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Atlantic Salmon (Salmo salar L.) Egg-to-Smolt Survival in Newfoundland Rivers

by

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Abstract

In Newfoundland, target egg deposition requirements for Atlantic salmon are calculated on the basis of the contribution of both fluvial and lacustrine habitats to total production. A critical parameter in the model currently used for egg requirement determinations for each habitat type is egg-to-smolt survival. Recently calculated egg-to-smolt survival values, spanning several year classes for three Newfoundland rivers, were less than half the values presently used for the model. These findings should serve as a caution that target egg depositions presently recommended for many Newfoundland rivers may be underestimated.

Résumé

À Terre-Neuve, la ponte cible du saumon de l'Atlantique est calculée d'après l'apport respectif des habitats fluviaux et lacustres à la production totale. La survie du stade de l'oeuf à celui du saumoneau est un paramètre essentiel du modèle qui sert actuellement à déterminer la ponte cible dans chaque type d'habitat. Or, il est apparu qu'en ce qui concerne plusieurs classes d'âge de saumon dans trois rivières de Terre-Neuve cette survie est en réalité inférieure de plus de la moitié à la valeur utilisée dans le modèle. Il ressort de cette constatation que les pontes cibles actuellement recommandées pour de nombreuses rivières peuvent avoir été sous-estimées.

Introduction

Currently, egg depositions for Newfoundland rivers are determined by converting numbers of smolts produced in fluvial and lacustrine habitats to numbers of eggs using an egg-to-smolt survival value of 1.25% for fluvial habitat and 1.9% for lacustrine habitat (O'Connell et al. 1991). These are interim egg-to-smolt survival values, and are to be used until such time that new information becomes available to justify change.

In this paper we examine egg-to-smolt survivals in three rivers for which data are currently available for several year classes. The rivers are Northeast Brook (Trepassey) and Freshwater River (Cape Race) located in Salmon Fishing Area (SFA) 9 and Conne River in SFA 11 (Fig. 1).

Results and Discussion

Fig. 2 is a schematic representation of the model used to calculate target spawning requirement, showing where egg-to-smolt survival values fit in the overall calculation. The limitations of the model and associated parameter values are discussed in O'Connell and Dempson (1991a,b).

Egg-to-smolt survival rates for Northeast Brook (Trepassey), Freshwater River (Cape Race), and Conne River are presented in Table 1. In Northeast Brook, survival ranged from 0.35% to 0.50% for four year classes. This river, which has historically possessed a population of Atlantic salmon, is dominated by fluvial habitat and natural egg depositions for the period under consideration exceeded 6.0 eggs/m^2 (based on accessible habitat). Survival for Freshwater River, which is also dominated by fluvial habitat, ranged from 0.28% to 0.69%. This river, which did not previously possess Atlantic salmon due to an impassible waterfall at the mouth, has been artificially stocked since 1985. Hence, there was a period of initial year class establishment. Stocking density for the first year class in Freshwater River was 6.0 eggs/m^2 while for the remaining years it was approximately 2.4 eggs/m^2. For Conne River, egg-to-smolt survival for two year classes ranged from 0.48% to 0.53%. In contrast to the other two rivers (third order), Conne River is much larger (sixth order) and possesses a relatively high proportion of lacustrine habitat. Smolt age composition (data for all years combined) for Northeast Brook, Freshwater River, and Conne River is presented in Fig. 3. Modal smolt age for Northeast Brook was 4+ years compared to 3+ years for the other two rivers. Smolt age ranged from 2+ to 6+ for Northeast Brook and Freshwater River and from 2+ to 5+ for Conne River.

The egg-to-smolt survival values obtained for the three rivers in this study were considerably less thas those currently in use for egg deposition determinations. These values were obtained from

rivers that differed with respect to morphological characteristics, stocking densities, stocking strategies, and relative proportion of fluvial versus lacustrine habitat. It should be noted that severe drought conditions in 1987 may have impacted negatively on parr survival across the year classes presented. Until longer time series have been developed, it is premature to recommend changing the current egg-to-smolt values. Findings presented here should serve as a caution that egg deposition requirements presently recommended for many Newfoundland rivers may be underestimated.

