FOCUS: Biodiversity

“Buffalo” fish travel upstream to Citico Creek

Buffalo in Citico Creek, April 6, 2019

Every spring in east Tennessee, tens of thousands of fishes called buffalo make the short trip upstream from Tellico Reservoir into a small tributary called Citico Creek to reproduce. Although their journey is far less dramatic than the much-celebrated salmon of the Pacific Northwest, these buffalo likely share at least one important similarity with the salmon: through their migrations, they transport large quantities of essential nutrients between aquatic habitats. Given their ability to act as conveyor belts of materials that fuel production in habitats used for spawning, researchers at Tennessee Tech are left to wonder, are suckers the salmon of the South?

Nearly half of the 30,000+ fishes in the world use freshwater habitats, and many of these fishes regularly move back and forth between different habitats to find food, reproduce, or seek shelter. These regular movements, often called migrations, serve a wide variety of functions. In many parts of the world, migratory fishes are a critical food source for humans while in other places, they serve as the base of economically valuable fisheries. Less recognized, though equally important, is the role of fish migrations in moving essential nutrients like nitrogen and phosphorus between habitats. Perhaps the most well-known examples of migratory fishes in the world are the Pacific salmon. These fishes are born in freshwater before migrating to the ocean where they spend most of their adult lives. Eventually, adult salmon migrate back to the freshwater systems where they were born to reproduce and start the cycle anew. These reproductive, or spawning, migrations from the ocean to inland rivers and lakes have the potential to transfer substantial amounts of nutrients from marine to freshwater habitats. In some cases, the receipt of these marine-derived nutrients facilitates the growth of development of biota across multiple levels of freshwater food chains. While the ecological importance of salmon migrations is now widely recognized, many unanswered questions remain about the potential significance of other migratory fishes, including those that move exclusively among freshwater habitats.

“Buffalo” fish travel (cont.)

Catostomids, a group of fishes commonly called suckers, are distributed across the United States, and frequently represent a considerable proportion of fish communities in the Southeast. Many suckers are known to make annual spawning migrations between freshwater habitats in the spring. These migrations can result in the aggregation of hundreds of thousands of individuals over relatively small spaces and short times. Moreover, suckers are relatively large-bodied fishes that produce and eventually deposit large numbers of eggs when they spawn. Consequently, they have the potential to serve the same function in Southeastern freshwaters as their more famous salmon relatives in the Pacific Northwest. However, the ecological role of suckers is poorly understood, largely due to their status as non-game species of little commercial or recreational value.

We are conducting research to determine the magnitude and ecological significance of the nutrient subsidy delivered by migratory suckers in Southeastern rivers and streams. Initially, our work is focused in Citico Creek, a small tributary to the Little Tennessee River in east Tennessee. Citico Creek flows into Tellico Reservoir, and one particular type of sucker called buffalo moves en masse into Citico from the reservoir every spring to spawn. After spawning, adult buffalo move downstream to return to the reservoir, and they are followed shortly thereafter by great numbers of tiny larval buffalo floating with the current of the creek. These very small, very young buffalo are extremely vulnerable to a suite of aquatic predators during their downstream journey. Moreover, the vast majority of buffalo eggs deposited during spawning do not ever reach the larval stage due to predation or decomposition. Thus, nutrients contained within buffalo eggs and larvae represent a contribution to Citico Creek, as do other nutrients that are released by spawning buffalo via excretion and by decomposing buffalo that die during the reproductive migration.

The first step of our research involves estimating the amount of nutrients being contributed to Citico Creek by migratory buffalo. Once that estimate is generated, we can compare it with ambient or background nutrient levels in Citico Creek. If buffalo-derived nutrients are comparatively large, it indicates their ecological importance in the system.

Given the ubiquity of suckers like buffalo across Southeastern freshwater habitats, we plan to study other systems for comparison with the Citico Creek buffalo migration, and such a broadening of our research would facilitate more effective conservation and management of water resources. With a more complete understanding of the ecological role played by migratory suckers in the Southeast, we can use historical data to estimate nutrients that have been lost due to diminished sucker migrations in river networks that have been fragmented by structures like dams and culverts and degraded by poor land use practices. Additionally, we will be better positioned to identify what can be gained by restoring aquatic connectivity and habitat conditions, thereby providing critical information to resource managers and decision makers.

Incoming Tennessee Tech biology graduate student Ryan Hudson holding a migratory smallmouth buffalo (Ictiobus bubalus).