

Investigating the natal origins of sea trout (*Salmo trutta*) entering the Rivers Tamar, Tavy and Lynher, southwest England

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Summary

For fisheries management to be effective, information on the stock composition of the fisheries in question is essential. We demonstrate the utility of a microsatellite baseline for estimating the stock composition of sea trout entering three rivers in southwest England that share a common estuary. There is a high degree of geographical structuring of the genetic variation with rivers being grouped into eleven reporting regions. Testing with simulated and real datasets showed fish can be assigned to both region and river of origin with a high degree of accuracy. Mixed stock analysis of over 1000 sea trout showed that the fish entering all three rivers constituted mixed stocks. In the Tamar, straying is restricted to the lower catchment. As well as providing insight into sea trout behaviour, this study also has important management implications. A salmonid net fishery is due to restart within the Tamar estuary in the near future and our results highlight that this will likely be a mixed stock fishery.

Introduction

The perceived wisdom is that anadromous species such as sea trout and salmon, after spending time feeding at sea, return to their natal river to spawn, though straying is known to occur and is thought to play an important role in colonization and range expansion. However, the extent of straying is often difficult to determine.

We highlight the utility of the Atlantic Aquatic Resource Conservation (AARC) Project trout microsatellite baseline by presenting results of a study on the origins of sea trout entering the Rivers Tamar, Tavy and Lynher, all major sea trout rivers in southwest England.

Materials and Methods

For the initial genetic baseline, individual resident trout were sampled from 83 populations from 31 rivers Devon and Cornwall, south west England. Fish were caught during routine electrofishing surveys. The sampling scheme was designed to reduce the collection of potentially related individuals by targeting 1+ or older fish. Sea trout scales were obtained from a fish trap at the tidal limit of the Tamar as well as from fish caught in the rod-fisheries within the Tamar, Lynher and Tavy. All samples have been genotyped using 19 microsatellite loci. The final baseline contains genotype data for ~3200 fish.

Mixed stock analysis (MSA) was conducted using the Bayesian procedure of Pella and Masuda (2001) as implemented in cBayes (Neaves *et al.* 2005). Simulated and known-origin mixtures were used to test the accuracy of stock compositions derived from the baseline. Baseline reporting regions were identified from population groupings determined from a neighbour-joining dendrogram based on Cavalli-Sforza and Edwards (1967) chord distance.

Results and Discussion

There was a high degree of genetic structuring of the baseline samples with geographically proximate rivers being genetically similar. This allowed the 31 rivers to be clustered into 11 groups for assignment purposes. MSA of simulated single river, single reporting region and real single river mixtures showed a high degree of self-assignment, especially to group. Importantly, mis-assignment to our focal rivers was negligible.

Results indicate that a significant proportion (>10%) of the trout caught in the Tamar trap are strays, mainly from the Lynher and Tavy, but also from other rivers in south Devon and Cornwall (Figure 1). The assignments of fish from the in-river rod fisheries also show a high degree of

straying, especially for the Tavy, where assignment to other rivers exceeded 70%. Within the Tamar, straying is restricted to the lower catchment with non-natal fish not penetrating into the upper catchment.

These results highlight an interesting aspect of sea trout biology, namely that non-natal fish are frequently entering the freshwater reaches of our three focal rivers, but at least for the Tamar, they don't migrate higher into the catchments and therefore do not contribute to the spawning population.

From a management point of view, our results indicate that the rod fisheries in the lower Tamar, Tavy and Lynher constitute a mixed stock fishery (MSF) under the NASCO (2000) definition of a MSF. However, as the three catchments discharge through the same estuary, they are currently considered the same 'river' (Potter and Ó Maoiléidigh 2006) and the fish within this 'river' are deemed to constitute a single stock. Finally, the definition of a MSF being used by the Environment Agency in England does not currently apply to sea trout. Nonetheless, our microsatellite evidence shows they are genetically distinct entities and highlights the need to incorporate genetic evidence into current MSF definitions.

References

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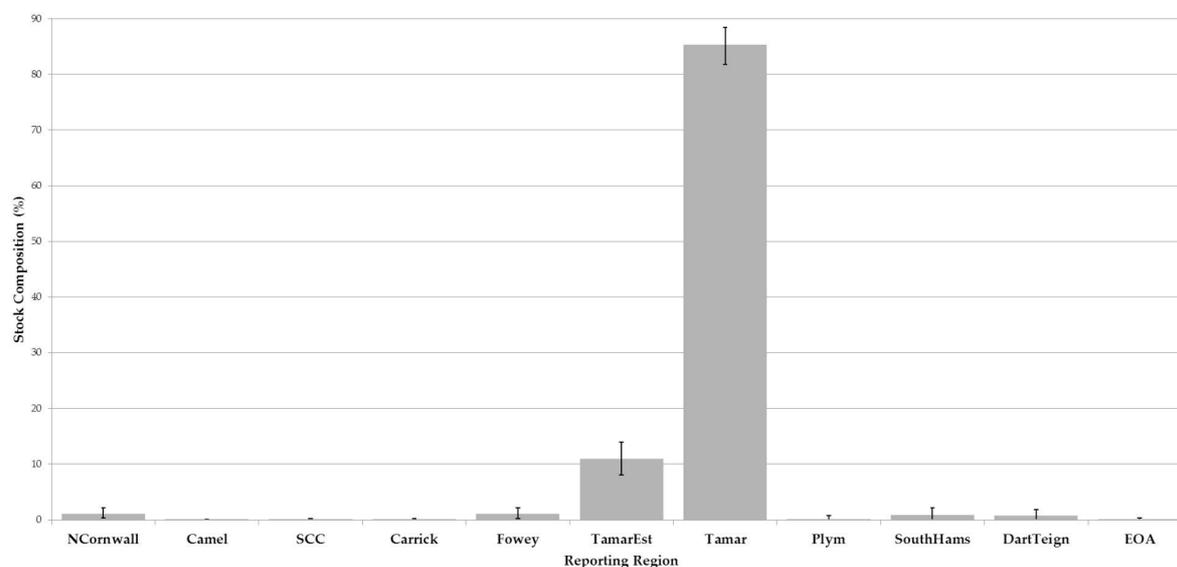


Figure 1. Mixed stock analysis for sea trout caught in the Tamar fish trap. Assignment percentages are plotted with 95% confidence intervals