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Prediction of 1 SW Atlantic Salmon
Returns Statistical Area N, 1984

by

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ABSTRACT

Atlantic salmon smolts (Salmo salar L.) were used to predict harvests and returns of 1 SW salmon one year in advance. Smolt migrations at Western Arm Brook, Newfoundland, were significantly correlated to the commercial and recreational fisheries of Statistical Area N one year later. Returns in 1984 are predicted to be below the 1978-82 mean.

RESUME

Les quantités de saumoneaux ont servi de base pour prévoir un an à l'avance l'importance des prises et des retours de castillons. L'ampleur de l'émigration des saumoneaux de Western Arm Brook (T.-N) s'est révélée étroitement liée aux prises des pêches commerciales et sportives dans la zone statistique N un an plus tard. Les retours en 1984 n'atteindront pas, selon les prévisions, la moyenne des années 1978 à 1982.

INTRODUCTION

An important objective in management of Atlantic salmon is to predict abundance of stocks well before harvest. Predictions of stock size made one year in advance allow fisheries to be properly regulated with a minimum of economic hardship. Strict quotas are becoming increasingly necessary as salmon stocks become less abundant but more valuable. In a previous paper the abundance of Atlantic salmon smolts were used to predict the returns and harvests of 1SW salmon in Area N, Newfoundland, one year in advance (Chadwick 1982). A 1SW salmon spends one year at sea before its first spawning (Allan and Ritter 1977). This paper provides current data to predict salmon returns to Area N in 1984.

METHODS

Migrations of Atlantic salmon smolts and adults have been counted on Western Arm Brook for 13 years (1971-83). Details on the size and biological characteristics of the migrations are presented elsewhere (Chadwick 1980, 1981; Chadwick et. al. 1978). 1SW salmon are identified as fish <62.5 cm.

Western Arm Brook is one of five scheduled salmon rivers located in Statistical Area N (Fig. 1). These rivers are similar: they produce almost entirely 1SW salmon; they drain sedimentary bedrock; they have numerous shallow lakes in their headwaters; they are crossed by a highway at the mouth; and the watersheds are nearly pristine. Total drainage basin of these rivers is 1544 km²; 99% is accessible to Atlantic salmon. The drainage basin of Western Arm Brook (149 km²) is 10% of Area N. The mean 1962-71 recreational catch in Western Arm Brook (184 salmon) is nearly 10% of the mean for Area N (1954 salmon). (Angling pressure on Western Arm Brook was not inhibited by the counting fence during the years 1962-71.) For these reasons, I assumed that Western Arm Brook produced 10% of the salmon smolts in Area N. Similarly, the number of 1SW adults counted at the fish weir in Western Arm Brook was assumed to equal 10% of the spawning escapement to all rivers in Area N.

Recreational catch of salmon was obtained from Moores et. al. 1978; Moores and Tucker 1979, 1980, 1981; and unpublished data. Over 99% of the recreational catch in Area N are 1SW salmon. In these reports, 1SW salmon are identified as fish <2.7 kg.

Commercial catch of salmon was obtained from Waldron 1974; Reddin and Waldron 1976; Reddin and Day 1980; Reddin and Short 1981; Short and Reddin 1981a, 1981b; and unpublished data. Over 75% of the commercial catch in Area N are small salmon. In these reports, small salmon are identified as fish <2.7 kg and they were assumed to be 1SW salmon. Numbers of 1SW salmon were obtained by dividing total catch of small salmon by a mean weight of 1.8 kg (Chadwick, unpublished data).

Correlations were tested between the number of smolts in Western Arm Brook in year i and two variables in Area N in the year $i+1$. These variables were combined commercial and recreational harvests, and total returns of salmon. Total returns were the sum of total harvest and escapement to rivers. Escapement to rivers was assumed to be ten times the escapement in Western Arm Brook. Significant correlations ($P < 0.05$) were used to predict total harvest and total returns of salmon in 1984, assuming no changes in fishing effort.

