Ranking Resiliency of Brook Trout Populations to Climate Change

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Predicting coldwater fisheries distributions under various climate scenarios is of interest to many fisheries managers and researchers. Larger scale models have been useful in highlighting the potential large scale threat. However, the error associated with these models makes predictions of the persistence of individual cold water fisheries problematic. Most of this error is associated with predicted air and water temperatures which typically are simple elevation and location (latitude/longitude) models with simple caveats such as one degree increase in air temperature equals 0.8 degree increase in water temperatures. We ranked the resiliency of 2,329 unique patches of reproducing brook trout populations throughout the Mid-Atlantic and southeastern portions of their range based on the unique air and water temperature relationship of each brook trout patch. We directly measured paired air and water temperature at the pour point of each patch. Several GIS generated metrics (annual solar gain in the 100 m riparian buffer; the percentage of ground water flow; the % of forest in the 100 m riparian area; the pour point elevation; 30 year mean maximum air temperature at the patch pour point and the percentage of forested area within the patch) were useful for characterizing differences among the patches and explaining the residual errors in the air and water temperature relationship curves. We found that our paired air and water temperature relationships are highly variable among patches and were a useful metric for ranking the resiliency of individual brook trout populations. Directly measuring paired air and water temperature relationships can identify outliers of large scale models and are useful for managers making investment decisions in protecting and restoring brook trout. This model also has utility for other fishes.