across all SFA's.

RESUME

En 1987, l'état des stocks de saumons unibermarins et pluribermarins les zones de pêche du saumon (ZPS) 19, 20 et 22 de la côte Atlantique (Nouvelle-Ecosse) et les ZPS 22 et 23 de la baie de Fundy (Nouvelle-Ecosse et Nouveau-Brunswick) variait d'une zone à une autre.

Des dénombrements effectués aux passes migratoires des rivières Liscomb et LaHave révélaient que les remontées de saumons unibermarins avaient augmenté de 60 % (ZPS 21) à 120 % (ZPS 20) par rapport à 1986. Le pourcentage de remontées de saumonceaux d'élevage devenus unibermarins (de 1,3 à 3,3 %) était le plus élevé de ceux que l'on a connu au cours des onze années pour lesquelles on détient des statistiques. Les retours de saumons pluribermarins ont diminué de 10 à 25 % par rapport à l'année précédente.

Les prises sportives de saumons unibermarins provenant des stocks de l'arrière-baie de Fundy dans les ZPS 22 et 23 étaient les plus faibles de toutes celles qui ont été enregistrées ces dernières années. Le dénombrement des stocks d'unibermarins et de pluribermarins de l'avant-baie de Fundy dans la ZPS 23 révélait une baisse de 20 % par rapport à 1986, le compte étant le plus bas depuis 1983.

Les prévisions de remontées d'unibermarins (arrière-baie de Fundy) et de pluribermarins (avant-baie de Fundy et côte Atlantique), fondées sur des paramètres relatifs aux stocks et à l'environnement, semblent permettre d'escompter un accroissement des remontées dans toutes les ZPS en 1988.

INTRODUCTION

This document is background to the status of Atlantic salmon stocks of the five Salmon Fishing Areas (SFA's) 19 to 23 of Scotia-Fundy Region and, as such, documents sport landings^a (incl. releases), fishway counts and forecasts of returns in 1988.

BACKGROUND

The Atlantic Salmon Management Plan implemented in 1984, and modified in 1985, was continued virtually unchanged through 1986 and 1987. Key elements of the plan have been closure of the commercial fisheries and mandatory release of sport-caught MSW salmon in SFA 19 (Cape Breton East), SFA 20 (Eastern Shore, Nova Scotia), SFA 21 (Southwest NS), SFA 22 (Upper Bay of Fundy, NS) and SFA 23 (South Western, NB)(Fig. 1).

Attrition and voluntary buy-back have reduced the number of commercial salmon licenses from 290 in 1982 to 41 in 1988. Licenses in 1982 and 1987 and mean numbers of fish landed, 1974-84, are as follows:

	SFA					Scotia-Fundy Region
	19	20	21	22	23	
Licenses, 1982	76	41	81	14	78	290
Licenses, 1987	8	3	5	1	24	41
\bar{x} Harvest ^a						
1974-'84, 1SW	360	593	2,117	452	1,634 ^b	5,156
MSW	3,553	1,053	2,036	500	4,274 ^b	11,416

^a Numbers of fish incl. by-catch

^b 1981-1983 with quota

Sport fishery regulations in 1987 remained virtually unchanged from those of 1986. Release of MSW salmon was mandatory; daily and seasonal possession limits were 2 and 10 1SW fish (less than 63 cm), respectively. Open seasons for angling, most rivers (1°) and excepted rivers (2°,3°) may be generalized as follows:

SFA	Opening dates		Closing dates		
	1°	2°	1°	2°	3°
19	Jun 15	Jul 1	Oct 15	Sep 30	
20	Jun 15	May 18	Aug 29	Aug 14	Sep 22
21	Jun 1	May 10	Aug 15	Jul 31	
22	Aug 15		Oct 31		
23	Jun 15	Jun 1	Oct 15	Oct 31	Sep 15

^a Sport catch statistics are final and while preempting those of Adv. Doc. 87/24, do not alter the basic advice.

However, a dry summer, unusually low river discharges (Table 1) and resultant Closed Time Variation Orders restricted successful fishing to pre-July and post-August periods.

METHODS

Sport fishery data for SFA's 19-22 (Nova Scotia) in 1987 are the result of an analysis of license stubs returned by Nova Scotia Salmon Fishing License holders. Landings in SFA 23 (South Western NB), 1987, are based on the sum of river estimates by individual fishery officers (DF0) and biologists (DNRE).