RESULTS AND DISCUSSION

The smolt migrations in Western Arm Brook were correlated to combined commercial and recreational harvests and total returns to Statistical Area N one year later. The 1983 smolt migration predicted a total harvest of 7,103 1SW salmon (95% C.L. ± 1698) and a total return of 12,866 1SW salmon (95% C.L. ± 2723) in 1984. The equations are:

1. Harvest = $0.69x - 152.02$ $r = 0.64$ $P \ll 0.05$
2. Returns = $1.22x + 43.45$ $r = 0.67$ $P \ll 0.05$

As can be seen from Fig. 2, the correlations would be greatly improved if the abnormally low and high sea survivals of 1977 and 1978 respectively, were omitted from the analysis; the correlation coefficient for total returns, $r = 0.84$, becomes highly significant ($P \ll 0.01$). In 1977, a below average sea survival was found for salmon stocks throughout Newfoundland and Labrador (Reddin and Carscadden 1981).

The additional two years of information from my previous paper (Chadwick 1982) has improved the correlation between smolts and total returns. The two equations have similar slopes but the intercept of the new equation is not different from zero. It appears that the predictive capabilities of Western Arm Brook as an index river for Area N is improving as the time series becomes longer.

Generally, total returns in 1984 will be below the 1978-82 mean of 16,999 1SW salmon, and as such there should be no increases in fishing effort in 1984 for statistical Area N.

References

- Allan, I.R.H., and J. A. Ritter. 1977. Salmonid terminology. J. Cons. int. Explor. Mer 37(3): 293-299.
- Chadwick, E.M.P. 1980. Atlantic salmon kelt (Salmo salar L.) as an index of spawners. ICES Res. Doc. C.M.1980/M: 29. 9 p.
1981. Biological characteristics of Atlantic salmon smolt in Western Arm Brook, Newfoundland. Can. Tech. Rep. Fish. Aquat. Sci. No. 1024, 45 p.
1982. 1 SW Atlantic salmon harvests predicted one year in advance. ICES C.M. 1982/m: 20, 10 p.
- Chadwick, E. M.P., T. R. Porter, and P. Downton. 1978. Analysis of growth of Atlantic salmon (Salmo salar) in a small Newfoundland river. J. Fish. Res. Board Can. 35(1): 60-68.
- Moore, R. B., and R. J. Tucker. 1979. Atlantic salmon angled catch and effort data, Newfoundland and Labrador, 1978. Fish. Mar. Serv. Data Rep. 147: 106.
1980. Atlantic salmon angled catch and effort data, Newfoundland and Labrador, 1979. Can. Data Rep. Fish. Aquat. Sci. 212: xiv + 86 p.
1981. Angled catch and effort data in the Atlantic salmon recreational fishery, Newfoundland and Labrador, 1980. Can. Data Rep. Fish. Aquat. Sci. 263: xiv + 85 p.
- Moore, R. B., R. W. Penney, and R. J. Tucker. 1978. Atlantic salmon angled catch and effort data, Newfoundland and Labrador, 1953-77. Fish. Mar. Serv. Data Rep. 84: 274.
- Reddin, D.G., and D.E. Waldron, 1976. 1975 Newfoundland and Labrador Atlantic salmon commercial catch data. Fish. Mar. Serv. Res. Dev. Tech. Rep. 684: 183.
- Reddin, D.G., and J.E. Carscadden. 1981. Salmon-capelin interactions. CAFSAC Res. Doc. 81/2, 38 p.

- Reddin, D. G., and F. A. Day. 1980. 1969-72 Newfoundland and Labrador Atlantic salmon (Salmo salar) commercial catch data. Can. Data. Rep. Fish. Aquat. Sci. 220: iv + 55 p.
- Reddin, D. G., and P. B. Short. 1981. The 1976 Newfoundland and Labrador Atlantic salmon commercial landings. Can. Tech. Rep. Fish. Aquat. Sci. 1007: iv + 105 p.
- Short, P. B., and D. G. Reddin. 1981a. Newfoundland and Labrador Atlantic salmon commercial catch data - 1977. Can. Data Rep. Fish. Aquat. Sci. 282: iv + 103 p.
- 1981b. Newfoundland and Labrador Atlantic salmon commercial catch data - 1978. Can. Data Rep. Fish. Aquat. Sci. 283: iv + 114 p.
- Waldron, D. E. 1974. 1973 Newfoundland and Labrador Atlantic salmon commercial catch data. Data Record Ser. No. NEW/D74-1, Res. Dev. Branch, Nfld. Region, 127 p.

Table 1. Smolt counts in Western Arm Brook and 1SW salmon harvests, escapements and returns to Statistical Area N (1971-1983).

