Conservation Conversation

By Ian Fergusson, Resources Director

A Willamette Basin Success Story, Part 2 – Downstream Passage

This is the second in a series of articles dealing with passage and habitat improvements on the Clackamas River. The successes on the Clackamas provide evidence that the Northwest Steelheaders' campaign, "Quest for 100k," has a reasonable goal: the return of 100,000 spring Chinook annually to the Willamette Basin.

The first article (Part 1—Upstream Passage, Northwest Steelheader, Spring 2018) dealt with the history of Portland General Electric's (PGE) operating license and its requirements for fish passage and protection, and the improvements made in upstream passage. This article describes improvements to the juvenile fish downstream passage system and shows some immediate benefits to downstream passage and adult returns.

PGE's studies identified significant mortality due to juveniles passing through the turbines or over the spillways at North Fork and River Mill dams. PGE fish biologist Garth Wyatt says this was particularly an issue for spring Chinook that migrate deeper in the water column, causing them to miss the surface attraction flow that would otherwise guide them into the existing bypass system. In response, PGE's new license focused on downstream passage improvements to increase survival.

Downstream passage improvements include an extension of the migrant bypass pipeline and new juvenile sampling facility (2011), a spillway exclusion net at North Fork dam (2013), a fixed surface collector at River Mill dam (500 cfs, 2013), and a floating surface collector at North Fork dam (1000 cfs, 2016). Surface collectors simulate a river flowing out of a lake to attract downstream migrants away from the turbines.

The historic downstream passage system at North Fork transitioned fish between a 250 cfs collector, adult ladder, and a bypass pipeline. Fish collected at North Fork were diverted into the 1.7-mile long adult fish ladder then into the original bypass pipeline. This configuration resulted in increased vulnerability to predation and delayed migration timing up to two weeks. This delay meant that fish often were unable to "ride" high water events, losing the advantages of high water, such as increased speed and cover (turbidity). To simplify the system the bypass pipeline was extended directly to the surface collectors, eliminating the adult ladder from the conveyance system, while flushing flow was added to the pipe. Now, a journey that might have taken 1-2 weeks takes 2-3 hours, with 99 percent survival.

Not only are more fish surviving the journey through the migrant system, the number of fish collected has increased substantially compared to 2000-2012 averages (Figure 1). Since infrastructure improvements, an average of 101,608 Chinook have been bypassed, an 8.5X increase over the previous average of 12,015. Steelhead collections have increased 2.5X, from an average of 18,184 to 46,045, while coho increased 2.2X, from an average of 66,987 to 148,169.

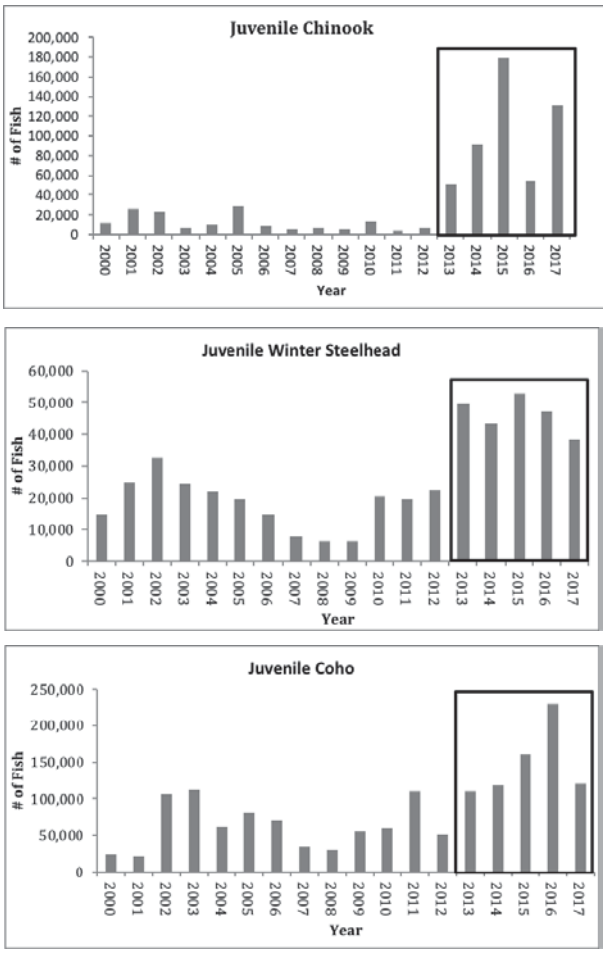

Figure 1. The number of juvenile fish bypassed around the Clackamas River hydro-system. The boxed areas represent collection with the newly installed infrastructure (PGE).