References

O'Connell, M. F., and J. B. Dempson. 1991a. Atlantic salmon (Salmo salar L.) target spawning requirements for selected rivers in Salmon Fishing Area 5 (Bonavista Bay), Newfoundland. CAFSAC Res. Doc. 91/17. 10 p.

O'Connell, M. F., and J. B. Dempson. 1991b. Atlantic salmon (Salmo salar L.) target spawning requirements for rivers in Notre Dame Bay (SFA 4), St. Mary's Bay (SFA 9), and Placentia Bay (SFA 10), Newfoundland. CAFSAC Res. Doc. 91/18. 14 p.

O'Connell, M. F., J. B. Dempson, and R. J. Gibson. 1991. Atlantic salmon (Salmo salar L.) smolt production parameter values for fluvial and lacustrine habitats in insular Newfoundland. CAFSAC Res. Doc. 91/19. 11 p.

Table 1. Egg-to-smolt survival values for Northeast Brook (Trepassey) and Freshwater River (Cape Race) located in SFA 9, and Conne River (SFA 11).

River	Brood Year	Egg-to-smolt Survival (%)
Northeast Brook	1984	0.50
	1985	0.35
	1986	0.45
	1987	0.46
Freshwater River	1985	0.69
	1986	0.79
	1987	0.28
	1988	0.30
Conne River	1986	0.53
	1987	0.48

