

Soda Springs Fish Passage Update, June 2016

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After four years of design, four years of constant construction, and two additional years of major upgrades, the new fish passage facilities at Soda Springs Dam are now in routine operation. The facilities were carefully designed and built to meet agency criteria for providing safe upstream and downstream passage of all native anadromous fish – salmon, steelhead, sea-run trout, and lamprey – and within the significant constraints imposed by the narrow canyon, steep and unstable slopes, reservoir fluctuations, and a temperamental river. The facility includes a fish ladder to allow adult fish to migrate upstream over the dam, and a screen to protect juvenile and adult fish migrating downstream to the ocean from going through the powerhouse (Figure 1).

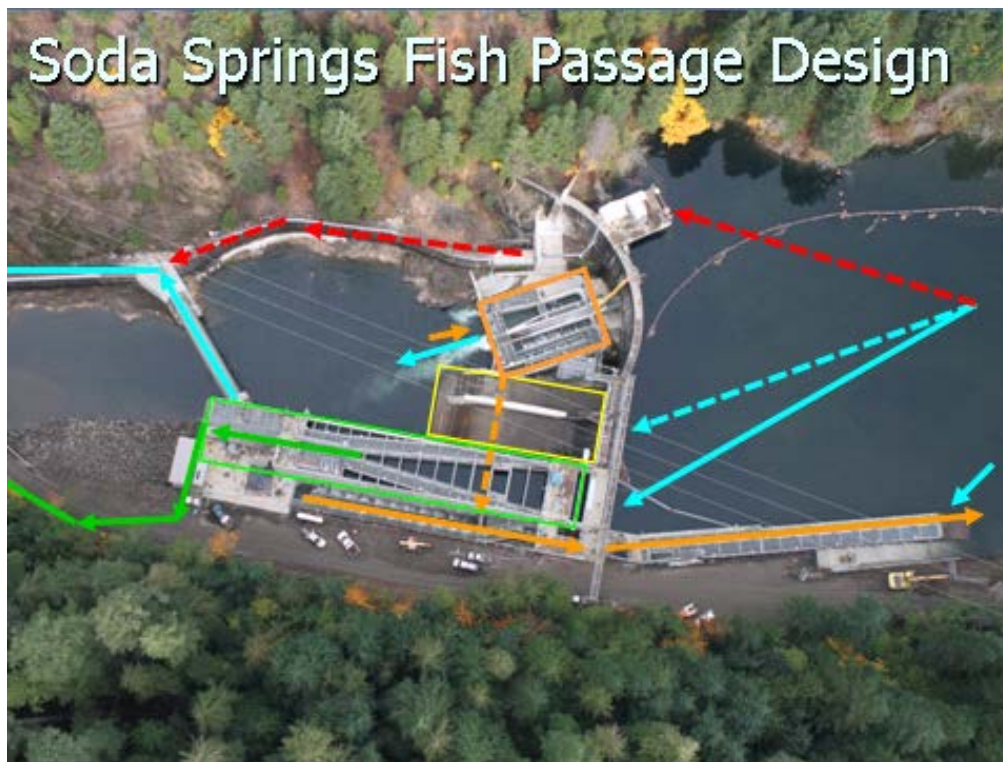


Figure 1. Soda Springs Dam and new fish passage facility, November 2012, with features color-coded. Blue lines indicate water flow toward the fish ladder, fish screen, spillway, out the fish ladder bottom, and through the penstock to the powerhouse. Red lines indicate water flow to the original intake (used during high-flow events to protect the fish screens from collapse). Orange lines indicate the path of adult fish from the base of the dam up the fish ladder and into the reservoir. Green lines indicate the fish screen and path of juvenile fish moving downstream back into the river. Yellow box indicates the new spillway surface smoothed for improved fish passage.

A rigorous 2-year performance evaluation is just concluding, and is being used to further improve and document facility performance. During the evaluation, flow was meticulously balanced based on thousands of water velocity measurements and fine-tuning the hundreds of baffles on the fish ladder and screen. Then, fish passage through both facilities was scrutinized, allowing the fish themselves to tell us whether the entire facility is working properly.

The fish ladder is 800 feet long with 59 pools. It is a proven “half-Ice-Harbor” design customized with a smooth, continuously sloped floor and rounded corners around the turns for proper hydraulics to facilitate fish and lamprey passage. At each pool, fish have the option of swimming through an 18-inch square opening at floor level or swimming / leaping over a 4-foot-wide weir at the top, resulting in a 1-foot rise in elevation. The uppermost portion of the ladder penetrates the dam and proceeds 200 feet into the reservoir. A window and video system in this area record passing fish, and the video files are reviewed by Oregon Department of Fish and Wildlife biologists to document the number, size, species, condition, and timing of adult fish using the ladder.