Another important addition is the River Mill surface collector. The stretch between River Mill and North Fork dams, with limited spawning habitat, was not considered to be a significant fish producer. PGE decided to include a 500 cfs surface collector at River Mill Dam to collect fish produced in and above Estacada Lake, as well as those not collected at North Fork. This facility has proven to be a valuable asset, averaging over 100,000 juveniles bypassed annually since commissioning in 2013 (70 percent of which are Chinook). Wyatt points out that prior to 2013, the only route of passage was through the River Mill turbines or over the spillway when powerhouse capacity was exceeded. Depending on flow, mortality through either route could be substantially higher than the 95-99 percent survival now documented through the new surface collector.

While the increase in the number of juveniles collected is impressive, the diversity of life history strategies may be just as important. The historic bypass system was moderately successful at collecting smolts, but pre-smolts and fry were not collected in meaningful numbers. In 2017, over half (125,000) of the 216,000 Chinook passed downstream at all facilities were fry or pre-smolts. Over 60,000 coho pre-smolts were collected in 2017. Schroeder et al. (2016) found that fish with dispersive life history strategies increased total Chinook productivity in the Willamette and reduced the year-to-year variability in total smolt population by 35 percent over individual life history strategies. Facilitating year-around passage of multiple life history strategies is like diversifying an investment portfolio to spread risk while providing stable returns.

Due to ocean residency of varying lengths, we have limited adult return data following downstream infrastructure improvements. Wyatt contrasted the few years of adult returns with neighboring basins in an attempt to determine infrastructure effect. The Clackamas wild spring Chinook and winter steelhead returns were plotted relative to their regional counterparts on the McKenzie and Willamette Rivers. In the first three years of adult returns (2015-2017) from juveniles that outmigrated through the new infrastructure, the divergence between Chinook returns to the McKenzie and Clackamas is apparent (Figure 2). The largest divergence between returns relative to their 2004-14 mean occurred in the last two years of the data set. Those were the first two adult run years (2016-2017) where all age classes of returning adults out-migrated as juveniles through the new infrastructure. The consistent divergence in the last three years of winter steelhead return data relative to the Willamette River (Figure 3) and other regional populations (Figure 4) highlight the effect that improvements to juvenile collection can have on adult steelhead returns. Perhaps more encouraging, we've yet to have a complete adult return of winter steelhead or Chinook that outmigrated through the 1000 cfs North Fork surface collector.

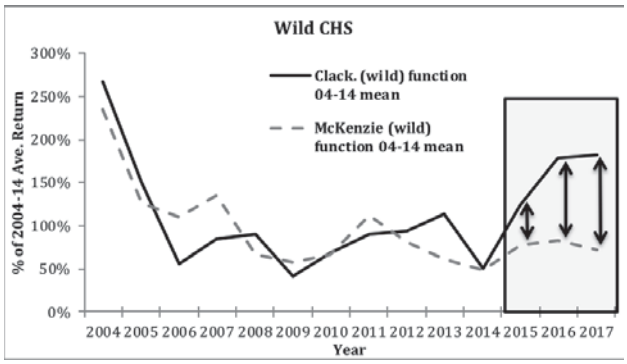

Figure 2. Annual wild Chinook returns to the Clackamas River (at North Fork dam) and McKenzie River (at Leaburg Dam) relative to their 2004-2014 mean. 100% on the vertical axis represents the 2004-2014 mean. The boxed area represents return years from juveniles that outmigrated through the new infrastructure. (PGE)