Recreational landings, 1974-1986, for all SFA's of Scotia-Fundy Region appear in the "Redbook" series (DF0, Halifax) and O'Neil et al. (1985; 1986; 1987). Sport landings for SFA's 19-22, 1974-1982, were adjusted upwards to a Nova Scotia license stub equivalency (1983-1986) based on a DF0:license stub comparison in 1983 because DF0-derived catches for that earlier period are felt to be underestimated.

Monitoring of salmon at trapping facilities in Scotia-Fundy Region over a significant time frame is restricted to four facilities: Liscomb River (SFA 20), LaHave and Tuskent rivers (SFA 21), and Saint John River (SFA 23). Each river currently has annually variable removals by the sport and, in the case of the Saint John, Indian food fisheries, and each facility passes salmon of both hatchery and wild origins (Tuskent fish are mainly hatchery origin). Only data for wild fish are relevant as indices of general stock abundance. Hatchery returns, resultant of smolts stocked at or above each facility were deemed useful, however, as an index of annually variable marine survival.

Forecasts of wild MSW returns for 1988 are possible from regressions of wild MSW counts on wild 1SW counts of the same smolt class at the Liscomb (SFA 20) and LaHave (SFA 21) facilities. The entire MSW run destined for Mactaquac, Saint John River (SFA 23), was similarly forecasted from reconstructed runs of wild 1SW and MSW salmon destined for Mactaquac (Marshall MS 1988).

Forecasts of maiden 1SW fish to the Stewiacke River sport fishery (SFA 22) were afforded by a regression of sport-caught recruit/spawner ratio on July to October precipitation at Stewiacke in the year in which recruits were mostly age 1+ parr (Amiro MS 1987). Sport catch of 1SW fish on the Big Salmon River, N.B., (SFA 23) was forecasted by the regression of sport-caught 1SW fish on September discharges in the Point Wolfe River in the year in which recruits were mostly age 1+ parr and July sea-surface temperatures at St. Andrews in the year in which recruits were smolts (Amiro MS 1987). Wild 1SW returns destined for Mactaquac (SFA 23) were forecasted from a regression of 1SW returns on egg depositions from which they originated (Marshall MS 1988).

RESULTS/DISCUSSION

SFA 19 (Cape Breton East)

Some 19 salmon-producing rivers of SFA 19 yielded an estimated 890 1SW fish to the 1987 sport fishery (Table 2). This estimate is 10% more than in 1986 but similar to the mean of the previous three years of the Salmon Management Plan. MSW releases in 1987 were estimated at 1,390 fish.

SFA 20 (Eastern Shore, NS)

The 19 principal salmon rivers of SFA 20 yielded an estimated 1,773 1SW fish to the sport fishery -- down 22% from 1986 and 19% from the 1984-86 mean (Table 2). Count of wild 1SW fish at the Liscomb fishway (Table 3), although admittedly a building stock, was the highest of nine years of records and double that of 1986. The return rate of hatchery 1SW fish to Liscomb was also the highest on record (Table 4). Hence, the catch of 1SW fish in the sport fishery in 1987 was likely significantly impacted by low summer discharges (Table 1) and Closed Time Variation Orders and underestimates the abundance of 1SW fish relative to abundance in years of more-normal river discharge.

Releases of MSW fish in the sport fishery of SFA 20 (Table 2) were only about 40 percent of those in 1985-86. The count of wild MSW fish at Liscomb was down approximately 25% from both the 1986 return and the value forecast for 1987.

Based on a regression of counts of wild MSW fish on wild 1SW fish at Liscomb ($Y = 0.15 X - 7.37$; $r = 0.88$; $p = 0.01$; Fig. 2) the forecast of MSW returns in 1988 will be 235 fish -- double the best ever returns in 1985 (Table 3).

SFA 21 (Southwest NS)

This SFA encompasses only about 8 salmon-producing rivers but typically leads Nova Scotia areas in yield to the sport fisheries. The estimated sport catch of 4,395 1SW fish in 1987 is the highest on record - some 40% higher than 1986 and 65% higher than the 1984-86 mean. Water levels in 1987 (Table 1) were apparently sufficient for angling through the primary period of June and early July. The count of 1SW fish at Morgan Falls was 2,529 fish (Table 3) -- also 60% higher than 1986 and some 50% higher than the previous 3-year mean. Return rates for hatchery 1SW fish to both the LaHave and Tusket in 1987 were also the highest of record (Table 4).

Release of MSW fish in the sport fishery of SFA 21 (Table 2) were about 50% of those in 1985-86. The count of wild MSW fish at Morgan Falls was 532 fish -- 10% less than the number in 1986 and about the same as the mean for the previous three years. The number, however, exceeded the 1987 forecast of 416 fish by 29% - attributable, perhaps, to the unprecedented high return rate noted for hatchery MSW fish (Table 4).

