# Spatial and temporal variability of elemental signatures in juvenile winter flounder (*Psuedopleuronectes americanus*): implications for natal connectivity

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Elemental signatures in otoliths (fish ear-stones) have become a powerful tool in fisheries science for identifying fish migration patterns, reconstructing environmental histories, and for delineating the nursery origins of adult fish populations. Assessing connectivity between adult offshore populations of fish and juvenile nursery areas requires an understanding of both the spatial and temporal variation in otolith chemistry. In this study, we investigated the spatial and temporal variability of elemental signatures in juvenile winter flounder collected from different nursery areas over a 3 year period to determine if chemical signatures could be used as natal tags.

Juvenile winter flounder (45-65mm) were collected (2002-2004) from different locations and habitats (unvegetated, macroalgae, and eelgrass) within Narragansett Bay, RI (USA), surrounding coastal ponds, and from a tidal river system. Sampling stations were selected based on salinity gradients and historical abundances of juvenile winter flounder. Otolith samples were analysed for elemental concentrations of Ba, Ca, K, Li, Mg, Mn, Na, Ru, and Sr using Inductively Coupled Plasma Mass Spectrometry (ICPMS) and or Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES).

Elemental concentrations in juvenile winter flounder otoliths varied according to water body type. Trends among water bodies were consistent over the 3 year sampling period. As expected, fish collected along a salinity gradient (19-32‰) in Narragansett Bay showed positive correlations (2002: r=0.25; 2003: r=0.52; 2004: r=0.47) between salinity and Sr. In contrast, fish collected along a salinity gradient (13-32‰) in Narrow river had the highest Sr concentrations and showed negative correlations (2002: r= -0.78; 2003: r= -0.70; 2004: r= -0.69) between salinity and Sr. Linear discriminate functional analysis used to classify fish to different nursery areas showed that Sr was the most important element to describe the multivariate fingerprint followed by Ba, Mg, Mn, and Li.

Results of our study provide insight into the spatial and temporal scales of variation in chemical signatures of juvenile winter flounder and suggest that differences in watershed characteristics (bedrock, soils, sediments, hydrogeology, mixing of water masses, etc.) and physical properties (salinity) may play important roles in elemental incorporation in otoliths. Future multivariate statistical analysis of juvenile cores extracted from adult offshore populations of winter flounder will be used to determine natal affiliation and connectivity.

Key words: otolith; winter flounder; elemental signatures