Year (i)	Smolts year(i)	1SW salmon year (i+1)			Spawning escapement year (i+1)	Total returns year (i+1)
		Commercial	Recreational	Total		
1971	5,734	2,062	1,332	3,394	3,090	6,484
1972	11,906	8,428	2,648	11,076	5,550	16,626
1973	8,484	2,738	1,789	4,527	3,990	8,517
1974	12,055	3,667	2,716	6,383	6,310	12,693
1975	9,773	4,258	3,014	7,272	5,200	12,472
1976	6,359	3,922	2,413	6,335	3,620	9,955
1977	9,640	1,268	1,350	2,618	2,930	5,548
1978	13,071	6,814	3,281	10,095	15,760	25,855
1979	9,400	6,919	1,651	8,570	4,350	12,920
1980	15,675	7,370	2,518	9,888	4,510	14,398
1981	13,981	10,799	2,156	12,955	3,910	16,865
1982	12,477	2,432	1,949	4,381	10,580	14,961
1983	10,515					

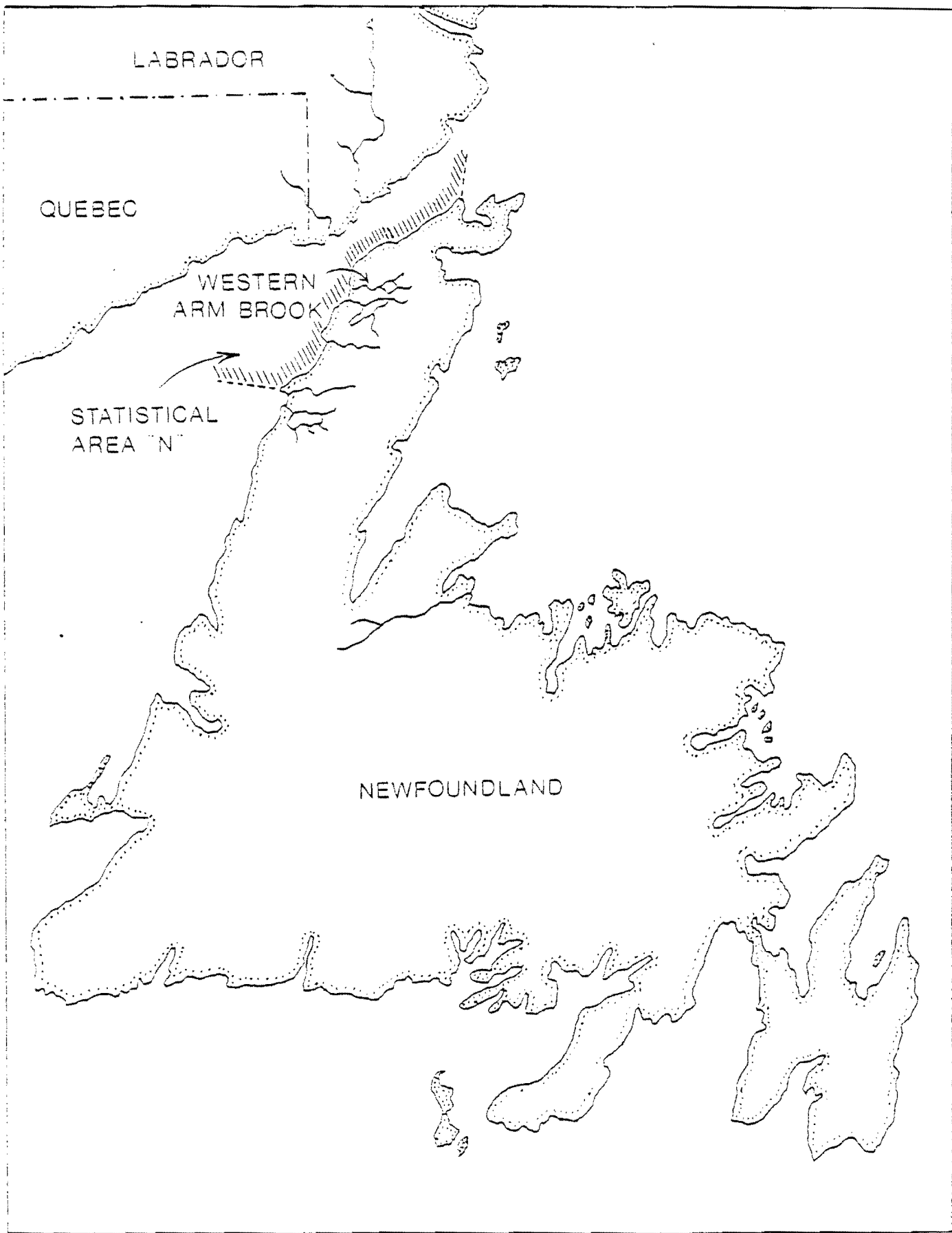


Fig. 1. A map of Newfoundland showing place names mentioned in the text.