Based on a count of 2,529 wild 1SW fish at Morgan Falls in 1987, the forecast wild MSW return to Morgan Falls in 1988 is $700 + 162$ (95% C.L.) fish ($Y = 11.35 + 0.27X$; $r = 0.89$; $p = 0.001$; Fig. 2) -- 10% higher than the previous high in 1985.

SFA 22 (Upper Bay of Fundy, NS)

SFA 22 comprises some 20 salmon-producing rivers. Most rivers produce 1SW fish (many of which return as repeat spawners) of limited marine migration. Initial sport catch data for 1SW fish indicate that only about 255 1SW fish were retained -- 30% of the number angled in 1986 (which was also a low year) and the lowest since 1980 (Table 2). Virtually all rivers are late-run and should have contributed to September-October angling when water levels had rebounded from summer lows (Table 1).

Low 1SW catches in Inner Fundy rivers were not unexpected. Amiro (MS 1987) had forecast an unprecedented low sport catch of 218 1SW fish for the Stewiacke River (227 license-stub equivalents). The estimated catch was however only 114 fish (license stubs). The equation $\ln R_s/S = 2.34X - 11.52$ (Fig. 4) which also correctly forecast reduced yields from the Stewiacke in 1986, predicts that the Stewiacke sport catch in 1988 will be 514 1SW fish. This value is still below a 1970-82 (DFO data) mean value of 623 ± 364 1SW fish.

SFA 23 (South Western NB)

Rivers of SFA 23 may be classified as either the 7 or 8 small Inner Fundy rivers with 1SW salmon stocks like those of SFA 22 or the 7 or 8 larger Outer Fundy rivers, including the Saint John River which produce maiden 1SW and MSW stocks.

Inner Fundy rivers only yielded an estimated 38 1SW fish to the sport fishery. Only 31 1SW fish are estimated to have been caught in the Big Salmon River -- perhaps in part because of low summer water levels. However, fall observation on the Big Salmon (Pettigrew pers. comm.) and Pointe Wolfe (Granger pers. comm.) rivers support an argument for extremely low 1SW returns in 1987.

A sport catch of 69 1SW fish had been forecast by Amiro (MS 1987) for the Big Salmon River, 1987. The same predictor, i.e., $Y = 180.0 X_1 - 134.1 X_2 + 1905.1$, where X_1 is \ln September Point Wolfe discharge (Fig. 5) and X_2 is the July sea surface temperature at St. Andrews (Fig. 6), estimates an improved sport catch of 398 1SW salmon in 1988. This value approximates the 1970-82 mean of 370 ± 253 1SW fish.

Outer Fundy stocks are largely represented by those of the Saint John River. Despite low summer discharges, a 1SW sport catch of 3,870 fish approached total landings of SFA 23, 1986. Wild 1SW counts at Mactaquac in 1987 were down by 20% from 1986 (Table 3). However, total reconstructed estimated returns destined for Mactaquac in 1987 (Marshall MS 1988) were 20% over the forecast. 1SW fish of hatchery origin experienced a 1.57% return rate, the highest since 1980, (Table 4).

A count of 3,088 wild MSW fish at Mactaquac in 1987 was down nearly 20% from 1986 (Table 3). Estimates of MSW fish destined for Mactaquac (4,352) were only 52% of the 1987 forecast (Marshall MS 1988). Spawning requirements above Mactaquac are estimated at 4,400 MSW fish.

Forecasts of wild 1SW and MSW fish returning to the Saint John and destined for Mactaquac in 1988 were derived from the respective equations $\ln 1SW = 6.523 + 0.407 \ln X$ ($r = 0.70$; $p = 0.012$) where X is the adjusted number of eggs five years previous (Fig. 7) and $\ln MSW = 5,026 + 0.433 \ln X$ ($r = 0.63$; $p = 0.007$) where X is wild 1SW fish one year previous (Fig. 8). Forecasts are for 6,054 wild 1SW fish and 6,983 MSW destined for Mactaquac in 1988. These values exceed the previous 18-year means by 20% and 12% respectively and represent (without removals) a surplus to spawning escapement.

SYNOPSIS

Indications are that 1SW returns to the Atlantic coast of Nova Scotia (SFA's 19, 20, 21) in 1987 increased over 1986 by 60 (SFA 21) to 120% (SFA 20). This windfall "recruitment" appears to be more a function of good marine survival than past increases in adult escapement (stock). MSW returns to these SFA's were, in general, down 10-25% from those of 1986, but were within +30% of forecast returns for 1987. Forecasts of MSW returns in 1988 are among the highest in recent data.

