Broadening the Regulated-River Management Paradigm: A Case Study of the Forgotten Dead Zone Hindering Pallid Sturgeon Recovery

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Abstract: The global proliferation of dams within the last half century has prompted ecologists to understand the effects of regulated rivers on large-river fishes. Currently, much of the effort to mitigate the influence of dams on large-river fishes has been focused on downriver effects, and little attention has been given to upriver effects. Through a combination of field observations and laboratory experiments, we tested the hypothesis that abiotic conditions upriver of the dam are the mechanism for the lack of recruitment in Pallid Sturgeon (Scaphirhynchus albus), an iconic large-river endangered species. Here we show for the first time that anoxic upriver habitat in reservoirs (i.e., the transition zone between the river and reservoir) is responsible for the lack of recruitment in Pallid Sturgeon. The anoxic condition in the transition zone is a function of reduced river velocities and the concentration of fine particulate organic material with high microbial respiration. As predicted, the river upstream of the transition zone was oxic at all sampling locations. Our results indicate that transition zones are an ecological sink for Pallid Sturgeon. We argue that ecologists, engineers, and policy makers need to broaden the regulated-river paradigm to consider upriver and downriver effects of dams equally to comprehensively mitigate altered ecosystems for the benefit of large-river fishes, especially for the Pallid Sturgeon. Christopher S. Guy, Hilary B. Treanor, Kevin M. Kappenman, Eric A. Scholl, Jason E. Ilgen, Molly A. H. Webb