Joint Meeting of Ichthyologists and Herpetologists, Rochester, NY, July 11-15, 2018

The mighty mandible:
Mosaic evolution facilitates trophic specialization in electric fish skulls

Kory Evans[1], Lesley Kim[2], Brian A. Schubert[3], and James Albert[2]

[1]*Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN 55108*
[2]*Department of Biology, University of Louisiana at Lafayette, Lafayette, LA 70504*
[3]*School of Geosciences, University of Louisiana at Lafayette, Lafayette, LA 70504*

Mosaic evolution allows functional specialization of organismal traits that are subject to differing levels of selection or constraints, and can result in differential rates of phenotypic evolution among traits. Here we use three-dimensional geometric morphometrics, biomechanics, stable isotope analysis, and gut-content analysis to study mosaic shape evolution in the skulls of 20 species of navajine electric fishes. We quantify the multivariate rates of shape evolution for three modules within the skull (face, braincase, and mandible), and assess their functional interactions with trophic ecology. We also use biomechanics to estimate the performance of the mandible, and its relationship to trophic ecology. We find that the mandible evolved nearly five times faster than other skull modules, and that mechanical advantage of the mandible is linked to trophic position. We also find that mechanical advantage and trophic position best fit an Orenstein-Uhlenbeck model of trait evolution, suggesting the presence of adaptive optima. We hypothesize that the mandible is more evolutionarily labile than other modules and is capable of mounting a larger response to directional selection resulting in its elevated rates of shape evolution relative to other skull modules and ultimately, a pattern of mosaic evolution among several regions of the navajine skull.