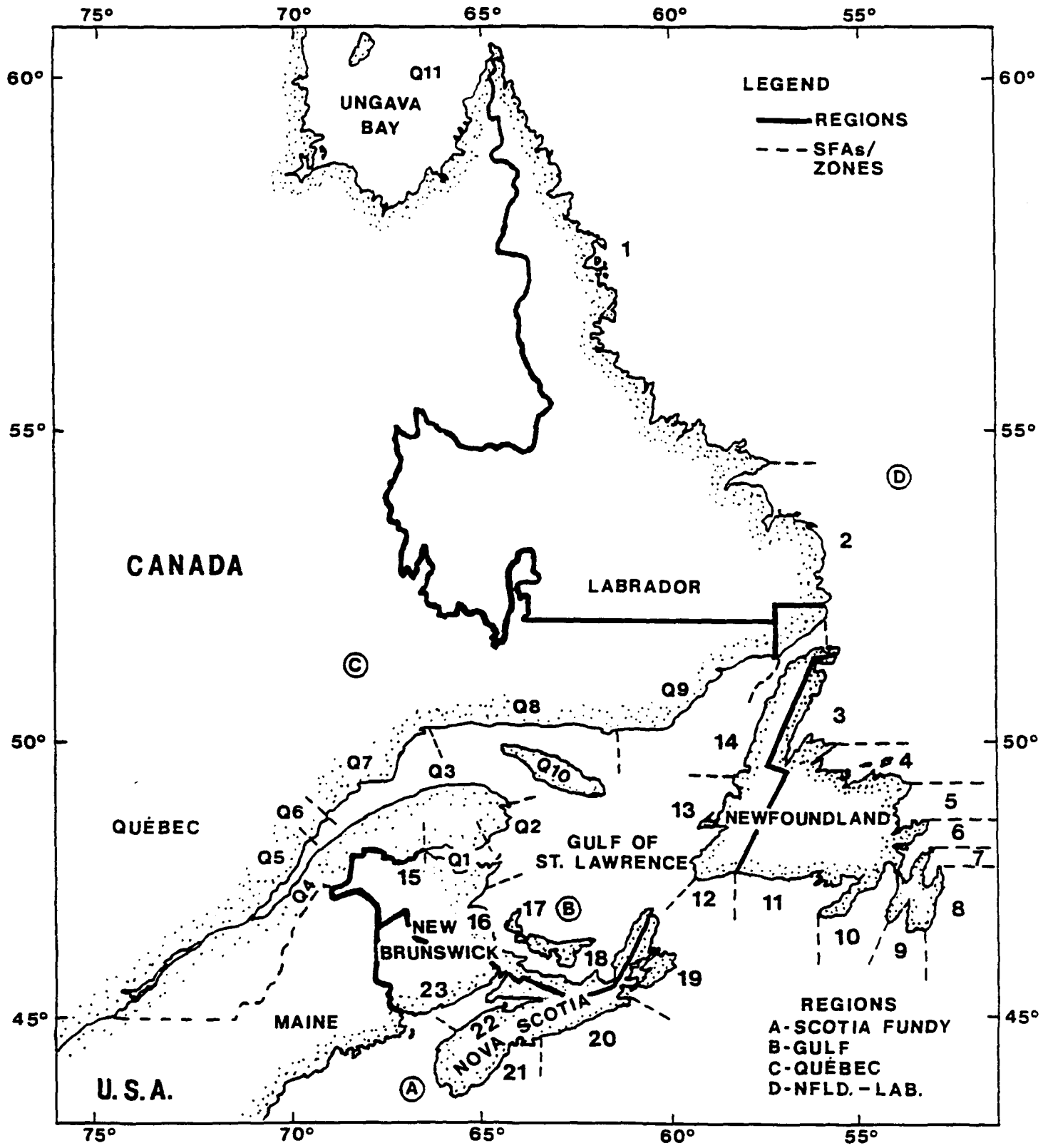

Fig. 1. Map of Atlantic Provinces of Canada showing Salmon Fishing Areas (SFAs) 1-23, Salmon Management Zones of Quebec (Qs) 1-11, and regional boundaries. The Newfoundland Region is comprised of SFAs 1-11.

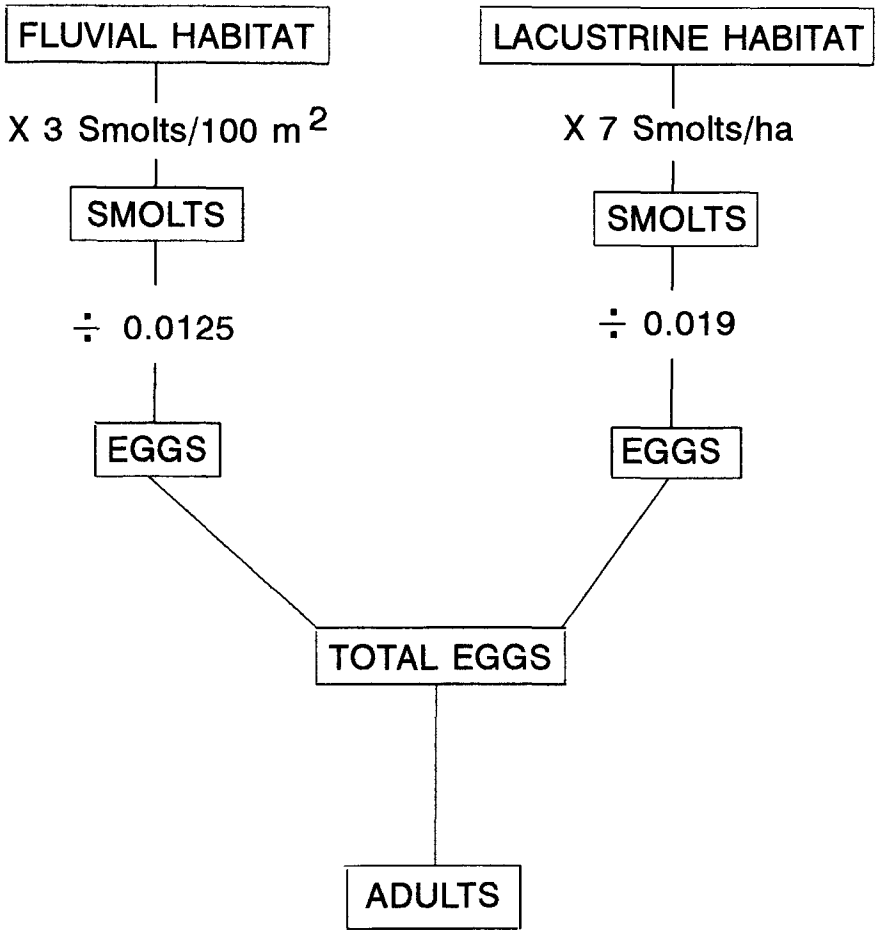

Fig. 2. Schematic representation of the model currently used to calculate target egg deposition requirements in Newfoundland rivers.

