DRIFTERS VERSUS RESIDENTS: ASSESSING SIZE AND AGE DIFFERENCES OF ATLANTIC SALMON FRY

Valérie Bujold
University of New Brunswick
Department of Biology, Bag service 45111
Fredericton, New Brunswick, CANADA, E3B 6E1
valerie.bujold@altavista.net

Richard A. Cunjak
University of New Brunswick

EXTENDED ABSTRACT ONLY - DO NOT CITE

Introduction

It is well known that some young-of-the-year (0+) Atlantic salmon have a tendency to drift soon after emergence from the gravel while others, so-called resident fry, set up and defend territories. This divergent behaviour can greatly influence survival within a population since very small behavioural and physiological differences between individuals can have major repercussions for subsequent life-history patterns, and therefore on recruitment and population production. According to Northcote (1978), this period is important in determining individual viability because mortality and growth rates are high during this phase of the life cycle. The goal of this project was to distinguish these two groups of fry on the basis of biometric characteristics.

Methods

Atlantic salmon fry were collected in Western Brook and its tributary, Stag Brook, Gros Morne National Park, Newfoundland (Canada). Resident fry were caught by electrofishing, and the drifting fry with drift samplers, simultaneously and in the same habitat. Sampling commenced at the start of the drift period within each brook. We sampled every three days, for each site, until the end of the drift period to determine if there was temporal variation. For each site, approximately 20 fry of each group were kept for measurements (length, weight) and frozen. Condition factor ($K = \text{weight} / \text{length}^3$) was also calculated.

e are currently ageing these fish using the otolith reading technique. Atlantic salmon fry, as many other teleosts, produce daily increment on their sagittae that are visible under light microscopy (Wright et al., 1991). Under natural photoperiod, salmon fry also produce a check ring on the sagittae at first feeding, that can serve as a set-point to establish age (days) since emergence.

Results

Resident salmon fry from both populations were significantly longer and heavier than drifters (Fig. 1, a, b, d, e). Condition factor was significantly higher for residents from Western Brook, but no such difference was measurable for fry from Stag Brook (Fig. 1. c, f).

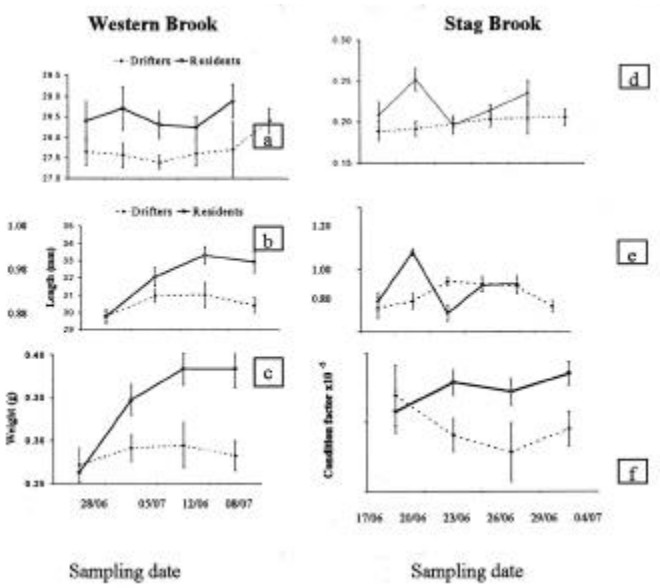

Fig. 1. Comparison between drifting and resident Atlantic salmon fry for length (mm), weight (g), and condition factor sampled during the summer of 1999 in Western Brook and Stag Brook.

Discussion

We found that resident fry are heavier and longer than the drifters for the entire period of drifting movement. These differences were present within the two different brooks and at different periods of the year. Moreover, as seen in Western Brook, the condition of the resident fish improved with time, while the drifters condition worsened.

The possible reasons for these differences are that a hierarchy may develop, between the two groups, at a certain time after the emergence from the gravel and that the drifting individuals are driven away from the habitat by the aggressive behaviour of resident fry. Salmon fry could establish a size-related dominance, through aggressive interactions, with dominant fish holding the positions that offer "maximum potential profit" (Titus, 1990). Subordinates may often be excluded from the best feeding areas, or may suffer a reduced foraging efficiency through the loss of food items (Metcalfe et al., 1986) which would explain the size difference between the two sub-population.

It is also possible that the differences can be explained by the fact that early emergers gain a competitive advantage over subsequently arriving rivals by having first choice of favourable stream positions, and because of the size advantage they are able to gain. By looking at the otolith, we will be able to determine the timing, in days, of the drifting movement because of the emergence check-mark and then determine if there is an age difference between the groups.

In conclusion, resident fry are in better condition than drifters and that can have major repercussion on their individual future. Dominant fish usually retain and increase their size advantage. Usually, the same fish remains dominant in the wild for months and even years and the resulting differential allocation of resources according to status can produce great variability in the growth and fitness across the population. According to Metcalfe (1993), a major driving force behind life-history variation in fish is variability in growth rates. It has long been recognized that faster growing individuals tend to mature and migrate at an earlier age. Considerable enhanced fitness can result from a minimal increase in growth performance and so might be worth the cost involved in aggressively defending the resources for the resident fry.

Acknowledgements

Drs. D. Quiring and S. Flemming, and Mr. G. Chaput assisted significantly in project

development. Financial support came from the Ecosystem Science Fund, Gros Morne National Park, and from a NSERC grant to R. Cunjak.

References

Metcalfe, N. B. 1993 .Behavioural causes and consequences of life history variation in fish. Mar. Behav. Physiol. 23:205-217.

Metcalfe, N.B., Huntingford, F.A., and Thorpe, J.E. 1986. Seasonal changes in feeding motivation of juvenile Atlantic salmon (*Salmo salar*). Can. J. Zool. 64: 2439-2446.

Northcote, T. G. 1978. Migratory strategies and production in freshwater fishes. In *Ecology of Frewshwater Fishes Production* (S.D. Gerking, Ed.). Blackwell Scientific Publications, Oxford. 326-359.

Titus, R. G. 1990. Territorial behavior and its role in population regulation of young brown trout (*Salmo trutta*): new perspectives. Ann. Zool. Fennici. 27:119-130.

Wright, P. J.; Rowe, D. K., and Thorpe, J. E. 1991. Daily growth increments in the otoliths of Atlantic salmon, *Salmo salar* L., and the influence of environmental factors on their periodicity. Journal of Fish Biology. 39:103-113.