Estimates of potential harvest of 2-SW salmon in Fishery
Statistical Districts 1, 2, 3 and 7 of Cape Breton Island
Nova Scotia, 1983

by

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Abstract

Predictive equations for landings of 2-SW salmon in four Fishery Statistical Districts of Cape Breton were refined by adding a second independent variable - female composition among grilse at Millbank - and by adjusting landings of those Districts for past commercial seasons to that season in 1982. Forecasts of 1983 landings are below 1982, 11-year mean, and 10-year-mean response values.

Résumé

Les équations prévisionnelles des débarquements de saumons de 2 ans en mer dans les districts statistiques 1, 2, 3 et 7 du Cap-Breton ont été raffinées par addition d'une deuxième variable - le nombre des femelles parmi les castillons observés à Millbank - et par ajustements à ceux de 1982 des débarquements dans ces districts pendant les saisons de pêche commerciale passées. Les prévisions pour 1983 sont inférieures aux valeurs de réponse de 1982, de la moyenne de 11 ans et de celle de 10 ans.

Introduction

Regression analysis of 1-SW salmon monitored at the Millbank trap, Miramichi River, New Brunswick, in year n on 2-SW fish in the commercial fishery of Cape Breton Island in year n+1 was previously used to estimate the potential magnitude of the 1982 commercial fishery in four Fishery Statistical Districts (Marshall, 1982). More recent analysis with a model to estimate 2-SW returns to the Miramichi given 1-SW returns the previous year revealed that percentage female composition among the grilse accounted for a significant amount of previously unaccounted for variation (Marshall, et al. 1982). This document updates the previous predictors for Cape Breton by inclusion of the percentage female factor among 1-SW fish at Millbank and provides estimates of 2-SW returns in 1983 to four Fishery Statistical Districts 1, 2, 3, and 7 (Figure 1).

Methods

Estimated landings of 2-SW salmon in six Fishery Statistical Districts of Cape Breton 1972-'81, numbers of 1-SW fish at Millbank and their percentage female composition 1971-'80 have been documented by Marshall (1982; Table 1) and Marshall et al. (1982; Table 1), respectively. Estimated numbers of 2-SW fish harvested in Cape Breton 1972-'81 have since been adjusted to reflect landings consistent with the reduced commercial seasons in 1982 (Table 1). Landings of 2-SW fish for 1982 were not used in the analysis because the 1981 1-SW counts at Millbank were excluded from the Miramichi model (Marshall, et al. (1982). Thus, the models use only 1-SW data for 1971-'80 and 2-SW data for 1972-'81.

Models were developed using multiple regression analysis available in SPSS on log-normalized numbers of salmon and the arcsin proportion female. Numbers of 1-SW fish and their sex composition at Millbank in 1982 (Randall, pers. comm.) were used to predict returns of 2-SW fish to Fishery Districts for which the predictive models were significant to the $p < 0.1$ level.

Results and Discussion

The addition of the arcsin proportion female variable (X_2) accounted for an additional 23.9, 8.6, 20.5, and 8.4 percentage variation in Districts 1, 2, 3, and 7, respectively (Table 2).

Predicted landings in 1983, given a season of the same length as 1982, could provide harvests of 1291, 1280, 132, and 413 2-SW salmon in Districts 1, 2, 3, and 7, respectively (Table 3). These values lie below: the respective 10-year-mean response values of 1482, 1328, 163, and 593; the 11-year-mean values of 1651, 1457, 231, and 854; and harvests in 1982. They are believed to reflect the depressed status of stocks in the Gulf of St. Lawrence.

Randall, R.G., Dept. of Fish. and Oceans, P.O. Box 5030, Moncton, N.B. E1C 9B6

Literature Cited

Marshall, T.L. 1982. A method to estimate potential 2-SW salmon harvest in Fishery Statistical Districts 1, 2, 3, and 7 of Cape Breton Island, Nova Scotia. CAFSAC Res. Doc. 82/8, 7 p.

Marshall, T.L., J.L. Peppar, and E.J. Schofield. 1982. Prediction of 2-SW and older Atlantic salmon returning to the Millbank trap, Miramichi River, New Brunswick. CAFSAC Res. Doc. 82/51, 10 p.

