Red Bluff Technical Report Abstract

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Borthwick, S.M., Weber, E.D., and R.R. Corwin, 2000. Travel Time and Condition of Juvenile Chinook Salmon Passed Through Archimedes Lifts, an Internal Helical Pump, and Bypasses at Red Bluff Research Pumping Plant, Sacramento River, California. Red Bluff Research Pumping Plant Report Series, Volume 11, United States Department of the Interior, Bureau of Reclamation, Red Bluff, California. 51 pp.

We evaluated travel time, the frequencies of mortalities and in uries, and the extent of descaling on juvenile chinook salmon that were passed through large pumps and associated fish bypasses at Red Bluff Research Pumping Plant (RBRPP). An internal helical pump (91 cm inlet) and two Archimedes lifts (122 cm intake) were used in this study. Vertical wedge-wire screens (2.4 mm openings) were located downstream of each pump. Fish-bypass channels led away from each screening facility. Water in these channels dropped into plunge pools before entering 46 cm diameter underground pipes. The 46 cm diameter underground pipe from each pump's fish bypass connected to the same 152 cm diameter conduit. The 152 cm conduit opened into the Sacramento River.

On average, one-quarter of the chinook salmon released into pump intakes remained within RBRPP 48 h after release. Recovery rates were significantly lower for trials begun at sunrise versus those begun at sunset (P=0.003). Passage delays occurred in screening facilities and in the 152 cm. diameter pipe. Turning pumps off and back on was ineffective at flushing fish from screening facilities. Pulsing flows through the 152 cm pipe at about 4.4 mYs effectively moved lingering fish into the river.

Mean total 96-h mortality of juvenile chinook salmon passed through pumps and their bypasses (treatment) was nearly 4 percent. Mean total 96-h mortality ranged from 2.0 percent to 2.4 percent for fish passed through bypasses only (control). These mortality values include deaths that may have occurred during pre- and post-trial handling and capture of fish, and therefore may be over-estimated. The difference in mortality between treatment and control samples was not statistically significant for either pump type. Mean body surface descaled and mean frequency of chinook salmon with non-lethal injuries was <1.2 percent and <8.0 percent, respectively for both pump, types, and did not differ significantly between treatment and control samples. There were no significant differences between the internal helical pump and the Archimedes lifts for mortality, descaling, or injury. Also, no differences were detected between pump bypasses for percent-frequencies of mortalities and injuries, or extent of descaling. Pulsing flows through the 152 cm. diameter conduit did not significantly increase the percent frequency of mortality or injury, or the extent of descaling to juvenile chinook salmon that were passed through the pumps and bypasses. Findings from this and other studies at RBRPP revealed that low mortalities, descaling, and injuries to juvenile chinook salmon that passed through RBRPP occurred mainly as fish traveled through the pumps, screening facilities, and plunge pools. Few adverse effects were associated with the 46 cm and 152 cm diameter underground bypass pipes.