

FLOW VELOCITY ENHANCEMENT SYSTEM – PRELIMINARY RESULTS FROM FIELD TEST TO GUIDE SMOLTS

Gordon Burns and Jean Johnson
Natural Solutions, 1890 Sierra Road East, Helena, Montana 59602
smolts@msn.com

Dennis W. Rondorf
U.S. Geological Survey, Columbia River Research Laboratory
5501A Cook-Underwood Road, Cook, Washington 98605
dennis.rondorf@usgs.gov

Charles C. Coutant
Coutant Aquatics, 120 Miramar Circle, Oak Ridge, Tennessee 37830
ccoutant3@comcast.net

ABSTRACT

Juvenile salmon have evolved to follow river currents downstream at time of outmigration. River regulation, however, has created slack-water areas at dams that remove these migratory cues. Also, flows to water diversions misdirect migrants to hazardous areas. It seems logical, therefore, to induce currents to guide juvenile salmonids to aid their migration through low-current zones and guide them to safe migration routes or collection devices. A hydraulic system has been devised that generates water currents with turbulence similar to that in natural streams (Natural Solutions, Helena, MT). Tests in large net pens confirmed that smolts would orient to and follow induced currents. Field experiments in the Cowlitz River, WA, tested the feasibility of deploying the hydraulic system in a remote area and provided fish-guidance information from radio-tagged smolts. Incremental improvements in the hydraulic system and in experimental designs for quantifying fish guidance indicate that the technology has significant promise for managing smolt migrations. This technology, which has been developed largely with private funding, was further tested in 2008 with funding from Bonneville Power Admin. and assistance of Tacoma Power and Light, Washington Dept. of Fish and Wildlife, and the US Geological Survey.

In summer 2008, two-dimensional acoustic telemetry was used to evaluate how juvenile Chinook salmon respond to a flow inducing system in the Cowlitz River. The study was conducted in the mainstem river at the upper end of Riffe Lake between Cowlitz Falls Dam and Taidnapam Park in a location where the flow inducing system has been tested in previous years. The study used juvenile Chinook salmon collected at the Cowlitz Falls Fish Facility. Acoustic telemetry provides a detailed, two-dimensional detection history of each fish that approaches and passes through the flow-inducing system within the detection array. Forty smolts were implanted with acoustic transmitters at the Cowlitz Falls Fish Facility, held for 24 hr and released over time in the tailrace of Cowlitz Falls Dam. Fish were released in groups of 4 per day during a 10-day period in August. The flow-inducing system was operated on a rotating one-day-on, one-day-off schedule to compare natural and guided migration trajectories. An acoustic detection array was positioned by USGS personnel to detect fish approaching the plume from the flow inducer and within the plume. Unusual debris conditions delayed positioning a net trap (as a test of the ability to guide smolts to a collection device) until after the tagged fish had passed through the area. Although results of the automated hydro acoustic detection system are still being analyzed, early indications are that fish were successfully guided by the induced flow field. At least preliminary findings will be included in the presentation.