In contrast, indications are that 1SW returns to Inner Fundy rivers (SFA's 22, 23) were, for a second consecutive year, among the lowest of recent record. Forecasts of 1SW sport catches in 1988 suggest that stocks will improve but will only approach long-term average values.

The 1SW count of the Saint John River (SFA 23; Outer Fundy) was down nearly 20% from that of 1986 but the reconstructed run-size was roughly 20% above the forecast value. The MSW count was also down from 1986 by 20% and the reconstructed run-size was only about 52% of the forecast. Actual wild (3,088) and hatchery (342) MSW fish at Mactaquac (without broodstock removals) were less than 80% of spawning requirements. Forecast returns in 1988 are expected to exceed those of 1987 and, if removals of MSW fish are held in check, possibly meet spawning requirements.

LITERATURE CITED

- Amiro, P.G. MS 1987. Similarities in annual recruitment of Atlantic salmon to sport fisheries of inner Bay of Fundy rivers and stock forecasts for 1987. CAFSAC Res. Doc. 87/58:17 p.
- Marshall, T.L. MS 1988. Assessment of Atlantic salmon of the Saint John River, N.B., 1987. CAFSAC Res. Doc. 87/00:vii + 19 p.
- O'Neil, S.F., M. Bernard, and J. Singer. 1985. 1984 Atlantic salmon sport catch statistics, Maritime Provinces (Redbook). Can. Data. Rep. Fish. Aquat. Sci. No. 530. v + 98 p.
- O'Neil, S.F., M. Bernard, and J. Singer. 1986. 1985 Atlantic salmon sport catch statistics, Maritime Provinces. Can. Data Rep. Aquat. Sci. No. 600. v + 71 p.
- O'Neil, S.F., M. Bernard, P. Gallop, and R. Pickard. 1987. 1986 Atlantic salmon sport catch statistics, Maritime Provinces. Can. Data Rep. Fish. Aquat. Sci. No. 663. v + 69 p.

Table 1. Monthly mean discharges (m^3/s), June to October 1987, monthly mean discharges, 1974 or 1976 to 1986, and rank of 1987 mean in 12 or 14 years of data for gauged rivers of SFA's 19 to 23.

SFA	River Means Rank	Discharge (m^3/s)				
		June	July	August	September	October
19	N.E. Margareea '87	10.9	4.4	4.6	9.3	22.4
	\bar{x} 1974-86	13.6	6.8	8.3	10.2	18.0
	Rank '87	7	12	11	8	5
	Grand River '87	2.2	2.3	0.2	3.2	4.7
	\bar{x} 1974-86	3.3	2.2	2.0	2.0	3.6
	Rank '87	10	7	13	4	4
20	St. Mary's '87	12.3	3.6	1.1	17.4	57.2
	\bar{x} 1974-86	27.8	15.3	16.9	14.8	33.5
	Rank '87	12	13	13	4	3
	Liscomb '87	4.2	2.5	0.3	11.2	21.1
	\bar{x} 1974-86	10.3	6.7	6.0	5.4	12.0
	Rank '87	12	13	14	1	2
21	Musquodoboit '87	6.0	1.7	1.4	15.9	20.6
	\bar{x} 1974-86	14.2	8.3	9.5	7.3	15.3
	Rank '87	10	13	12	1	4
	LaHave '87	14.5	5.6	1.4	4.4	20.3
	\bar{x} 1974-86	21.8	11.6	11.0	7.8	24.2
	Rank '87	10	11	13	10	7
22	Medway '87	14.6	8.5	2.8	3.0	19.4
	\bar{x} 1974-86	28.4	15.6	15.1	10.1	22.4
	Rank '87	12	12	13	12	8
	North '87	2.3	0.4	0.3	3.8	7.7
	\bar{x} 1976-86	4.5	2.8	2.8	3.1	5.7
	Rank '87	10	12	12	4	4
23	Point Wolfe '87	2.1	0.5	0.3	2.6	4.7
	\bar{x} 1974-86	4.6	3.0	2.4	2.6	5.5
	Rank '87	13	14	14	5	6
	Nashwaak '87	15.2	8.0	4.1	14.2	23.9
	\bar{x} 1974-86	37.7	19.4	14.2	15.0	27.2
	Rank '87	13	14	14	7	7
23	Kennebecasis '87	14.8	4.4	2.8	5.9	11.8
	\bar{x} 1974-86	22.7	12.9	10.0	8.2	19.6
	Rank '87	7	14	13	11	7

^a SFA 18 but proximate to SFA 19

Table 2. Recreationally caught and retained^a bright 1SW and bright MSW salmon (released) by SFA, Scotia-Fundy Region, 1974-87.