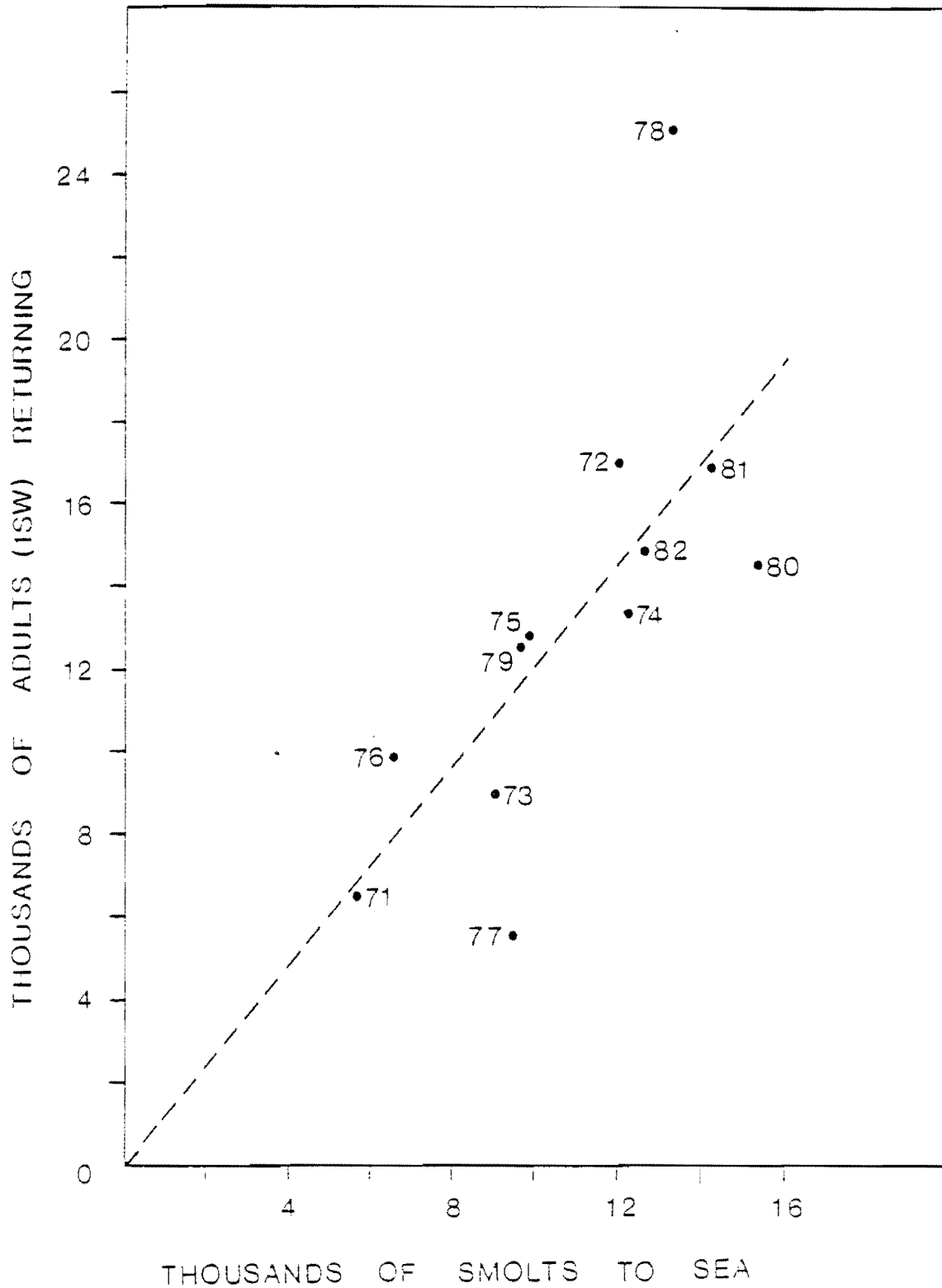


Fig. 2. Relationship between smolts counted in Western Arm Brook and total returns of 1SW salmon to Statistical Area N in the following year. The year of the smolt migration is indicated.