Table 1. Estimated numbers of 2-SW salmon landed in Fishery Statistical Districts 1, 2, 3, and 7, Cape Breton, 1972-1982, adjusted to the durations of the 1982 commercial season[1], and counts of 1-SW salmon and their percentage female composition at the Millbank trap, Miramichi River, 1971-1982.

| | Estimated number of 2-SW salmon | | | | 1-SW fish @ Millbank | |
| | Fishery Statistical Districts | | | | | Percent |
Year	1	2	3	7	Number	Female
1971					1962	11.0
1972	1759	1302	141	519	2543	22.0
1973	1406	1203	199	418	2450	16.9
1974	2245	2002	558	2770	4038	30.2
1975	2162	1834	245	1385	3548	27.4
1976	1990	1688	187	434	4939	24.1
1977	1903	2272	292	1928	1505	22.8
1978	1431	1067	111	426	1268	37.4
1979	372	541	18	120	2500	27.4
1980	1919	1558	304	748	2139	19.3
1981	1101	857	107	201	2174	25.1
1982	1878[2]	1701[2]	376[2]	450[2]	2665	29.5
1983	(1291)	(1280)	(132)	(413)		

[1]Districts 1, 2, and 3, June 1-July 31.
 District 7, May 18-July 31.

[2]Preliminary estimate.

Table 2. Results of regression analysis using one and two independent variables
for salmon data of Table 1.

$Y = \log_{10}$ number of 2+-SW salmon, yr n+1

$X_1 = \log_{10}$ number of 1-SW salmon, yr n

X_2 = arcsin proportion female 1-SW salmon, yr n

Statistical District	Variable	Regression coef.	SE	F-Value	Signif. levels and coef. of determination
1	X_1	0.8693	0.3219	7.29	0.027
	Constant	0.2200	1.1094	0.04	
					$r^2 = 0.4768$
	X_1	0.8837	0.2538	12.12	0.010
	X_2	-0.0228	0.0092	5.88	0.046
	Constant	0.8164	0.8968	0.83	
					$R^2 = .7156$
2	X_1	0.8582	0.1984	18.72	0.003
	Constant	- .2099	0.6742	0.01	
					$r^2 = 0.7006$
	X_1	0.8652	0.1792	23.30	0.002
	X_2	-0.0109	0.0065	2.80	0.138
	Constant	0.5008	0.6334		
					$R^2 = 0.7862$
3	X_1	1.4903	0.5612	7.05	.029
	Constant	-2.8457	1.9075	2.23	
					$r^2 = 0.4685$
	X_1	1.5134	0.4706	10.34	.015
	X_2	-0.0357	0.0170	4.38	.075
	Constant	-1.8909	1.6630		
					$R^2 = 0.6731$
7	X_1	1.5558	0.6023	6.67	.032
	Constant	-2.5083	2.0473	1.50	
					$r^2 = 0.4547$
	X_1	1.5714	0.5924	7.04	.033
	X_2	-0.0242	0.0214	1.27	.296
	Constant	-1.8603	2.0934		
					$R^2 = 0.5387$

Residuals:	Dist. 1	Dist. 2	Dist. 3	Dist. 7
No. 2 SD outliers	0	0	0	0
No. positive	5	4	5	5
No. negative	5	6	5	5
No. run signs	7	7	7	7
Durbin-Watson test	3.24	2.79	2.81	2.31
Von Neumann ratio	3.60	2.51	2.53	2.08

Table 3. Predictive equations for Fishery Statistical Districts 1, 2, 3, and 7 of Cape Breton Island, mean response value for 2-SW data in the model, and the predicted number of 2-SW fish for 1983 (Y = number of 2-SW salmon, yr n+1; X_1 = number of 1-SW salmon, yr n; X_2 = proportion female 1-SW salmon, yr n).

