

Mississippi River Basin Water Oxygen Isotope and Trace Element: Calcium Ratio Supplemental Data Set

Summary:

The elemental composition of water is used to identify the environment and distribution of both native and non-native fishes, particularly during early life stages, through analysis of individual fishes calcareous inner-ear or otolith. If locations that a fish occupies during its lifetime is chemically distinct and the fish spends sufficient time in each location to grow and acquire location-specific chemical “signatures” in its otolith, it is possible to infer which locations a fish occupied by analyzing samples taken from specific locations within the fish’s otolith. Water chemistry of the Upper Mississippi River, Middle Mississippi River, Illinois River, the lower Ohio River, and tributaries of these rivers or river segments has been studied for this purpose and relatively well-characterized. Water samples from main-stem rivers and tributaries where relevant water chemistry data are limited, particularly in the Lower Mississippi, Missouri, upper Ohio, and Tennessee-Cumberland drainages, are needed to assess potential applicability of otolith microchemistry techniques to native and non-native fishes. The objective of this study was to assess water chemistry, specifically strontium, barium, and calcium concentrations and stable oxygen isotope ratio of mainstem rivers and tributaries in the Mississippi River basin during 2021, focusing on rivers where limited or no water chemistry data were available.

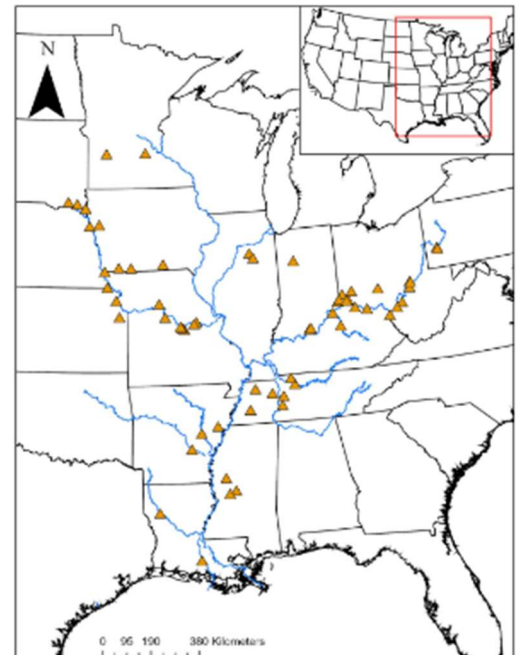


Distribution of Samples:

The map depicts the distribution of samples from throughout the basin. Orange triangles represent sampling locations. Blue lines represent a truncated version of the navigable portion of mainstem rivers for reference. Please see data available below for access to the full dataset and details of results by tributary or basin.

Caveats:

- The applicability of calcified structure chemistry studies to infer environmental history of fishes depends on the presence of persistent differences in water chemistry among relevant locations, which differ among studies depending on objectives (ex., identification of natal environments or inter-river movement patterns).
- The likelihood of being able to distinguish among relevant locations using one or more natural chemical markers generally declines as the number of locations increases due to the limited set of natural markers that meet the fundamental criteria for use in calcified structure chemistry studies.
- Individual fish need to remain in a location long enough to accrue enough calcified structure growth to acquire the chemical ‘signature’ of that location.
- Water chemistry in individual rivers is subject to temporal variability.
- Additional water sampling should be conducted as part of any calcified structure chemistry study, particularly in rivers where limited data are available.



Available Data:

- Whitledge, G. 2022. Water Sampling in the Mississippi River Basin to Inform Calcified Structure Chemistry Studies on Fishes.
 - Report available at: https://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=1013&context=fiag_reports
- Whitledge, G. 2022. Mississippi River Basin Water Sr:Ca, Ba:Ca, and Stable Oxygen Isotope Data.
 - Data available at: https://opensiuc.lib.siu.edu/fiaq_data/13