Year	SFA 19		SFA 20		SFA 21		SFA 22		SFA 23	
	ISW	MSW	ISW	MSW	ISW	MSW	ISW	MSW	ISW	MSW
1974	416	588	3,462	434	2,462	397	2,004	714	1,312	1,798
1975	117	213	694	94	1,416	656	818	293	1,888	1,691
1976	278	445	2,652	219	2,474	321	1,931	537	3,150	2,498
1977	768	561	1,639	422	3,434	643	296	898	2,040	2,553
1978	257	456	396	272	460	481	1,681	334	843	924
1979	281	304	2,178	267	2,969	374	1,258	490	3,034	927
1980	997	795	3,555	469	2,773	1,104	151	526	2,734	2,860
1981	1,265	496	2,556	581	4,324	1,248	1,045	379	1,963	1,473
1982	857	523	1,657	201	1,847	494	983	444	3,129	2,361
1983	330	426	1,363	400	524	326	2,402	386	2,210	1,103
1984	822	108(358)	1,745	128(282)	2,159	232(316)	966	29(257)	2,891	0
1985	1,016	0(833)	2,559	0(1715)	2,790	0(1567)	1,634	0(578)	4,485	0
1986	804	0(1976)	2,271	0(1622)	3,110	0(1583)	830	0(843)	4,033	0
1987	890	0(1390)	1,773	0(686)	4,395	0(799)	255	0(311)	3,870	0
\bar{x} 1974	557	481	2,015	336	2,268	604	1,257	500	2,230	1,819
- 83										
\bar{x} 1984	881		2,192		2,686		1,143		3,803	
- 86										

^a SFA's 19-22 based on C&P estimates 1974-1982 adjusted by differential between C&P and license stub returns, 1983; i.e., 1.52, (SFA 19) 1.32, (SFA 20) 1.36, (SFA 21) and 1.04, (SFA 22); and license stub returns since 1983. SFA 23 based on DFO estimates.

Table 3. Counts of wild Atlantic salmon from fishway traps in SFA's 20, 21, and 23, Scotia-Fundy Region.

