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Forecast of 1SW Atlantic salmon returns Statistical Area N, 1985

by

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ABSTRACT

Returns of 1SW salmon to commercial and sport fisheries of Statistical Area N were predicted from counts of smolts migrating from Western Arm Brook (1971-84). Because the 1984 smolt migration was the largest ever recorded, returns of 1SW salmon in 1985 are predicted to be well above average.

RÉSUMÉ

Le dénombrement de saumoneaux en avalaison de Western Arm Brook fut utilisé pour prédire les retours de castillons aux pêcheries du secteur statistique N (1971-84). En 1984, la migration des saumoneaux fut la plus grande depuis 1971; en conséquence on anticipe que les retours de castillons en 1985 seront supérieurs à la moyenne.

INTRODUCTION

In previous papers, the abundances of Atlantic salmon smolts were used to predict returns and harvests of 1SW salmon in Statistical Area N, Newfoundland, one year in advance (Chadwick, 1982, 1984). This paper provides current data to predict salmon returns to Area N in 1985.

METHODS

Migrations of Atlantic salmon smolts and adults have been enumerated on Western Arm Brook for 14 years (1971-1984). Details on the size and biological characteristics of the migrations are presented elsewhere (Chadwick 1980, 1981; Chadwick et al. 1978; Peppar 1984, unpublished).

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 km^2; 99% is accessible to Atlantic salmon. The drainage basin of Western Arm Brook (149 km^2) 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 (1,954 salmon). (Angling pressure on Westerm Arm Brook was not inhibited by the counting fence during the years 1962-71.) For these reasons, it is assumed that Western Arm Brook produced 10% of the salmon smolts in Area N. Similarly, the number of 1SW adults enumerated at the fish counting fence on 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; Moores and Ash 1984; Ash and Tucker 1984; and unpublished data. Over 90% of the recreational catch in Area N are 1SW salmon. In these reports, 1SW salmon are identified as fish $\ll$62.5 cm.

Commercial catch of salmon was obtained from Waldron 1974; Reddin and Waldron 1976; Moores and Dawe 1980; Reddin and Day 1980; Reddin and Short 1981; Short and Reddin 1981a, 1981b; Moores, Veitch and Ash 1984; and unpublished data. Over 75% of the commercial catch in Area N are small salmon. In these reports, small salmon are identified as fish $\leq$ 2.7 kg and 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 ($P \leq 0.05$) were used to predict total harvest and total returns of salmon in 1985, assuming no changes in fishing effort.

RESULTS AND DISCUSSION

The smolt migrations (x) in Western Arm Brook were correlated to combined commercial and recreational harvests and total returns to Statistical Area N (Table 1) one year later. The 1984 smolt migration predicted a total harvest of 14,024 1SW salmon (95% C.L. ± 8,325) and a total return of 24,856 1SW salmon (95% C.L. ± 14,453) in 1985. The equations are:

1. Harvest = 0.70x - 387.00 $r = 0.62$ $p = 0.02$

2. Returns = 1.23x - 594.74 $r = 0.63$ $p = 0.02$

The 1985 forecast indicates that homewater returns and harvests of 1SW salmon will be above average. It is not prudent to rely on the specific estimates of 1985 harvests and returns, because these values are outside, or nearly outside, the range of observed data. Secondly, there is considerable variance in both predictive equations. It is noteworthy, however, that logarithmic transformations did not reduce this variance; the sum of the squared residuals was lowest for a linear fit. Thus over the range of observations, there was no proportional decrease in 1SW salmon returns in Area N with increased smolt production from Western Arm Brook.

The equation of 1SW salmon returns on smolt production is presented in Figure 2. The intercept of the equation suggests that at low smolt production there is a proportionally lower sea survival, or return rate, of 1SW salmon. Again, the considerable variance in this equation is reflected by the wide 95% confidence belt.

Finally, the percentage of smolts produced in Area N (10x smolts in Western Arm Brook) that return to homewaters is given in Table 1. There are three years where survival was greatly different from other years: in 1977 and 1983, there was a very low survival; and in 1978, there was a very high survival. When all three years are omitted from the regression, the correlation is greatly improved ($R^2 = 0.69$). It is difficult to explain the high survival of the 1978 smolt migration, but the low survival of 1977 and 1983 smolt migrations could be related to adverse conditions at sea. It is also interesting to note that grilse from the 1977 smolt migration were the parents of most of the smolts going to sea in 1983.

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Table 1. Smolt counts in Western Arm Brook and 1SW salmon harvests, escapements and returns to Statistical Area N (1971-1984).

