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The potential of microchemical information in fish hard parts to study origin and migration in the Austrian Danube catchment

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Mainly due to the underlying geology, the Danube and its tributaries show a spatially distinct pattern in their elemental and isotopic composition. Fish living in a certain river system store the local chemical information in their hard parts (otoliths, scales, fin rays and vertebrae), allowing the determination of the origin of fish and bearing the potential to answer important ecological questions such as migration habits, which are usually difficult to monitor.

Focusing on freshwater fish, this study is the first to be done on a typical European fish species, the European chub (*Leuciscus cephalus* L.). Water and fish samples were taken from different rivers along the course of the River Danube in Austria and based on their microchemical composition (Ca, Mg, Sr, Na and the $^{87}Sr/^{86}Sr$ ratio), water samples were clustered to identify isozones which represent areas with similar chemical signatures. In a second step, the microchemical information in the fish hard parts was analysed in order to find out whether they could be matched with the chemical information of their origin, or respectively with the corresponding isozones.

Furthermore, the incorporation of the chemical information was studied in more detail, revealing the effects and influences of the time exposed to specific conditions in a river, the season, temperature and geological background. For this purpose, E. chub and barbel (*Barbus barbus* L.), were transferred from a river with calcareous background to a river with siliceous background and vice versa. The fish were held in specially designed fish cages under semi-natural conditions. Water chemistry was sampled before and after the exposure, while temperature was monitored during the whole experiment. After two and a half to three months of exposure, five fish from each location were sampled in order to investigate their hard parts.

The analysis of water samples and fish hard parts was conducted using nebulisation-based and laser ablation inductively coupled plasma mass spectrometry, respectively, whereby a quadrupole instrument (ICP-QMS) was used for trace element analysis and a multiple collector instrument for strontium isotope ratio analysis (MC-ICP-MS). The combination of these analytical techniques provides the establishment of specific elemental and isotopic fingerprints of individual rivers and/or isozones and is able to deliver highly precise information about the origin and migration of fish.