

# Evaluation of Sockeye Salmon after Passage through an Innovative Upstream Fish-Passage System at Cle Elum Dam

Determining survival rates of fish passed over a high head dam using Whooshh™ fish transport system

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Our research will determine survival rates of fish passed through the fish transport system over the Cle Elum Dam (test group) and compare these rates with existing trap and haul operations (control group).

## **Mission Issue**

If proven to be successful, using the Whooshh™ transport system could reduce fish passage construction cost and operation and maintenance cost, and could provide passage sooner than constructing conventional fish passage facilities.

## **Principal Investigator**

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## **Problem**

Many Reclamation dams were constructed in an era when provision for adult fish passage was not considered or viewed as low priority. Today, American society is placing an ever-increasing importance on protecting, enhancing and restoring the country's natural resources. There are ESA-listed and non-listed fish populations of cultural, ecological and recreational importance in most basins where Reclamation is responsible for water management. The absence of upstream fish passage at Reclamation storage and diversion dams is a growing concern for regulatory and management fish agencies.

Consequently, Reclamation has been asked to consider, and in some cases provide, adult fish passage to access historical habitat blocked by these dams. The cost to construct a conventional concrete fish ladder may be prohibitive or unfeasible. Trap-and-haul transport systems are also expensive to construct and certainly expensive to operate and maintain over the long term.

Whooshh™ Innovations has developed an adult fish transport tube that potentially could pass adult fish over dams currently without passage. Our research question: Can we develop a passive adult fish transport system incorporating Whooshh™ Innovations fish transport system technology to move fish past Reclamation diversion and storage dams?

## **Solution**

A study was completed in 2017 to evaluate the behavior and survival of adult sockeye salmon (*Oncorhynchus nerka*) after passage through the innovative Whooshh™ Fish Transport System (WFTS) at Cle Elum Dam, Washington. Tagged fish were monitored from the time of release in July through late-November, when spawning was complete. Detection data were analyzed to describe behavior patterns of tagged fish and estimate survival from the time of reservoir entry to September 1, 2017.

The Whooshh™ fish transport system was installed at the Cle Elum Dam in Washington State. The study included radio tracking of both a test and control group of Sockeye. Tracking occurred from the Roza Dam Fish Facility on the Yakima River to the base of the Cle Elum Dam, upstream in the Cle Elum reservoir, and into the spawning grounds located in the upper Cle Elum River.

Both the test and control groups were trapped and hauled from Priest Rapids Dam on the Columbia River to the Roza Dam Fish Facility on the Yakima River where they were radio tagged. After tagging, the test group was transported to the base of the Cle Elum Dam and sent through the Whooshh™ transport system into the Cle Elum Reservoir, while the control group fish were transported and released directly into the Cle Elum Reservoir.

***“Reclamation is pleased to work with Whooshh™ to show that fish could be successfully passed over Cle Elum Dam, a high head dam (165 feet) using Whooshh’s fish passage system. Further refinement and testing is needed to verify effectiveness of this system to meet or exceed traditional fish passage facilities survival rates before implementing it as a long-term solution to trap and haul passage.”***

Wendy Christensen  
Yakima River Basin Water Enhancement  
Project Manager

### **Collaborators**

The Yakima Nation  
USGS  
Washington Department of Ecology

### **More Information**

<https://www.usbr.gov/research/projects/detail.cfm?id=1662>

<https://www.usbr.gov/research/projects/researcher.cfm?id=2927>

## **Application and Results**

Results indicate that tagged sockeye salmon that traveled through the WFTS initially sustained substantial mortality, but survival improved as the release period progressed and system adjustments were made. Single-release survival probability estimates for WFTS-passed fish were low (0.362) on the first release day and increased to a high of 0.749 on the last release day. In comparison, survival probability estimates for reservoir-released fish ranged from 0.853 to 1.000 on the four release days.

## **Future Plans**

Reclamation continues to work with Whooshh™ Innovations to identify opportunities to test and possibly install a Whooshh™ transportation system at a Reclamation facility.



*Figure 1 Whooshh™ transport tube next to Cle Elum Dam spillway, Cle Elum, Washington. Tube passed fish over the dam (1100' long and 165' high) just under an average of 60 seconds.*