

Investigation of the effects of whitewater parks on aquatic resources in Colorado

Tim Stephens, Brian Fox, Nell Kolden, and Brian Bledsoe
Department of Civil and Environmental Engineering, Colorado State University

Abstract. Whitewater parks (WWPs) provide a valuable recreational and economic resource that is rapidly growing in popularity throughout communities in the United States, with Colorado being a leader in WWP design and construction. WWP structures are primarily constructed to create a hydraulic jump that is desirable to boaters. WWPs were originally thought to enhance aquatic habitat; however, recent studies have shown that the hydraulic conditions required to meet recreational needs can act as a partial barrier to upstream migrating trout and that WWP pools may contain lower densities of fish compared to natural pools. There is limited knowledge of the direct effects of WWPs on fish passage. Managers and policy makers are forced to review WWP designs and make permit decisions without sound scientific evidence. It is also difficult to make design recommendations for future WWPs and possibly retrofitting existing WWPs to allow for successful fish passage without improved understanding of the factors contributing to suppression of movement in WWPs. This presentation will describe novel approaches to combining fish movement data and the hydraulic results from a 3-D computational fluid dynamics model to examine the physical processes that limit upstream movement of trout in an actual WWP in Lyons, CO. These methods provide a continuous and spatially explicit description of velocity, vorticity, and turbulent kinetic energy (TKE) along potential fish swimming paths in the flow field. A spatially continuous analysis of flow paths provides insight on interactions among velocity, vorticity, and TKE and likely causes of suppressed movement of upstream migrating fishes, at each WWP structure relative to its design and configuration.