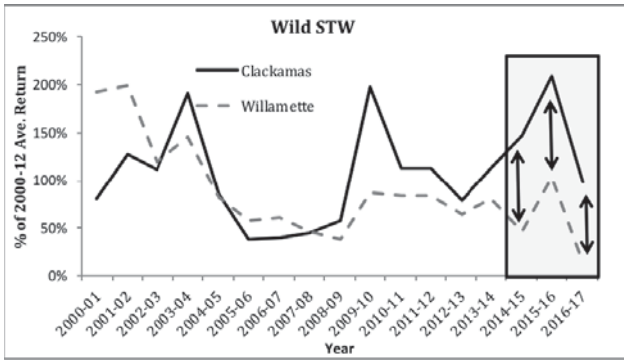

Figure 3. Annual wild winter steelhead returns to the Clackamas River (at North Fork dam) and Willamette Falls relative to their 2000-2012 mean. The boxed area represents return years from juveniles that outmigrated through the new infrastructure (PGE).

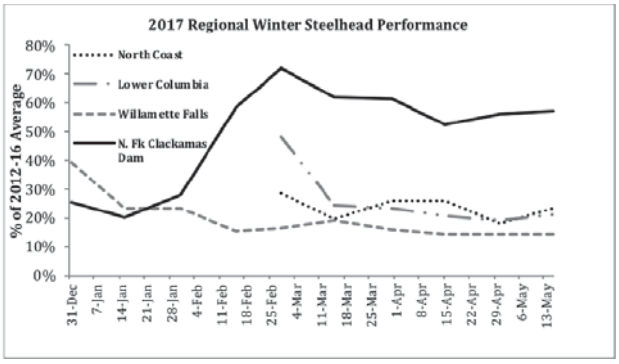

Figure 4. 2017 regional wild winter steelhead performance relative to their respective 5 year averages (2012-2016). ODFW redd counts were used from the North Coast and Lower Columbia (OASIS, 2018) while adult fish counts were obtained from North Fork (PGE) and Willamette Falls (ODFW).

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The 2017 Clackamas wild coho return of 7,081 also proved to be a regional anomaly, at 245% of the 18 year average (Figure 5). During this same period, regional returns averaged 40% of their respective 18 year averages. This was the first return of coho that outmigrated with the added collection benefit of the 1000 cfs North Fork collector. This was the second time in four years the adult coho count at North Fork exceeded 7,000 fish, a level not observed in the previous 59 years.

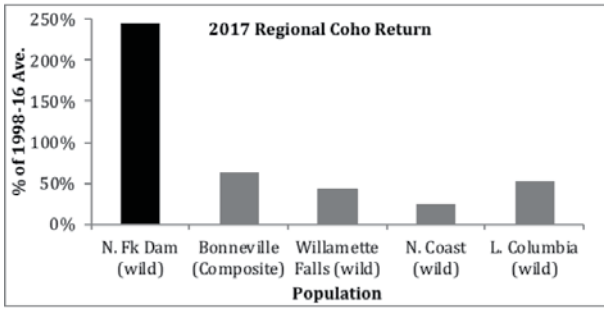

Figure 5. 2017 return of coho relative to their respective 18 year averages for North Fork (wild), Bonneville (composite of hatchery/wild), Willamette Falls (wild), North Coast (redd counts), and Lower Columbia (redd counts). Data were obtained from Columbia River DART, PGE, and ODFW unpublished redd survey data (OASIS, 2018).

In last issue's upstream passage article we saw how infrastructure improvements have helped spring Chinook reach the cool high quality habitat in the upper river. Similarly, preliminary data suggest downstream infrastructure improvement reduced a bottleneck for survival and timing of fish migration. These passage upgrades demonstrate the potential that fish passage projects have for contributing to recovery of our prized native salmon and steelhead.

The next article in the series (Fall, 2018) will discuss the numerous habitat improvements in the Oak Grove Fork of the Clackamas and the resulting spectacular effects on fish usage. **NWS**

Schroeder, R.K., Whitman, L.D., Cannon, C., and Olmsted, P. 2016. "Juvenile life-history diversity and population stability of spring Chinook salmon in the Willamette River basin, Oregon." Oregon Department of Fish and Wildlife, Corvallis Research Laboratory, 28655 Highway 34, Corvallis, OR 97333,.