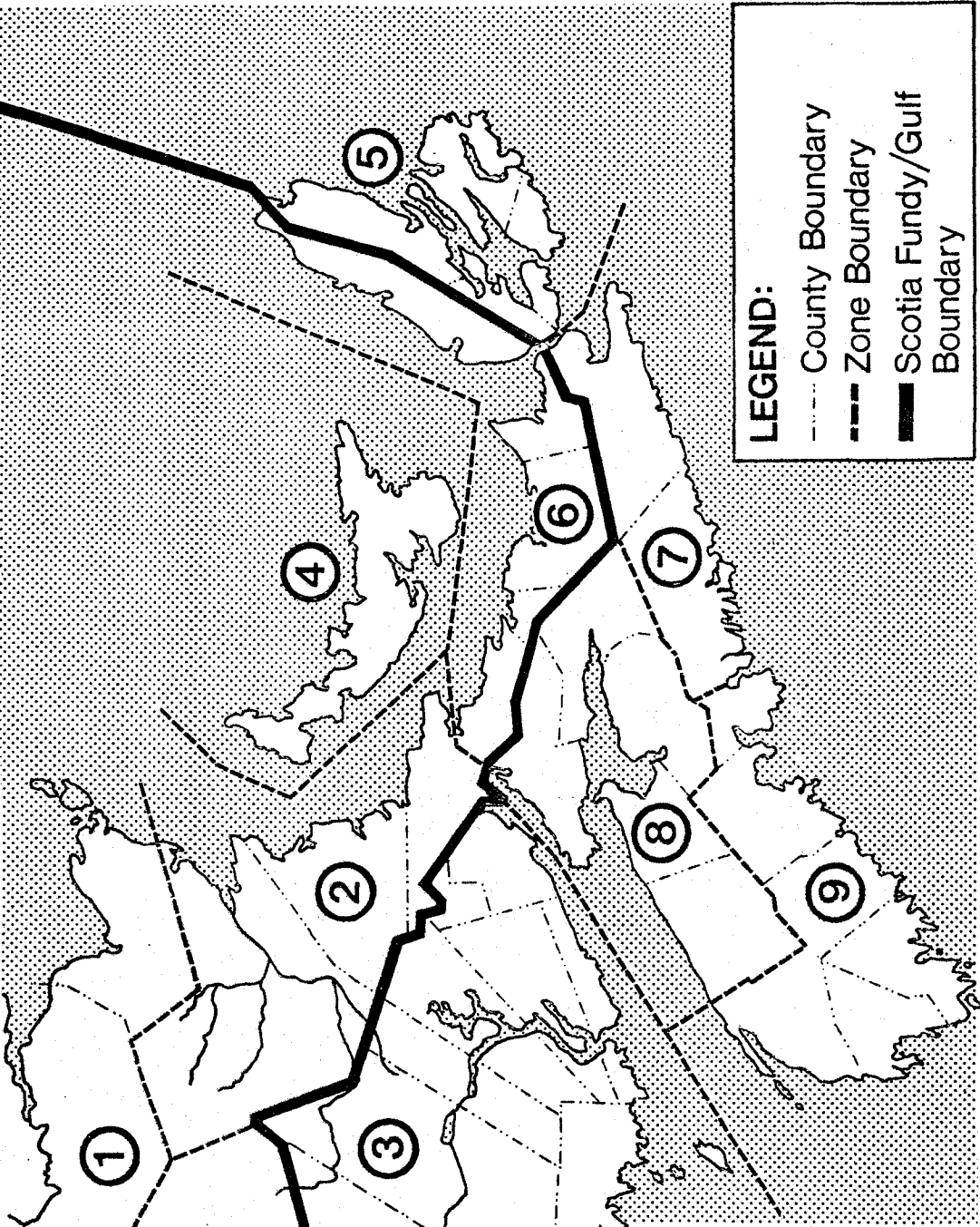
Year	SFA 20 Liscomb		SFA 21 LaHave		SFA 23 Saint John	
	ISW	MSW	ISW	MSW	ISW	MSW
1974			29	2	3,389	4,775
1975			38	5	5,725	6,200
1976			178	23	6,797	5,511
1977			292	25	3,504	7,247
1978			275	67	1,584	3,034
1979	60		856	67	6,234	1,993
1980	111	0	1,637	288	7,555	8,157
1981	76	6	1,866	366	4,571	2,441
1982	252	10	799	256	3,932	2,262
1983	520	15	1,129	213	3,623	1,712
1984	606	48	2,043	384	7,353	7,011
1985	507	87	1,343	638	5,331	6,391
1986	736	117	1,579	584	6,347	3,656
1987	1,614	88	2,529	532	5,097	3,088
\bar{x}_1 to 1983	204	10	710	131	4,691	4,333
\bar{x}_2 1984-'86	616	84	1,655	535	6,344	5,686
% change						
1987 from \bar{x}_1	692%	780%	256%	563%	9%	-29%
1987 from \bar{x}_2	162%	5%	53%	-1%	-20%	-46%
1987 from 1986	119%	-25%	60%	-9%	-20%	-16%

Table 4. Percentage 1SW and MSW returns from hatchery-reared smolts released to rivers of SFA's 20, 21a, and 23, 1975-1987.

Return year	1SW			MSW		
	SFA 20 Liscomb	SFA 21 LaHave Tusket	SFA 23 Saint John	SFA 20 Liscomb	SFA 21 LaHave Tusket	SFA 23 Saint John
1975			1.89			0.68
1976			2.80			0.84
1977		2.12	2.35		0.34	0.85
1978		0.70	1.04	0.03	0.06	0.41
1979	1.14	1.32	1.95	0.12	0.48	1.53
1980	1.59	0.94	4.42	0.08	0.32	1.07
1981	0.90	1.70	2.04	0.15	0.15	0.66
1982	1.95	1.90	1.44	0.15	0.20	0.29
1983	1.35	1.32	0.78	0.10	-	0.56
1984	0.57	1.10	0.98	0.08	0.28	0.55
1985	0.44	0.71	0.92	0.27	0.34	0.35
1986	2.59	2.60	0.87	0.18	0.80	0.45
1987	2.75	3.32	1.57			

a LaHave values have been adjusted from those background to Adv. Doc. 87/24 but do not alter its advice.

