How does parental contribution affect offspring performance in anadromous and resident brown trout, *Salmo trutta L.*?

Submitted by

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ABSTRACT

The brown trout, Salmo trutta L., displays one of the most variable and polymorphic life-history strategies of all the salmonids. In some populations, individuals spend their whole life-cycle in the river (freshwater-resident) whereas in others, a varying proportion migrates to sea for variable amounts of time to better feeding conditions before returning to spawn (anadromous). The 'decision' if an individual will migrate or not will be determined by the balance of the costs and benefits of following a particular life-history strategy. The balance of these, which do not affect males and females equally, will determine the future success (measured by fitness) of each strategy. This research addresses the influences of parental contribution, mainly maternal effect, of anadromous and freshwater-resident brown trout on offspring performance and subsequent life-history.

A partial migratory population of brown trout was studied in the Tadnoll Brook, one of the seven major tributaries on the River Frome. The tributary is classified as a circum-neutral chalk stream, 9.9 km long with a catchment approximately 50 km2. Carbon and nitrogen stable isotope analysis (SIA) was used to quantify maternal reproductive contribution of anadromous and freshwater-resident brown trout to offspring and determine the future success (measured by fitness) in terms of size and time of emergence. A panel of 12 microsatellite loci was used to assign parentage to 0+ parr. Using field data collected over 1.5 years on individual fish, this study tested parental influence on offspring performance in terms of size and growth rate and calculate the reproductive contribution of maternal/paternal anadromous and freshwater-residents. Adult life-history strategy was identified using a combination of results from SIA, PIT tag data and ecological data (body size, temperature). Parr life-history strategy (1+) was inferred using PIT tag detection data.

The results of the SIA indicated fry of anadromous females emerged earlier and at a larger size than fry of freshwater-resident females. Parentage assignment of parr was low (28 %), with 8 parr assigned to both parents and 43 assigned to only a single parent. There was no detectable effect of parental life-history on parr size and growth rate, however the raw data may suggest offspring of anadromous parents have an early size advantage but a slower growth compared to offspring of freshwater-resident parents during the first year of the parr stage. Twenty-four percent of the offspring were identified as putative smolts at 2+ and both forms interbred and could produce offspring of each life-history. Estimates of reproductive

contribution (SIA and growth) show a higher proportion of anadromous females and males (growth only) contributed to offspring production.

The results of this research indicate that the maternal anadromous contribution is higher in the Tadnoll Brook population, affording fitness benefits to their offspring during early ontogeny such as size advantages and emerging at a more profitable time to establish feeding territories. Adult life-history does not appear to influence juvenile (0+ parr) life-history but may have an effect on offspring performance. The presence of both forms in the population suggests the anadromous fitness benefits to offspring may only have an affect during ontogeny and early stages of growth. Then after juveniles reach a size threshold environmental factors influence offspring life-history, resulting in the largest parr with the fastest growth adopting an anadromous life-history.

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