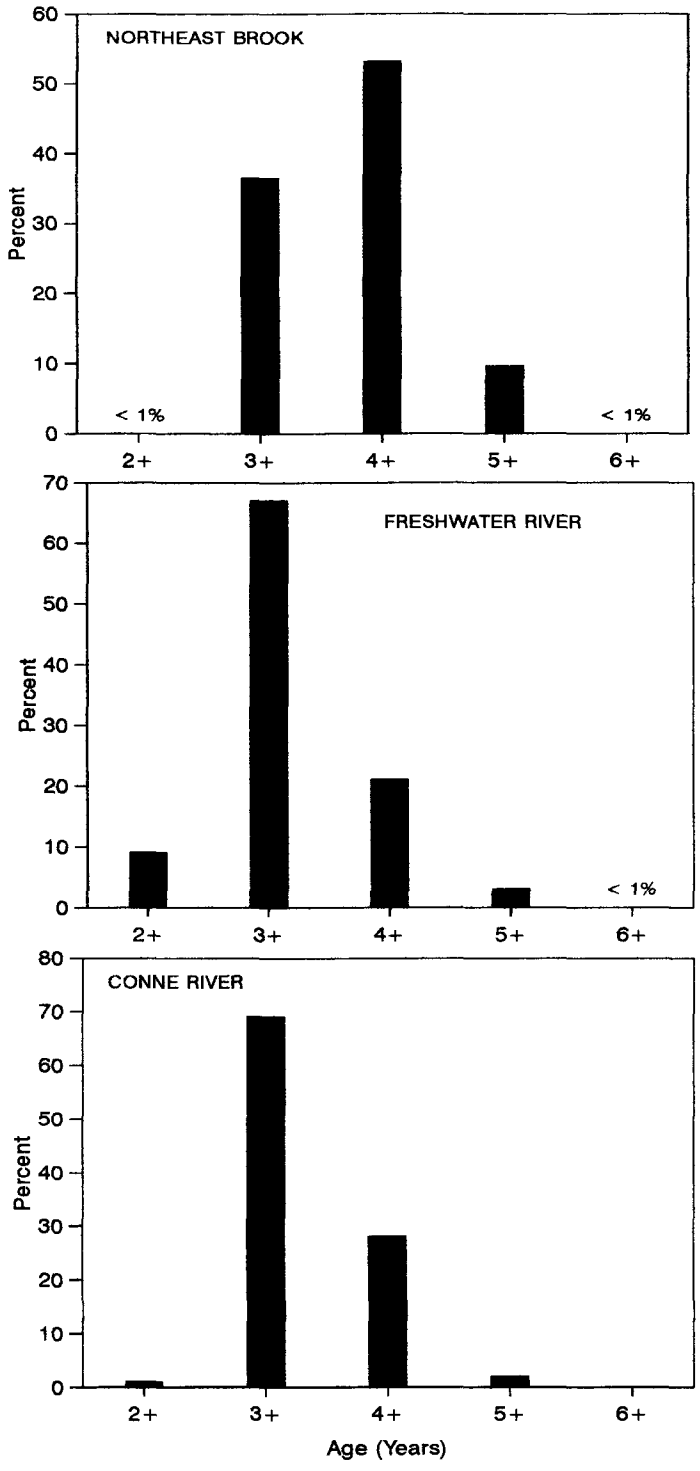

Fig. 3. Atlantic salmon smolt age composition for Northeast Brook (Trepassey) and Freshwater River (Cape Race) located in SFA 9, and Conne River (SFA 11).