Fishery District	Predictive Equation	P-value[1]	No. of 2-SW salmon Mean $\overline{Y}$	No. of 2-SW salmon $\hat{Y}$ 1983
1	$\log Y = 0.8164 + 0.8837 \log X_1 - 0.0228 \arcsin\sqrt{X_2}$	0.013	1482	1291
2	$\log Y = 0.5008 + 0.8652 \log X_1 - 0.0109 \arcsin\sqrt{X_2}$	0.005	1328	1280
3	$\log Y = -1.8909 + 1.5134 \log X_1 - 0.0357 \arcsin\sqrt{X_2}$	0.020	163	132
7	$\log Y = -1.8603 + 1.5714 \log X_1 - 0.0242 \arcsin\sqrt{X_2}$	0.066	593	413

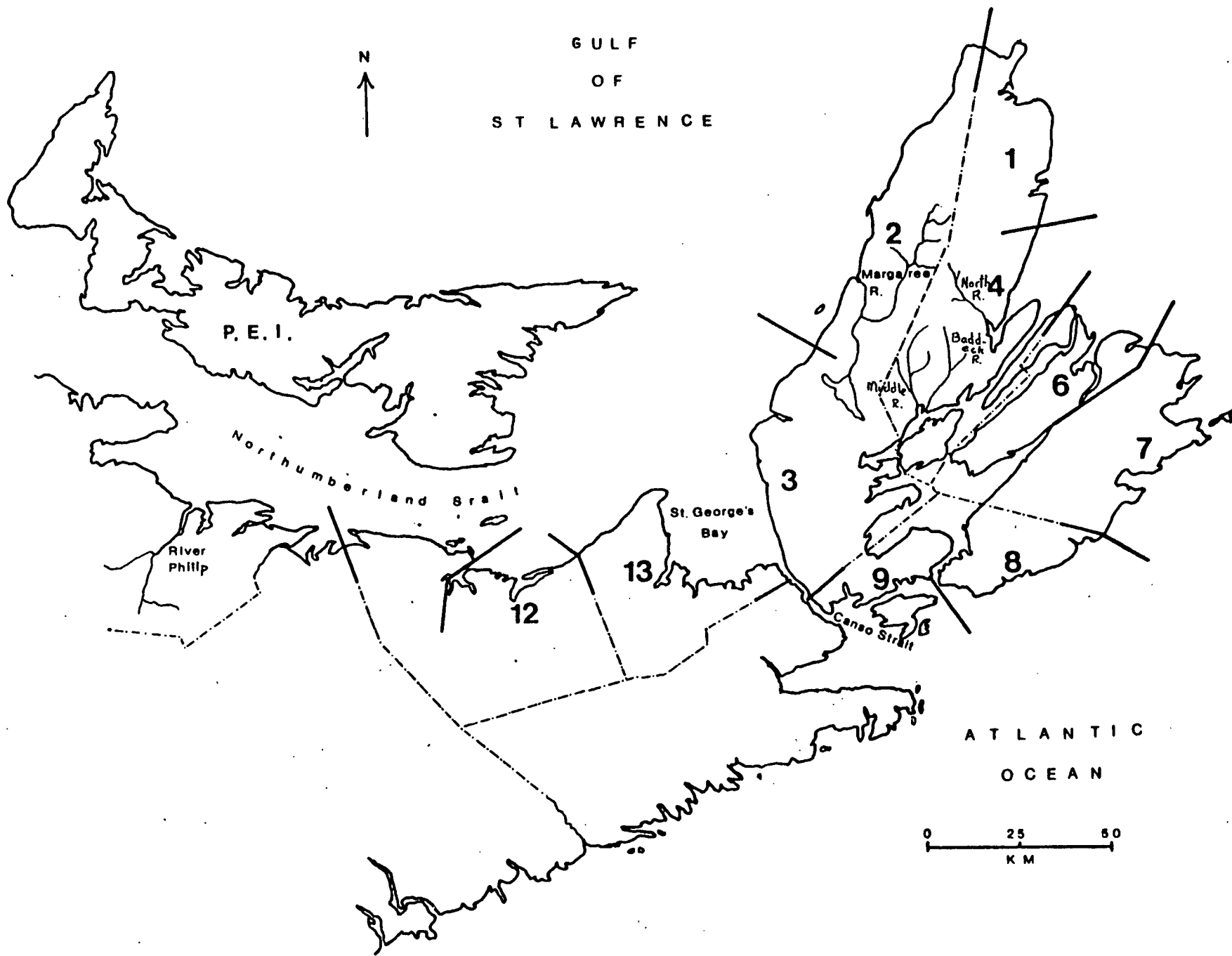[1]Exact P- values for the multiple correlation coefficients with n=10; v_1 = 2 and v_2 = 7.

Figure 1. Fishery Statistical Districts 12, 13, 1-9, of Nova Scotia.