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	11.3
1972	11,906	8,428	2,648	11,076	5,550	16,626	14.0
1973	8,484	2,738	1,789	4,527	3,990	8,517	10.0
1974	12,055	3,667	2,716	6,383	6,310	12,693	10.5
1975	9,733	4,258	3,014	7,272	5,200	12,472	12.8
1976	6,359	3,922	2,413	6,335	3,620	9,955	15.7
1977	9,640	1,268	1,350	2,618	2,930	5,548	5.8
1978	13,071	6,814	3,281	10,095	15,760	25,855	19.8
1979	9,400	6,919	1,651	8,570	4,350	12,920	13.7
1980	15,675	7,370	2,511	9,881	4,280	14,161	9.0
1981	13,981	10,799	2,156	12,955	3,910	16,865	12.1
1982	12,477	2,432	1,947	4,379	11,420	15,799	12.7
1983	10,552	2,766	1,753	4,519	1,230	5,749	5.4
1984	20,653						

* Percentage of total smolts in Area N, i.e. smolts in Western Arm Brook x 10.

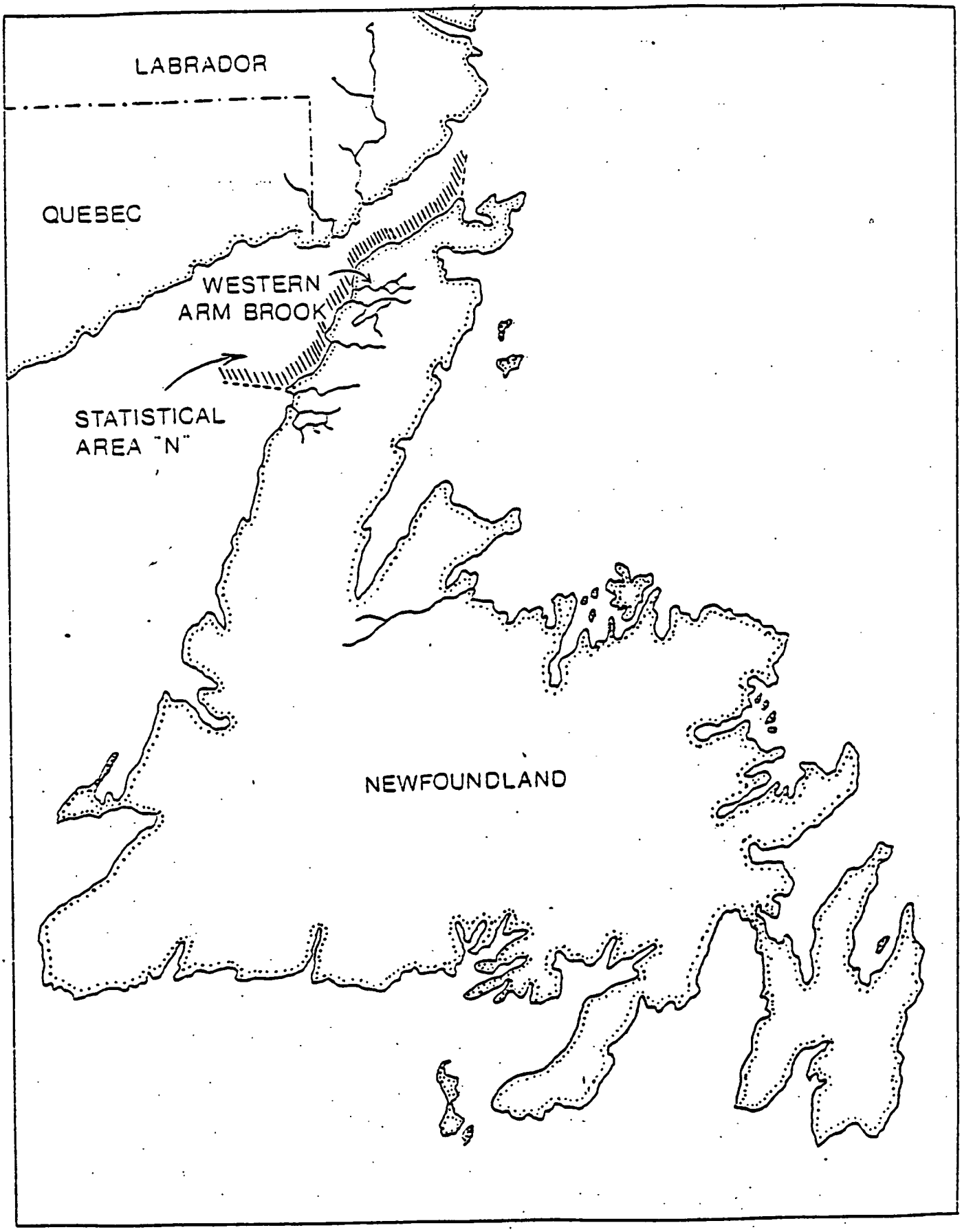

Fig. 1. A map of Newfoundland showing place names mentioned in the text.

