119 - T112. Halo-Dash: The Deep and Shallow History of Aquatic Life's Passages between Marine and Freshwater Habitats

Monday, 10 October 2022
1:30 PM - 5:30 PM

119-4: EXPLORING THE ROLE OF TRANSITIONS BETWEEN FRESH AND SALT WATER IN THE MACROEVOLUTION OF RAY-FINNED FISHES (ACTINOPTERYGII) **SIME, John**, Earth and Environmental Sciences, University of Pennsylvania, 251 Hayden Hall, 240 South 33rd Street, Philadelphia, PA 19104-6316 and SALLAN, Lauren, Marine Macroevolution Unit, Okinawa Institute of Science and Technology, 1919-1 Tancha, Onna-Son, Kunigami-Gun, Okinawa, PA 904-0495, Japan
doi: 10.1130/abs/2022AM-383579

Abstract

Salinity gradients between fresh and salt water erect physiological barriers to the dispersal of fishes that may affect the potential for speciation. While such barriers existed in the geologic past, their evolutionary significance depended on the tolerance of fishes to different salinities. The Devonian Period provides examples of apparent euryhalinity among many fishes, including stem-group ray-finned fishes (Actinopterygii), indicating a lower physiological barrier to dispersal and likelihood of speciation along salinity gradients. However, the end-Devonian Hangenberg Extinction (359 Ma) reshaped the distribution of most fish groups among marine (saltwater) and continental (freshwater) environments. Surprisingly, the share of ray-finned fish species in those environments was the same before and after the extinction, even though ray-finned fishes underwent an ecological radiation during the post-extinction recovery. We hypothesize that transitions between fresh and salt water were an important part of the ray-finned fish recovery. To test this, we updated an existing phylogeny of early actinopterygians with Carboniferous species and assigned all species environments (freshwater, brackish, or saltwater), based on existing literature. Stochastic character mapping of the discrete environmental traits (SIMMAP), implemented in R, determined the ancestral states and transition rate parameters. The early Paleozoic history of ray-finned fishes may help elucidate long-term macroevolutionary trends when it is compared with the clade's more recent Cenozoic diversification: Do ray-finned fish lineages become more or less liable to transition between fresh and salt water? We hypothesize that crown-group ray-finned fishes are less likely to transition between environments than their Paleozoic predecessors because of the latter's broad fossil distributions. We extracted phylogenies of extant ray-finned fishes, representing a comparable interval of time in the Cenozoic (~50 Ma) to the stem-actinopterygian tree, from a fossil-calibrated phylogeny of nearly all extant ray-finned fishes. Fishbase provided the environmental data for extant fishes. The results will clarify if salinity gradients had changing macroevolutionary effects on fishes during their 500 million year history.

Geological Society of America Abstracts with Programs. Vol 54, No. 5, 2022
doi: 10.1130/abs/2022AM-383579