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The marine life of Atlantic salmon: evidence from scale isotopes

Kirsteen MacKenzie (1), Clive Trueman (1), Martin Palmer (1), and Andy Moore (2)

(1) School of Ocean & Earth Sciences, University of Southampton, Southampton, UK (kym@noc.soton.ac.uk), (2) Cefas, Lowestoft, UK (andy.moore@cefas.co.uk)

The wild Atlantic salmon has been in decline since the 1970s, with the majority of mortality occurring at sea where direct monitoring is difficult and expensive. The isotopic composition of carbon and nitrogen in fish scales provides information on the trophic level and nutritional status of the fish, and the state of primary production at feeding sites, which provides information on migration patterns. Archives of salmon scales dating back decades exist around Europe and may be used to assess historical trends in salmon ecology.

In this project three geographically distinct scale archives from the UK are used: the Cefas North Sea driftnet, the CEH Dorset River Frome and the Environment Agency Welsh River Dee archives (all records span 1985-2002). These archives have been selected following an extensive search for salmon scale archives of UK rivers, and were chosen as the longest and most complete archives for comparison.

We are using stable isotope data to identify the extent of geographic separation in marine feeding, and to test whether climatically-driven changes in ocean conditions correlate with periods of high or low marine mortality or to changes in trophic level and body condition of the returning fish. The results are compared both within and between populations, in particular assessing differences in marine behaviour of fish that return as grilse (1 sea-winter) or as MSW (multi sea-winter) fish.

The magnitude and timing of fluctuations in δ^{13}C data are not consistent between archives, indicating a complex, population-specific relationship between ocean productivity, migration and fish survival. We are using these results to produce isoscape maps showing strengths of covariation between δ^{13}C in these salmon scales and oceanographic variables, positing a means of inferring marine feeding areas for the different stocks based on their temporal δ^{13}C variability.