Geophysical Research Abstracts
Vol. 12, EGU2010-1569-1, 2010
EGU General Assembly 2010

IsoMark - a comprehensive assessment of the potential of isotopes in hard parts of freshwater fish to determine origin and migratory patterns using LA-(MC)-ICP-MS

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The 'IsoMark' project focuses for the first time on the comprehensive investigation of microchemical information (elemental fingerprint of Ca, Sr, Na, Ba, Mg; isotopic fingerprint of Sr, Ca, and additionally of C and O) in different hard parts of several typical European freshwater fish species like brown trout (Salmo trutta f.f., L.), European grayling (Thymallus thymallus, L.) or nase (Chondrostoma nasus, L.) and the barbel (Barbus barbus, L.). Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) is used as major technique for the direct in situ analysis of trace elements and isotopes, whereby the employment of a multiple collector – inductively coupled plasma – mass spectrometer (MC-ICP-MS) enables high precise isotope ratio analysis of such sample matrices due to its simultaneous detection capabilities. Microchemical patterns in hard parts of farmed and wild fish are analysed resulting in natural site specific elemental and isotopic signatures. Within a pilot study the potential to discriminate between wild and hatchery trout by chronological microchemical patterns of different otolith regions in relation to site specific water chemistry was documented. 100% accuracy of classification of fish to life stage specific habitats and therefore to their origin was achieved by the elemental ratios 88Sr/43Ca, 23Na/43Ca and the isotope ratio of 87Sr/86Sr. Clear differences in otolith chemistry were found, when fish experienced different geological units or specific environmental situations (e.g. groundwater) in hatcheries during a certain period of their life. These results proved the concept that natural microchemical patterns in hard parts linked to specific life stages of fish represent a valuable tool for a wide variety of ecological questions, e.g. discriminating wild and hatchery fish without the necessity of inducing any other artificial mark, or studying natural migration phenomena on small spatial scales in freshwater systems within geologically diverse river catchments.