Zeigler, M. P., K. B. Rogers, J. J. Roberts, A. S. Todd, K. D. Fausch. 2019. Predicting persistence of Rio Grande Cutthroat Trout populations in an uncertain future. North American Journal of Fisheries Management.

Abstract

The Rio Grande Cutthroat Trout *Oncorhynchus clarkii virginalis* (RGCT) occupies just 12% of its ancestral range. As the southernmost subspecies of Cutthroat Trout, we expect a warming climate to bring additional stressors to RGCT populations such as increased stream temperatures, reduced stream flows, and increased incidence of wildfire. We developed a Bayesian Network (BN) model using site-specific data, empirical research, and expert knowledge to estimate the probability of persistence for each of the 121 remaining RGCT conservation populations, and rank the severity of the threats they face. These inputs quantified the genetic risks (e.g., inbreeding risk, hybridization risk), population demographics (disease risk, habitat suitability, survival), and probability of stochastic disturbances (stream drying risk, wildfire risk) in an uncertain future. We also created stream temperature and baseflow discharge models coupled with regionally downscaled climate projections to predict future abiotic conditions at short-term (2040s) and long-term (2080s) time horizons. In the absence of active management we predict a decrease in the average probability of population persistence from 0.53 (current), to 0.31 (2040s), and 0.26 (2080s). Only 11% of these populations are predicted to have a >75% chance of persisting to the 2080s. Threat of invasion by nonnative trout had the strongest effect on population persistence. Of the 78 populations already invaded or lacking complete barriers, 60% are estimated to be extirpated by 2080 and the remainder averaged only 10% chance of persistence. In contrast, the effects of increased stream temperatures were predicted to affect future persistence of only 9% of the 121 RGCT populations remaining, because most have been restricted to high-elevation habitats that are cold enough to buffer against some stream warming. Our BN model provides a framework for evaluating threats, and will be useful to guide management actions likely to provide the most benefit for long-term conservation.