Spatial habitat variation in a Great Plains river: effects on the fish assemblage and food web structure

by

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ABSTRACT

We investigated spatial variation in fish assemblage and food web structure in the Kansas River, USA in relation to habitat changes. Fishes were collected at ten sites throughout the Kansas River for assessing assemblage structure in summer 2007 using fish community metrics and at 3 sites in 2006 for food web structure using stable isotope analysis. Satellite imagery indicated riparian habitat on the Kansas River was dominated by agriculture in the upper reaches (>35%) and tended to increase in urban land use in the lower reaches (>58%). Instream habitat complexity also decreased with increased urban area (<25%) becoming more channelized. Jaccard's similarity and percent similarity indices suggested that large-bodied fishes show changes in species presence and composition longitudinally within the river. Also, reaches directly above Bowersock Dam in Lawrence, Kansas and below the Johnson County Weir, near Kansas City, Kansas had low percent similarity compared to other reaches, suggesting the dam and the weir affect community composition. Canonical correspondence analysis indicated that species that prefer high velocity flows and sandy substrate (blue sucker and shovelnose sturgeon) are associated with the upper river reaches. Also, there was a higher abundance of omnivorous and planktivorous fish species in the lower more channelized river. The lower reaches contain more tolerant, macrohabitat generalist species and the upper river contained more intolerant, fluvial specialist species. Fish, macroinvertebrates, and detritus were collected at three river reaches classified as the heterogeneous instream habitat (>40% grass islands and sand bars) intermediate (22% grass islands and sand bars), and homogeneous (6% grass islands and sand bars) instream habitat reaches in June 2006. Riparian land use (proportion as agricultural and urban) was related to instream habitat with homogeneous areas having more urban riparian area compared to the heterogeneous and intermediate reaches. The heterogeneous habitat reach had higher variability in [Delta][superscript]13C for fish classified as piscivores/invertivores (P=0.029) and macroinvertebrates (P=0.004) suggesting the complex habitat in the heterogeneous habitat reach provided more variable food sources. The [Delta}15N values also indicated that ten of the twelve fish species tended to consume prey at higher trophic levels in the heterogeneous habitat reach suggesting a more complex food web. Land use practices are leading to homogenization of instream habitat and this homogenization of habitats may be related to food web diversity and trophic position of fishes. Conserving intolerant, native species in the Kansas River may require maintaining suitable habitat for these species and restoration of impacted

areas of the river.