EVALUATION OF THE COUGAR DAM PORTABLE FLOATING FISH COLLECTOR BASED ON ACOUSTIC CAMERAS, 2014

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A Portable Floating Fish Collector (PFFC) was tested in 2014 as a fish passage alternative in the forebay of Cougar Dam. As part of the evaluation, two treatments were tested where the attraction pumps for the PFFC were operated at 85% of maximum flow (High treatment) and 50% (Low treatment). Fish collection performance was evaluated using PIT-tagged fish, JSATS tagged fish, and acoustic cameras. In this study, we deployed an acoustic camera immediately upstream of the entrance and one inside the entrance of the PFFC. The Dual-Frequency Identification Sonar (DIDSON 300), operating at 1.8 mHz with a 29º beam and 15 m range, was primarily used to monitor fish movement at the entrance of the PFFC and was aimed looking across the opening for most of the study period. The Adaptive Resolution Imaging Sonar (ARIS 3000) operating at 3.0 mHz with at 30º beam and a 5 m range, was used to monitor fish movement inside the PFFC and was aimed looking into the collector for a portion of the study and looking outward for a portion of the study.

Data were collected with both cameras beginning May 30 and ending on December 02, 2014. We collected approximately 7,500 hours of data during this study. One of the challenges of using acoustic cameras to evaluate fish movements is processing the tremendous amount of data in a timely manner and summarizing it in a meaningful way. In 2013 we developed a semi-automated method for processing and analyzing the data. To our knowledge, USGS is the only agency that has developed this process for data collected on smolt-sized fish. Our methods allow us to summarize a larger proportion of the raw data than has previously been feasible using traditional manual processing methods. Processing more of the raw data enables us to more reliably quantify the number of fish present and to characterize their behaviors and movements over daily and seasonal changes in temperature, flow, dam operations, and PFFC treatments.

Analysis of the acoustic camera data using circular statistics showed that fish were present immediately upstream of the PFFC and were moving primarily across the face of the entrance, not into the entrance. This result comports with the density plots produced from data collected from JSATS tagged fish. The acoustic camera did detect fish inside the PFFC. However, fish appeared to enter the PFFC and then turn around and exit before they could be captured in the weir box at the back of the collector. The location where fish turned around differed under the High and Low treatments and appeared to be correlated with the hydraulic conditions inside the PFFC. Under the High treatment, Acoustic Doppler Velocimeter (ADV) data revealed a hydraulic jump about a third of the way inside the PFFC. Acoustic cameras data showed that this is about where a large portion of the fish turned around after entering the PFFC. Under the Low treatment there did not appear to be a significant hydraulic jump based on the ADV data, but the velocities were generally lower through the PFFC. Under this treatment, the acoustic camera data showed that fish entered but turned around about two-thirds of the way into

the PFFC. It is not clear why fish turned around, but it is plausible that fish sensed the change in velocity as water entered the weir box and they turned and exited the PFFC. Additionally, numerous predator-sized fish were observed residing near the face of the entrance, and subsequently deterring smolts from approaching the entrance of the PFFC.