

Science

BRIEFING

March 4, 2014

DNA BARCODING AT RIVERSCAPE SCALES

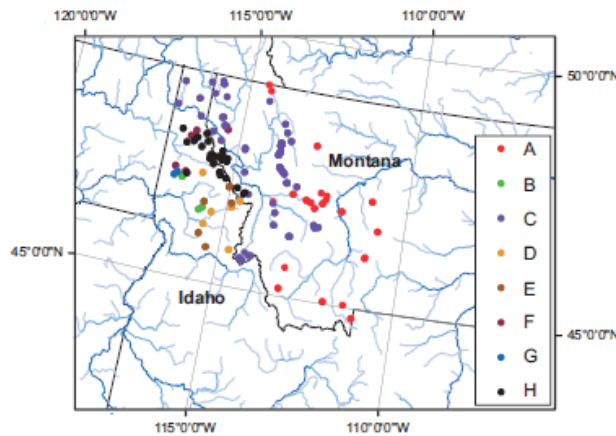
BACKGROUND

Projections of a rapidly changing climate and increasing human population have led to calls for broad-scale biodiversity assessments that can serve as benchmarks for identifying ecological change. Genetic tools have been used for such assessments for decades, but spatial sampling considerations have been overlooked.

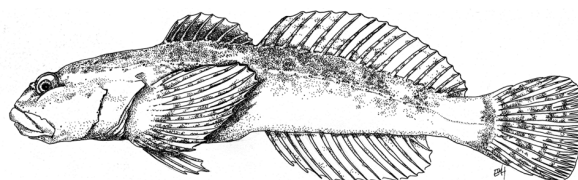
RESEARCH

Research Activity: Research conducted by RMRS scientists demonstrates how intensive sampling efforts across a large geographical scale can influence identification of taxonomic groups among the fishes of the genus *Cottus* in the northern Rocky Mountains. Researchers used specific sequences from mitochondrial DNA regions and phylogenetic analyses techniques as indicators of biodiversity and to identify unique species. Analyses of linked DNA sequences from sculpin collected in all major watersheds within the study area revealed eight groups with species-level differences that were also geographically bounded by large geological features. Surprisingly, six of these groups could not be assigned to recognized species, despite North American fishes having been generally well inventoried in genetic surveys.

Management Implications: *Cottus* species have been widely acknowledged as being among the most taxonomically challenging freshwater fishes to identify; as such, there has been much confusion about the identity and distribution of many sculpin species throughout the U.S. Northern Rocky Mountains. This research brings some clarity to the taxonomic picture of stream dwelling sculpin, but many questions remain regarding genetically based identification and the desired spatial scale and grain of sampling. Genetic assessments based on spatially robust sampling designs will likely reveal previously unrecognized biodiversity in many other taxa.



Analyses of genetic diversity revealed eight unique species (groups A-H) of stream dwelling sculpins distributed throughout the upper Columbia and Missouri River basins.



The Cedar sculpin (*Cottus schitsuumsh*) is a newly discovered species (group H above) found distributed throughout the Coeur d'Alene and St. Joe River basins in northern Idaho, with a disjunct range in the central Clark Fork River basin in western Montana.

KEY POINTS

- DNA analysis revealed abundant and unexpected biodiversity among sculpin species.
- Genetic patterns were indicative of variation in climatic, glacial, and geological history, suggesting that many sculpin species may be glacial relicts from regional paleodrainages.
- Genetic analyses of spatially comprehensive collections of *Cottus* revealed eight geographically and genetically delineated groups of sculpins that were regarded as distinct taxa.
- A species of sculpin was determined to be unrelated to all other species on the basis of phylogenetic analyses conducted— this group constitutes a new and previously undescribed species.
- DNA barcoding revealed cryptic invasions by nonnative species, a pattern that is likely to emerge for many species across the western U.S.

MORE INFORMATION

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