SALMON MANAGEMENT ZONES



Gulf Region

- 1. Restigouche
- 2. Miramichi
- 4. P.E.I.
- 6. Gulf Shore Nova Scotia

Scotia - Fundy Region

- 3. Saint John - Fundy
- 5. Cape Breton - East
- 7. Eastern Shore
- 8. Upper Bay of Fundy
- 9. Southwestern Nova Scotia

LEGEND:

- County Boundary
- - - Zone Boundary
- Scotia Fundy/Gulf Boundary

Figure 1

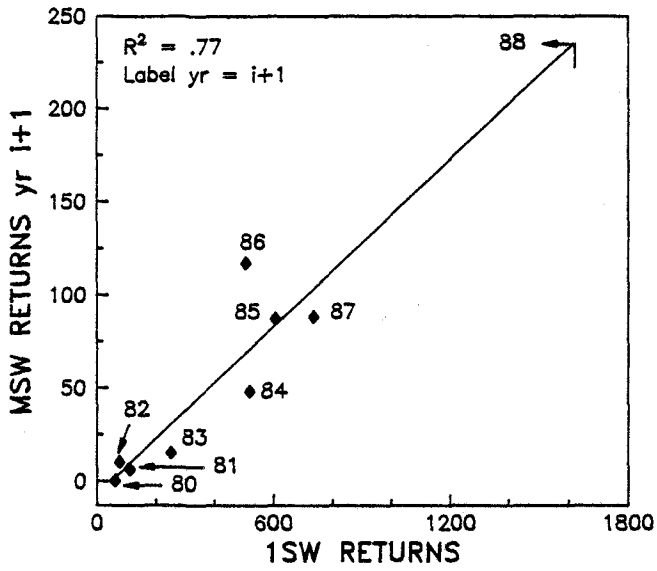


Fig. 2. Liscomb, counts at fishway.

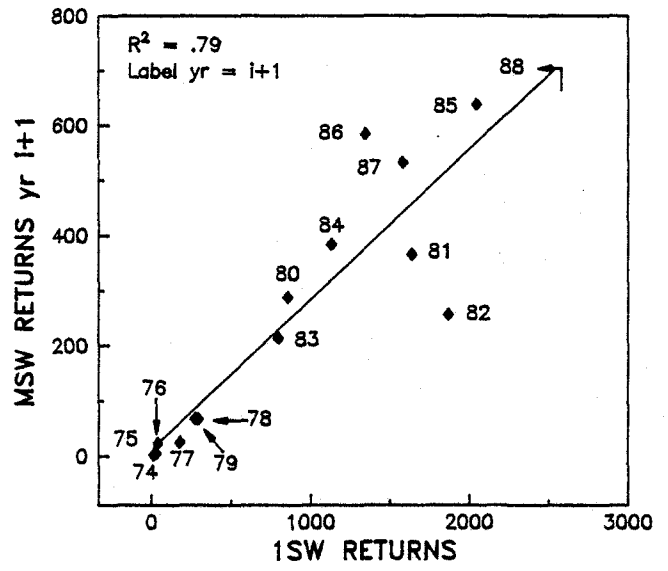


Fig. 3. LaHave, counts at Morgan Falls.

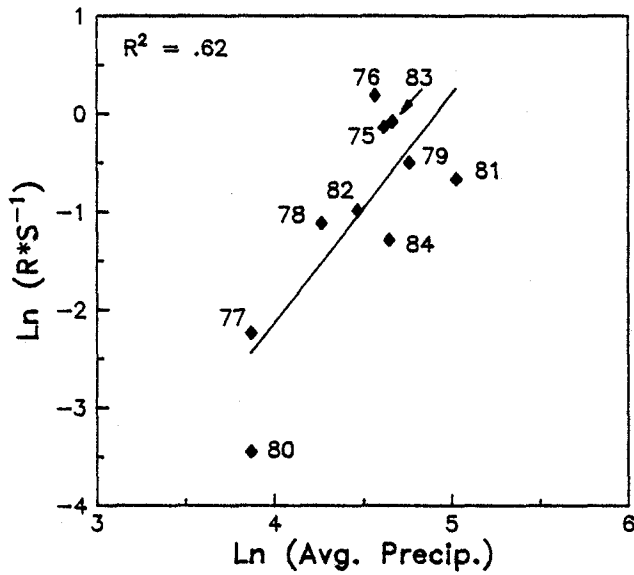


Fig. 4. Stewiacke, recruit-eggs per spawner egg (indexed from sport catch) on precipitation.