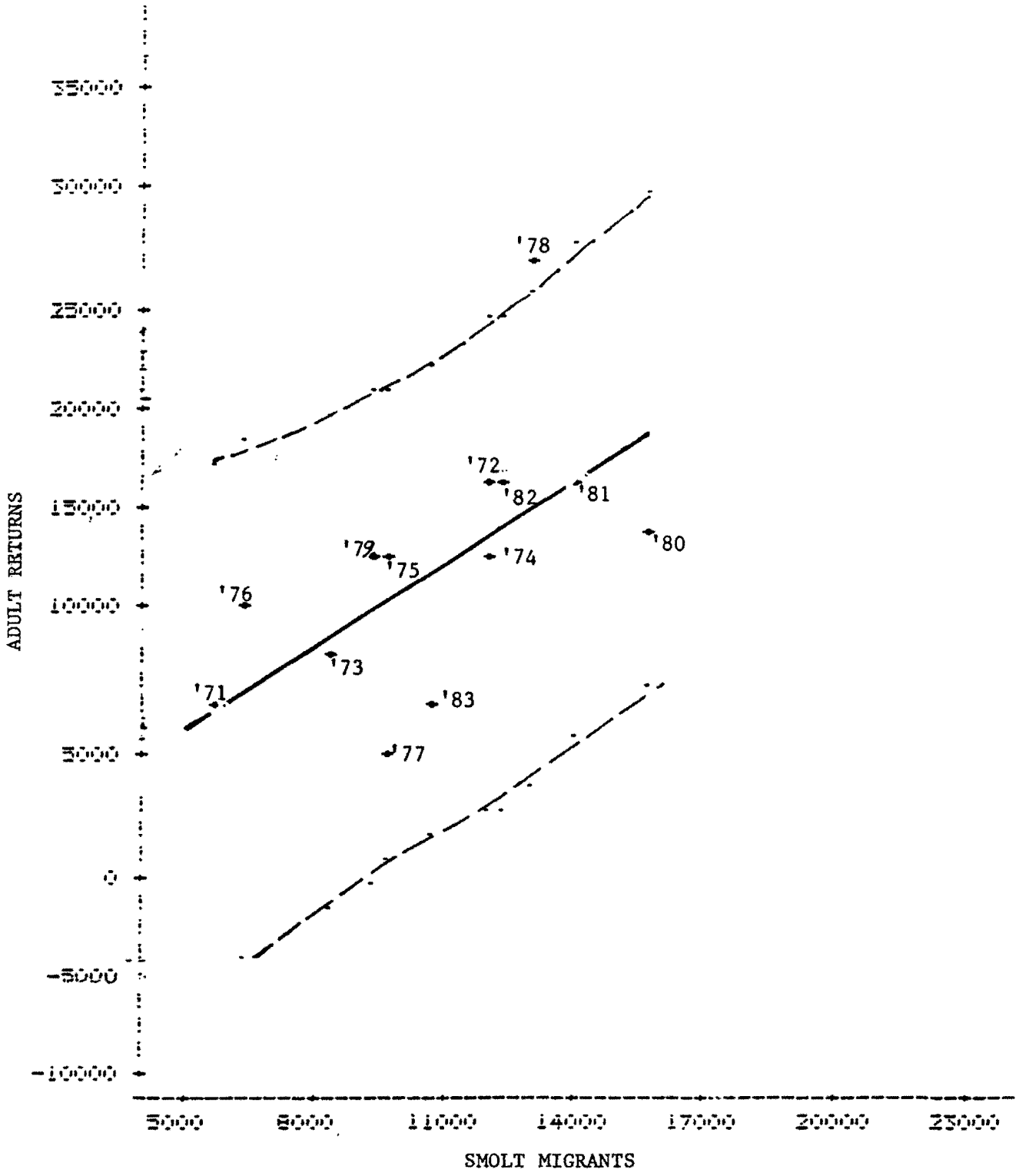

Figure 2. Relationships between smolts counted in Western Arm Brook and total returns of 1SW salmon to Statistical Area N in the following year. The year of the smolt migration is indicated. The dashed lines are 95 % C.L.