



Migration Survival of Juvenile Chinook Salmon, Steelhead, and Lamprey from Wapato Dam to the Mouth of the Yakima River, Washington, 2018.

Michael Porter¹, Tobias Kock², Russell Perry², Patrick Monk³ and Ian Courter⁴.

¹Yakama Nation – Yakima/Klickitat Fisheries Project, Toppenish, WA. ²U.S. Geological Survey, Cook, WA. ³U.S. Bureau of Reclamation, Yakima, WA, ⁴Mt. Hood Environmental, Boring, OR.



The 2018 study employs acoustic telemetry to monitor yearling and sub-yearling Chinook Salmon (*Oncorhynchus tshawytscha*), juvenile Steelhead (*Oncorhynchus mykiss*) and Lamprey (*Lampetra tridentata*) in the lower 111 miles of the Yakima River, where previous studies have shown that juvenile salmon survival can be poor.^{2,3,4} The study is part of a multi-year evaluation of factors affecting migration survival of juvenile Chinook Salmon, Steelhead, and Lamprey at a scale that will enable us to model and more effectively manage these factors to improve smolt survival.

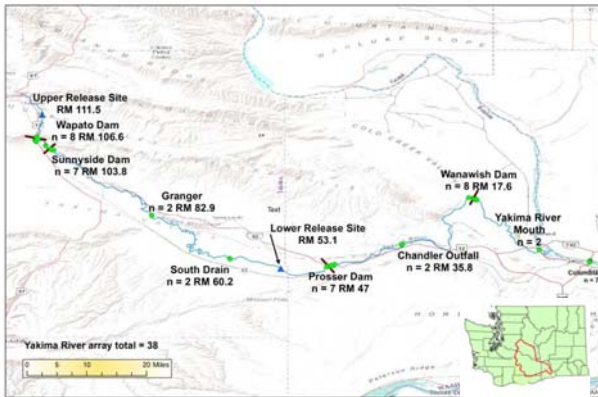


Figure 1. Study Area and Telemetry Monitoring Sites.¹

Duration: March to July 2018 (pilot study), 2019 and 2020

Measured Parameters:

- River Flow and Turbidity
- Water Temperature
- Predatory Bird and Fish Abundance
- Irrigation Diversions

Release groups (actively migrating juvenile fish):

- 350 yearling Chinook Salmon
- 350 sub-yearling Chinook Salmon
- 400 summer Steelhead
- 100 Pacific Lamprey (experimental tags via PNNL)

Reach Monitoring:

- 7 reaches of the Yakima River from Yakima to the Columbia River (Fig. 1)
- Columbia River mainstem from the Yakima River to Bonneville Dam

Telemetry data is gathered via acoustic monitoring arrays (Fig. 1 & Fig. 2) established and maintained in the Yakima River and Columbia River by the Yakama Nation (YN) and U.S. Geological Survey (USGS).¹



Figure 2. Columbia River acoustic arrays.¹

Acoustic receivers deployed in the Columbia River by Pacific Northwest National Laboratory for a concurrent U.S. Army Corps of Engineers smolt survival study will also monitor tagged fish and Lamprey, extending the geographic scope without the cost of additional equipment.



Figure 3. Monitoring Survival at Diversion Dams.¹

Wapato Dam, Sunnyside Dam, Prosser Dam, and Wanawish Dam are each monitored by 7 to 8 receivers to gather route specific passage by tagged fish. Receiver deployment locations are selected to¹.

- Detect fish as they arrive at the dam
- Provide multiple detection sites within each passage route
- Detect fish as they move downstream after passing the dam
- Determine fish screen integrity

Week	Yearling Chinook		Sub-yearling Chinook		Steelhead	
	Wapato	Prosser	Wapato	Prosser	Wapato	Prosser
Mar 26-30	30	20				
Apr 2-6	30	20				
Apr 9-13	30	20			30	20
Apr 16-20	30	20			30	20
Apr 23-27	30	20			30	20
Apr 30-May 4	30	20			30	20
May 7-11	30	20			30	20
May 14-18			30	20	30	20
May 21-25			30	20	30	20
May 28-Jun 1			30	20		
Jun 4-8			30	20		
Jun 11-15			30	20		
Jun 18-22			30	20		
Jun 25-29			30	20		
Jul 2-6			30	20		
Totals	210	140	240	160	210	140

Table 1. Fish Tagging and Release.¹

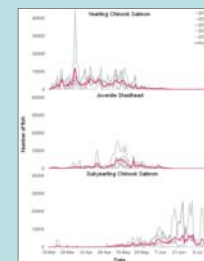


Figure 4. Chandler Fish Passage.⁵

To ensure that tagged fish are moving through all reaches of the study area continuously from late March to early July¹ a fish release strategy was developed by apportioning the 2018 release of 1,100 fish shown in Table 3, based on outmigration timing shown in Figure 4.

Fish releases occur several times each week at State Route 24 (mile 111.1) 4.5 miles upstream of Wapato Dam and Sunnyside Drain Bridge (mile 53.1) 6 miles upstream of Prosser Dam (Fig 1).¹

Two Columbia River acoustic arrays will test the detection probability of the receivers and potentially eliminate the HWY 395 array in year 2 and 3 of the study, making those receivers available for use elsewhere in the Yakima River providing more resolution for survival analysis.

Predators can have significant impacts on survival of juvenile salmonids⁶ and lamprey. Survival may vary by river reach and predator numbers. A weekly predator index will be developed in the lower Yakima River during the study period. Predator survey data will be used in the survival analysis.¹



Figure 5. Fish Predator Survey Reaches.

A fish predator index is developed by conducting weekly fish predator electrofishing surveys in six river reaches (~50 miles) within the study area.

An avian predator index will be developed via a weekly count in 5 river reaches (~68 miles) within the study area. Avian hotspots at two dam locations will also have weekly avian predator counts.



Mt. Hood Environmental will conduct monthly fish predator abundance estimates in three river reaches of the study area using a mark/recapture effort. During this effort predator stomachs will be collected to develop a salmonid consumption estimate.

The Yakama Nation is continuing work with the Bureau of Reclamation and the U.S. Geological Survey on water resource management actions to improve salmon and lamprey survival. New partnerships have been developed through this study to maximize its scope and benefits. The McNary Mitigation Fund is funding experimental acoustic tags for lamprey. Pacific Northwest National Laboratory is making the tags and providing expert assistance. The Yakima Basin Joint Board is providing funding for the fish predator abundance and salmonid consumption estimates. Kennewick Irrigation District is funding an additional 8 acoustic receivers to evaluate salmon and lamprey survival near the delta of the Yakima River.

Acknowledgments:

The Juvenile Salmon Study (JSS) is a joint effort by the U.S. Geological Survey and the Yakama Nation, with funding in 2018 provided primarily by Yakama Nation and the Bureau of Reclamation, also the Roza-Sunnyside Board of Joint Control, Kennewick Irrigation District and Klickitat Reclamation District. Special thanks to David Lind and Paul Huffman of the YN and Susie Dunham of Oregon State University for providing input in creating this poster. Bibliography available at <http://yfkfp.org/par.html>