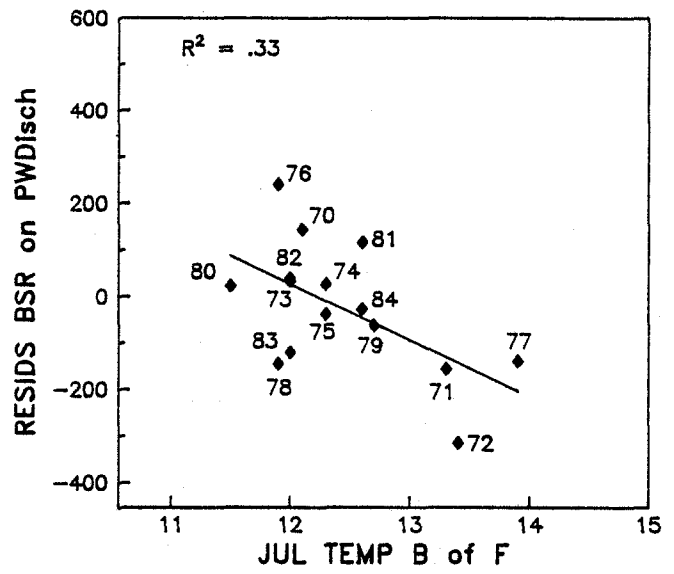
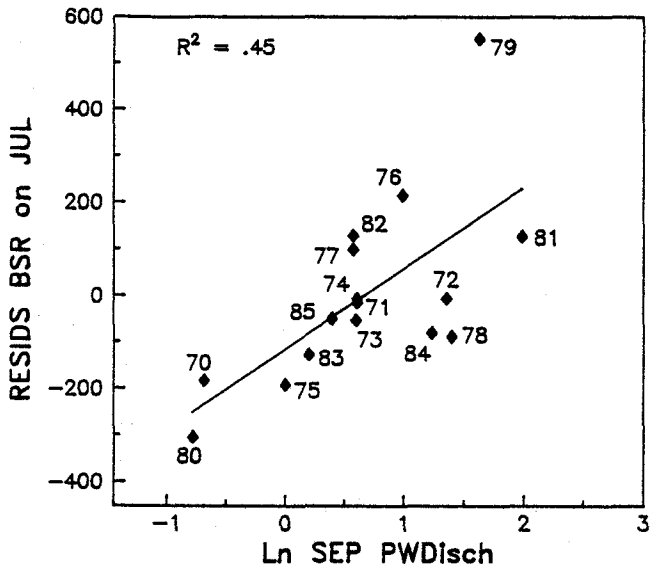


Fig. 5 & 6. Residuals fo Big Salmon River ML model.

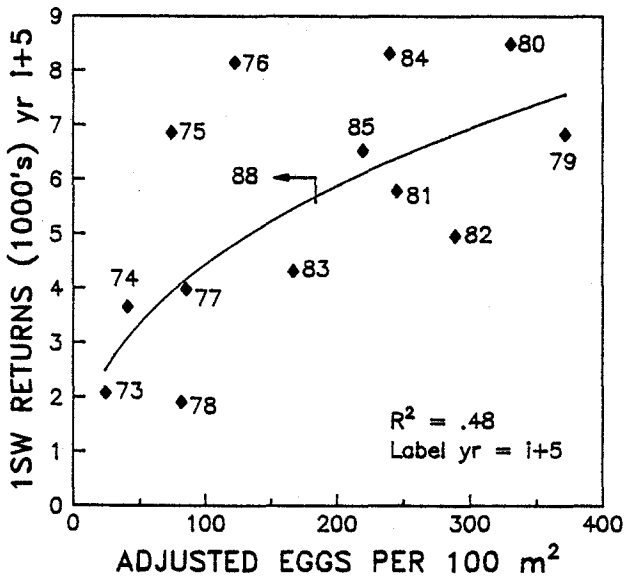


Fig. 7. Saint John, 1SW recruitment above Mactaquac.

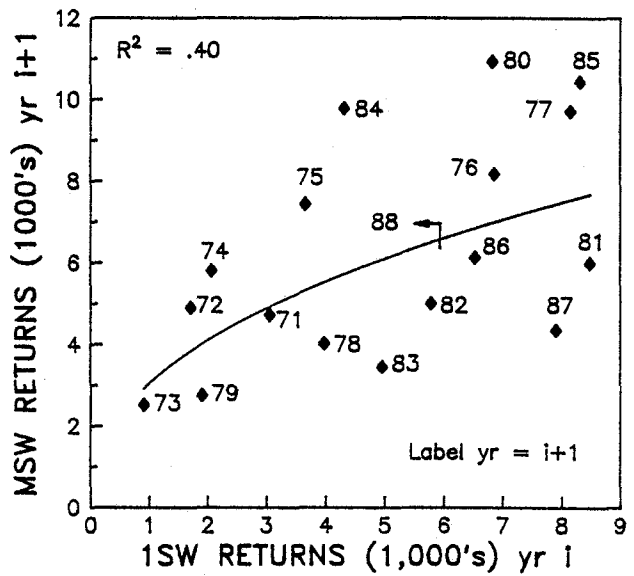


Fig. 8. Saint John, MSW recruitment above Mactaquac.