Assessing threats to native fishes of the Lower Colorado River Basin

by

Kristen L. Pitts

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ABSTRACT

I investigated the influence of anthropogenic threats and hydrologic alteration on fish assemblages within the Lower Colorado River Basin (LCRB). Life history traits of fish assemblages for individual stream segments were summarized by species presence/absence data of current (1980-2006) records. To assess anthropogenic threats, I developed a series of ecological risk indices at various scales (e.g., catchment, watershed, aquatic ecological system and upstream of aquatic ecological system) and related each index to fish life-history traits to determine the method and scale that best related to biotic metrics. Hydrologic alteration was quantified using the Indicators of Hydrologic Alteration software to calculate hydrologic alteration values using the range of variability approach. Ecological risk indices within all scales were strongly correlated (r^2>0.54, p<0.0001) to one another. Relationships between fish life history traits and ecological risk indices occurred only at the catchment and watershed scales. Strongest relationships were at the watershed scale where increased levels of anthropogenic risk were related to reduced occurrences of native, fluvial dependent species (r^2=0.12, p<0.0001) and increased occurrences of nonnative generalist species (r^2=0.22, p<0.0001). The percent agriculture was positively related to indices of alteration of low flows (r=0.401, p=0.006) while forested land cover was negatively related to alteration of low flow events (r=-0.384, p=0.008). Relationships between indices of hydrologic alteration and fish traits indicate the occurrence of piscivorous, nonnative fishes increased with alteration of low flow events whereas occurrence of fluvial dependent fishes that preferred rubble substrate decreased with alteration of low flow events (r=0.64, p=0.001). Our analysis suggests that ecological risk indices and hydrologic alteration in the LCRB are related to composition of biotic communities. Incorporating cost-effective risk indices into conservation planning will likely increase the effectiveness of conservation efforts while understanding biotic responses to modified flow regimes are a necessity in sustainable development of water resources as human populations grow and water resources decrease in the LCRB.