

Stable Isotopes and Museum Samples Provide Baselines and Metrics for River Restoration

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River and stream restoration aims to reverse long-standing and undesirable ecological changes, but the effects may take decades to manifest. Stable isotope analysis (SIA) of samples held in biodiversity collections offers baselines and metrics for assessing conditions before restoration, and provides a means to track restoration progress if appropriate sampling is conducted. I explore this approach in the Rio Grande in New Mexico where various disturbances have impacted the ecosystem over the past century. Disturbances include channel incision from sediment deprivation, a dampened flow regime, and exponential human population growth. SIA of carbon and nitrogen was conducted on museum-preserved fishes. Metrics associated with trophic complexity and resource heterogeneity for fishes decreased significantly after flood-control structures were completed and these effects persist today. Increased nutrient inputs led to $\delta^{15}\text{N}$ enrichment in the entire fish community and effects were pronounced downstream of a major wastewater release point. Restoration of sediment supply, creation of low-lying riparian habitats and meandering river courses, and wastewater treatment improvements are expected to move SIA-derived metrics away from the disturbed state, helping track and assess the effectiveness of restoration efforts over time. I also discuss some limitations of this approach in detecting restoration-related changes.

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