ANADROMY IN BROOK TROUT: RELATION TO DIET

PARTITIONING WITH COEXISTING ATLANTIC SALMON

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EXTENDED ABSTRACT ONLY - DO NOT CITE

Introduction

Many populations of trout have both anadromous (migrant) and non-anadromous (resident) forms in the same river ecosystem (Northcote, 1992). The forms have different life history strategies. Both elements of genetics and environment may govern the partial migration (Jonsson and Jonsson, 1993). In the Sainte-Marguerite River (SMR) ecosystem of Eastern Quebec, Canada, brook trout (*Salvelinus fontinalis*) migrate from those streams where they co-exist with Atlantic salmon (*Salmo salar*) and rarely from that where the trout are the only occupant. Feeding conditions in different streams could be a major environmental determinant of anadromy in trout (Nordeng, 1983). Existence of other competing species, such as the Atlantic salmon, could alter the feeding conditions. We compare here the feeding ecology of trout in two streams of the SMR, Allaire and Epinette, with and without salmon, respectively. Trout outmigrates only from Allaire.

Methods

Fish were caught by electroshocking the chosen stream reaches at 4 hour intervals over 24 h, on three occasions during August-September, 1996. After anesthetization, length and wet mass of the fish were recorded. Gut contents were collected by pulsed hydraulic gut flushing and frozen until analysis. Contents were identified, enumerated and dried in pre-weighed aluminum pans at 70°C for 72 h to obtain the dry biomass of food taken. Diet similarities between trout and salmon in Allaire and between trout in Allaire and trout in Epinette were calculated using Schoners' Overlap Index (Krebs, 1989). Daily ration of the fish was estimated by Eggers' model (Eggers, 1977; Amundsen et al., 1999). Only fish with fork lengths between 7-14 cm (1+ and 2+ age groups) were selected for this study.

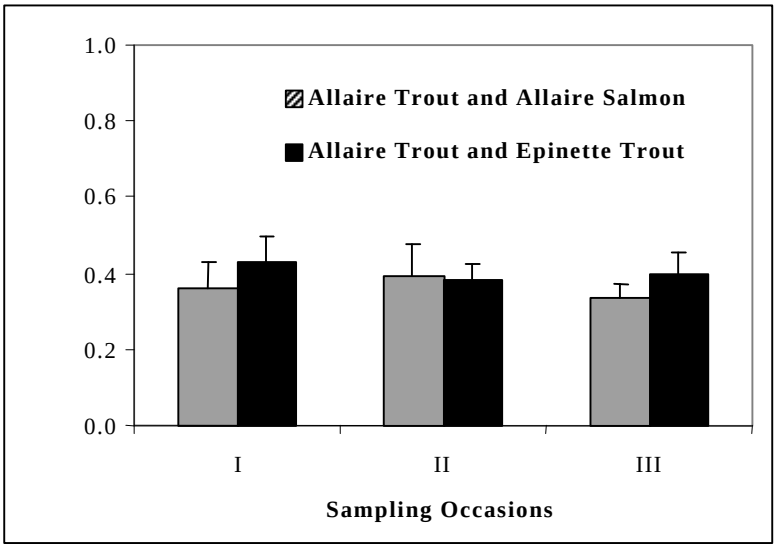

Figure 1. Diet overlap between coexisting trout and salmon in Allaire and between trout in Allaire and trout in Epinette on three sampling occasions in 1996 (I: Aug. 9-12; II: Aug. 28-31; III: Sept. 20-23). Values > 0.6 indicate significant overlap (Krebs, 1989).

Results

The insignificant overlap in diet between salmon and trout in Allaire suggests food partitioning between coexisting salmonids (Figure 1). On all sampling occasion, the diets of trout in the two streams were significantly different (low overlap, Figure 1). The trout in Epinette fed primarily (~70%) on autochthonous aquatic insects (Trichoptera, Ephemeroptera), while the trout in Allaire fed a lot more (up to 80 %) on the allochthonous terrestrial components (adults of Diptera and Hymenoptera) of the stream drift (Table 1). Similar-sized salmon fed predominantly on the aquatic drift (Ephemeroptera). The conditions of the trout for the age groups studied, were comparable in both streams. Assuming a similar gastric evacuation pattern, trout in Epinette fed twice as much as those in Allaire on any sampling occasion (Table 1).

Table 1. Summary of observations in two streams. Values for Condition Factor and Daily Ration (g dry weight of food 100 g^{-1} wet weight of fish day^{-1}) are averages from all sampling occasions. All other values indicate the range for all occasions pooled.

	Trout in Epinette	Trout in Allaire	Salmon in Allaire
Fish Condition Factor	1.078	1.081	1.157
Daily Ration	1.622	0.709	0.451
Prey Type Taken (%)			
Aquatic	70-76	24-33	80-90
Terrestrial	24-30	67-76	10-20
Major Prey Taxa (%)			
Aquatic			
Ephemeroptera larvae	25-30	8-14	39-60
Trichoptera larvae	27-35	6-15	11-30
Terrestrial			
Diptera adults	2-8	2-23	1-5
Hymenoptera adults	1-4	12-51	0-15

Discussion

In general, the trout in these streams have poor feeding conditions; the total drift densities are very low (~ 4 m^{-3}) compared to other salmonid streams (~ 60 m^{-3}). This could be further aggravated by the presence of closely related and more aggressive species such as the salmon. The separation in feeding niches between sympatric and possibly competing trout and salmon in Allaire allows a greater exploitation of resources and their coexistence. However, it appears that a major environmental determinant of partial anadromy of trout seen only in Allaire, could also be related to this food partitioning. The quantitative and qualitative differences in the diet intake of trout in the two streams were not related to the prey availability within the streams.

Feeding on terrestrial invertebrates appears to be less profitable. The allochthonous inputs would depend on the extent of riparian canopy which is very poor along Allaire. Also, our preliminary biochemical analyses indicate a different macromolecular (e.g. fatty acid profile) composition of the terrestrial invertebrates compared to the aquatic ones. The lower intake of food and a more terrestrial invertebrate consumption by trout in Allaire, suggest a different foraging efficiency of the trout in the presence of salmon, when compared to in its absence. This may influence the fitness of the trout in sympatric streams and subsequently may contribute to their partial anadromy.

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