Geophysical Research Abstracts
Vol. 14, EGU2012-9281-1, 2012
EGU General Assembly 2012

The Regional Patterns of Chemical Composition in the Otolith Core of Larval Fish

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The elemental composition of fish otoliths can record the environmental information because once a trace element is deposited in the otolith; it presents a permanent record of the environmental conditions experienced by the fish at a particular time. The elemental signature of the otolith nucleus, the area lying within the first annual growth ring, is likely to be characteristic of the nursery areas of the species, and could be used as biological tracer for tracking origin and dispersal. However, ocean acidification may alter otolith growth and element incorporation, and it is important to establish baseline information about the sources of variation – both biotic and abiotic. The objectives of this study, as part of the wider CalMarO network, is to examine the regional differences in the otolith cores of selected fish species, contrast these differences with those measured between these same species in areas where their larvae co-exist and to find out the maternal effect to the chemical composition during the first forming of otoliths. The laboratory and field experiments were included to produce otolith material reflecting the maternal and regional patterns. Otolith composition was measured using laser-ablation ICPMS.
For clarifying the regional patterns, juveniles from six locations and seven spawning groups along the west of the British Isles and larvae from the North Sea were sampled to distinguish the origin of spawning herring. There are three main nursery-ground groups, the Irish Sea, Scottish sea lochs and the Minch, contributing to the spawning herring in the west of the British Isles according to the otolith elemental composition data. However, the spawning origin of the North Sea herring larvae was still unclear. The otolith concentrations of Li, Na, Mg, Mn, Cu, Ru and Sr were significantly different among nursery-ground populations. Together with length-at-age data, at least two nursery-ground groups contributed to each spawning population. The juveniles from western Irish Sea and the Stanton Bank contributed most to the spawning populations. The otolith signature (without length-at-age information) indicated that the North Sea larvae contributed mostly to the spawning herring from the Dingle and the Cape Wrath. The results suggested that there might be different current systems, which drove the larval dispersal both northward and southward from the spawning ground to the North Sea. Although there might be mixtures and interconnections among the west coast herrings, which resulted in the similar otolith chemical signals, the otolith chemical composition still provided useful information of regional differences for tracing back the origin of spawning populations. The detailed current system may be needed to provide more inference for the larval dispersal and the linkage between nursery-ground and spawning populations.

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