The fish ladder has been in service continuously since October 2012, except during the winter of 2015 when it was shut down for two months to enlarge and improve the fish counting window (Figure 2). Chinook salmon were the first fish to enter it within minutes of beginning the initial testing, and are the most numerous fish species passing upstream in most years, followed by steelhead and coho salmon. Thus far, the total number of adult salmon and steelhead passing the dam annually has ranged between 900 and 1,200 – with the majority of those being wild, unmarked fish (Table 1). This response is due solely to the inherent nature of fish to colonize beyond their place of origin, since these adults *did not* originate upstream of the dam. The number of adult fish is expected to increase as the progeny of these fish, which *have* spawned upstream of the dam, begin returning from the ocean in 2017 and beyond.

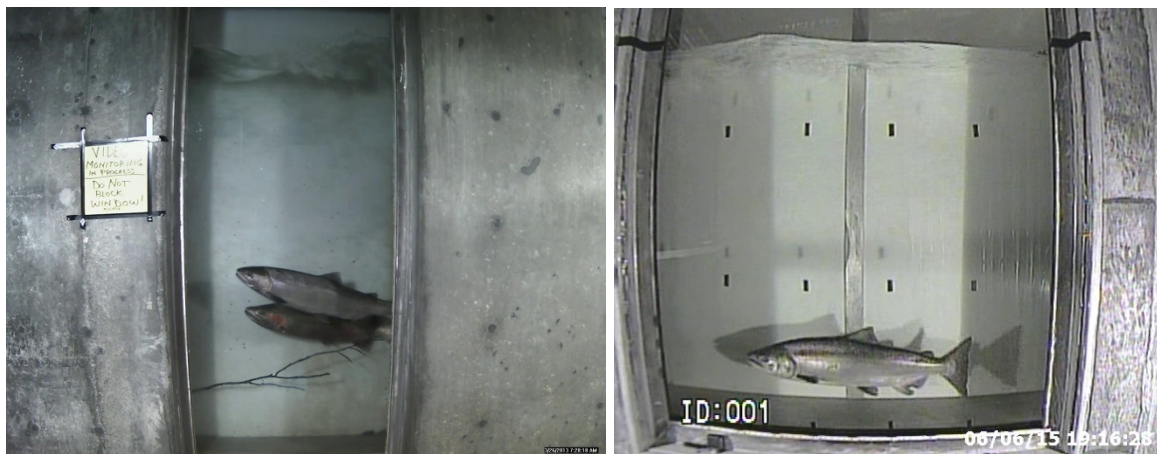


Figure 2. Fish ladder counting window – original (left) with a pair of wild winter steelhead in March 2013, and the new improved window with a wild spring Chinook salmon passing in June 2015 (black marks on window denote 1-foot increments). The window is video-monitored but is not open to the public due to safety and security concerns in the confined space of the video room.

Table 1. Net upstream passage (preliminary numbers) by species and mark (hatchery clip) at Soda Springs Dam, North Umpqua River, OR (years are defined from Feb 1 – Jan 31). No lamprey were observed.

Species:	Spring Chinook		Summer Steelhead		Coho		Winter Steelhead		Trout
Year	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	(bn/rb/ct)
2015	368	66	81	3	207	0	258	7	349
2014	370	92	52	76	272	2	271	25	690
2013	516	137	31	33	65	2	318	11	701

The fish screen, which protects downstream-migrating fry, smolts, and adult steelhead kelts, is actually a series of three different screens providing more than 5,000 square feet of screened area over a length of about 400 feet. The primary screens are about 200 feet long by 19 feet tall; while the secondary and finishing screens are smaller in overall area. All screen material is stainless steel wedgewire, with gaps Soda Springs Fish Passage Update, June 2016

less than 1.75 millimeters (<3/32 inch). Screen surfaces are cleaned by a combination of moving brushes which wipe off leaves and debris, and water jets which move sediment along the bottom and backwash the finishing screens. Most water passes through the screens into the penstock (and hence to the powerhouse a half-mile downstream) or into the fish ladder entrance to help attract fish and supply water to the river. The remaining water flow, about 30 cubic feet per second, carries the fish back to the river via a custom, super-smooth pipe system. When fish are being sampled, the flow and fish are routed into an evaluation building and further screened so that fish can be retained in a holding tank and examined for size, number, condition, and species.

During high flows in the Spring of 2016, multiple groups of hatchery Chinook fry and coho smolts were marked (Figure 3), released into the fish screen, and recaptured in the evaluation building to determine whether the screen system damaged any fish. Of the 300 fry and more than 300 smolts released into the fish screen area, injury was observed on zero fry and only 2 smolts. The observed injury may have been related to the screens, or a predator such as a larger trout. Regardless, the low rate of injury indicates very good performance. During that study, it was encouraging that healthy wild fish were also captured, including hundreds of Chinook fry, 10 coho juveniles, and 18 steelhead/rainbow juveniles. These wild fish also exhibited very low rates of injury (Figure 4).

