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Transgenerational isotopic marking of carp *Cyprinus carpio*, L. using a ^{86}Sr /^{84}Sr double spike

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Transgenerational isotopic marking has been recognized recently as an effective tool for mass marking and tracking of individual fish to their original source. Compared to other conventional marking techniques, transgenerational marking offers several advantages. Most importantly, it is possible to mark all offspring of one individual female without the necessity of handling eggs or larval fish. Furthermore it is possible to vary the concentrations of individual isotopes to obtain specific marks for individual female fish. An enriched isotopic spike solution is usually applied to gravid female spawners by injection into the body cavity for transgenerational marking. The isotope is then incorporated into the central otolith region of the offspring which is known to be built up by maternally derived material. Within this study transgenerational marking of a typical cyprinid fish species, *Cyprinus carpio*, L., was tested using a ^{86}Sr /^{84}Sr double spike. Buffered solutions with different isotopic composition and concentrations were administered to 4 female individuals by intraperitoneal injection 5 days before spawning, while one female was injected a blank solution. After spawning, otoliths (Lapilli) from juvenile fish were sampled at the age of about 5 months at fish sizes between 3 and 4 cm and analyzed for their isotopic composition by LA-ICPMS applying cross sectional line scans. Central otolith regions of the progeny showed a shift in the natural isotope ratios for the administered isotopes. Deconvolution of the blank corrected measurement data of the Sr isotopes was done to trace back the original spike ratio. The different spike ratios could be well distinguished reflecting the original composition of the spike solution. This study proved that it is possible to create batch-specific unique transgenerational marks in otolith cores by varying the concentrations of two naturally occurring Sr isotopes. This method has high potential to reduce the marking effort for any application in aquaculture and ecological research and management where the tracking of high numbers of offspring is needed.