

New studies quantify the impacts of water use on diversity of fish and aquatic insects in NC streams

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Credit: RTI International

The health of fish and aquatic insects could be significantly affected by withdrawals of fresh water from the rivers and streams across North Carolina according to a new scientific assessment.

A series of studies were conducted by a team of researchers, led by Jennifer Phelan, Ph.D., a senior ecologist at RTI International, to understand the relationships between changes in streamflow and the diversity of fish and richness of [aquatic insects](#).

The studies quantified how changes humans make to streams by withdrawing [water](#) impact the ecological health of aquatic systems.

"We were able to show that man-made disruptions in natural flow patterns contribute to reductions in both the abundance and diversity of fish and insects," Phelan said. "The equations derived from our analysis can be used by water resources managers to better predict how a proposed water withdrawal or other alteration to natural stream flow will affect the health of downstream fish populations."

The research was conducted in collaboration with the Ecological Flows Science Advisory Board that was formed in response to 2010 North Carolina state legislation (NC Session Law 2010-143) directing the North Carolina Department of Environmental Quality to identify the river flows necessary to maintain the ecological integrity of each of the 17 major river basins in the State.

RTI staff worked closely with several of the Board members including the Environmental Defense Fund, the North Carolina Department of Environmental Quality, the U.S. Geological Survey, the North Carolina Wildlife Resources Commission, and The Nature Conservancy to develop a scientific basis for establishing the prescribed ecological flows.

"Notably, the findings of this research show that, for most fish species, any amount of flow reduction, no matter how small, will likely lead to some decrease in population," said Sam Pearsall, Ph.D., formerly with the Environmental Defense Fund and a key member of the Scientific Advisory Board. "This significant body of work represents a model example of science informing policy and lays the groundwork for future considerations of ecological flows within the state's long term efforts for protecting the health of its vital [water resources](#)."

The research team used RTI's Watershed Flow and Allocation Model, WaterFALL, to estimate streamflows under both pre-human development conditions and current conditions, reflective of today's land and water use by North Carolina communities.

"The ability of WaterFALL to simulate water flows within individual, small segments of rivers and streams was pivotal in enabling the study team to develop statistically significant correlations between changes in streamflow and biological diversity and richness at each of the locations where biological inventories had been prepared by the North Carolina Department of Environmental Quality," said Michele Eddy, lead developer of the WaterFALL model and member of RTI's study team.

According to Robert Dykes, senior director for RTI's Water and Ecosystems Management Center, there is a growing need worldwide to better quantify the river flow patterns necessary to ensure adequate functioning of aquatic species, particularly fish and other important food sources.

"The methodologies that RTI pioneered in performing our assessments have broad relevance beyond the State of North Carolina and represent a significant advancement in the science of defining ecological flows," Dykes said.

This body of work is [published](#) as a featured collection in the February 2017 issue of the *Journal of the American Water Resources Association*.

Provided by RTI International

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