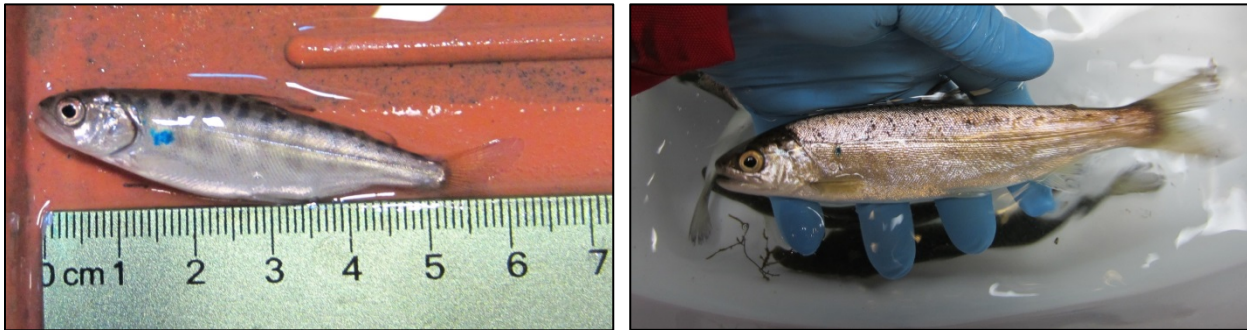


Figure 3. Hatchery test Chinook fry (left) and coho smolt, with blue tattoo marks visible behind the gill plates, March 2016.

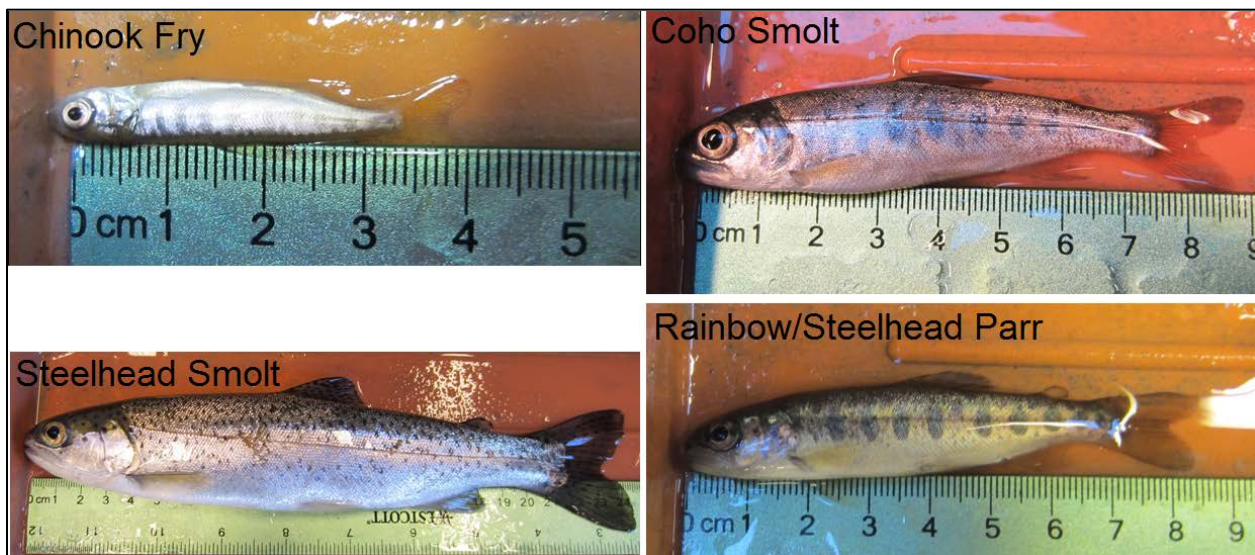


Figure 4. Photos of wild salmonids captured during the fish screen biological performance evaluation, March 2016.

During the next 22 years, long-term monitoring will resume using methods similar to those employed prior to the construction of fish passage. While fish ladder passage continues to be monitored 24/7,

juvenile downstream passage will be monitored approximately weekly during the outmigration season beginning in 2017. This combination will tell the story of how effectively fish are able to colonize and survive within the newly-accessible habitats above the dam. A related effort will continue to study predation by brown trout within the reservoir, and whether control efforts would be likely to increase production of salmon and steelhead. Long-term monitoring also includes spawning habitat abundance and quality; redd counts, and smolt trapping at various sites intermittently through 2038 (the entire current hydropower operating license period) to evaluate the overall benefits realized from restoring fish passage at Soda Springs dam.

Note that the interagency Resource Coordinating Committee will be hosting its annual tour of the hydropower project and fish passage facility on Friday October 7 from about 10 to 3, beginning at the North Umpqua Implementation Center (milepost 57 off Highway 138 East). Stay tuned to local media for more details and to RSVP for the tour. Before fishing the area, be sure to check regulations - but as of this writing the North Umpqua River is closed to fishing between Soda Springs dam and Slide Creek dam to protect the salmon and steelhead resting and spawning in this area.

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