FY20 Willamette RM&E Concept Paper Modified from 18-02-SYS

***STUDY CODE: FY 20 JPL-xx -SYS***

***TITLE: INTERIM PASSAGE AND DELAYED MORTALITY***

**MANAGEMENT PURPOSE:** Provide estimates of the proportion of juvenile Chinook salmon (fry, subyearling, yearling) and steelhead (age-0, age-1, age-2) that survive passage through Willamette Valley System (WVS) dams, under interim passage measures, and what fraction make it to Willamette Falls, or other check points downstream..

**FISH PROGRAM FEATURE:** CRFM

**BIOLOGICAL OPINION ACTION:** RPA measures 4.3, 4.8, 2.8, 4.11

**BACKGROUND:** NOAA’s 2008 Willamette Project BiOp RPA measures 4.8 and 4.11 require the Action Agencies to evaluate downstream juvenile fish passage at Project dams to inform interim and long-term decisions regarding safe and efficient downstream passage facilities and operations. Estimates of project survival, including dam passage survival at differing life stages, are increasingly important and remain incomplete without estimating immediate and delayed passage-related mortality. Currently, all juvenile salmonids produced above dams must pass through WVP dams to gain access to the lower river, with unknown numbers surviving.

Mortality associated with the continued operation of the WVS that can result from causes, such as changes in migration timing; injuries or stress incurred during migration through turbines, regulating outlets or spillways at dams; disease transmission or stress resulting time in reservoirs prior to passage operations; etc. For the purposes of this study losses occurring due to juvenile passage through and over one or more WVP dams and reservoirs, detectable at juvenile life stages, will include the delayed effects of dam passage during juvenile life stages on adult returns, survival, and reproductive success.

Dam passage survival estimates have been conducted at various WVP dams (Cougar: Chinook Normandeau 2010a, Detroit: steelhead Normandeau 2010b, Foster: steelhead Normandeau 2013) with 48-hr mortality estimate inclusion. These estimates were derived using large fish (subyearling Chinook salmon in the fall or yearling smolts, and age-1 steelhead) because of tagging constraints, and have not addressed smaller fish (fry or smaller subyearlings, and age-0 steelhead) passage. In 2013 and 2015, Romer et al. (2016) were able to estimate the proportion of juvenile Chinook surviving to below Cougar Dam in the South Fork McKenzie sub-basin throughout the year using above and below dam estimates. They concluded that ~ 17.7% (4.5-37.3%) of the Chinook salmon entering Cougar Reservoir in 2015 (2014 BY) survived to below Cougar Dam and ~17.5% (11.6 – 25.0%) survived in 2013 (2012 BY). However, these estimates do not include mortality that may be observed later associated with initially sub-lethal factors incurred during dam passage (i.e. mechanical injuries, stress, barotrauma and gas bubble disease).

Similarly, Beeman et al. (2011) estimated reach specific survival for fish (yearling sized) that had been radio and PIT-tagged and passed through Cougar Dam. They estimated survival of tagged fish between the South Fork McKenzie River Bridge and Leaburg juvenile bypass facility (37.3 km downstream) following dam passage. The estimated survival within this reach was 0.454 (SE 0.055) for fish passing through the regulating outlet and 0.586 (SE 0.223) for those passing through the turbines. This suggests considerable delayed mortality. The researchers noted two likely factors affecting reach specific survival estimates: one was chronic expression of delayed passage-related mortality, and fish living longer than the life of radio tags.

Estimation of delayed mortality following dam passage would enable us to more accurately assign mortality to the life stage and location where it is most appropriate.. Data from immediate dam passage survival is less informative if a significant portion of fish either do not pass or subsequently perish due to factors associated with dam passage. Therefore, mortality estimates to downstream antennae for all interim measures are valuable. They are needed to provide useful data for life cycle models, decision-making models, and design of fish passage facilities. These mortality estimates should be used in conjunction with direct mortality and injury estimates when comparing passage alternatives to ensure that all potential adverse effects are considered when choosing a preferred alternative. It will also be important to compare estimates of direct and delayed mortality with collection efficiency evaluations to isolate the effects of dam passage from other sources of potential bias (ISAB 2012).

**CRITICAL UNCERTAINTIES:**

- Effects of dam passage operations on Chinook salmon (and steelhead) survival, specifically with changes from passage survival through the two or more options at dams proposed for interim measures (see Table 1).

- Life-stage specific differences in delayed mortality following dam passage (Chinook: fry,

subyearling, yearling, and steelhead: age-0, age-1, age-2)

- Factors affecting survival (e.g., route of dam passage, forebay elevation, temperature, passage timing)

**OBJECTIVE:** Estimate mortality associated with interim operations and dam passage at different life stages for Chinook salmon and steelhead. Use PIT tags to track passage in conjunction with screwtrapping below dams during modified operations. Report on PIT data from checkpoints during downstream migration and where possible in future years, for adult returns.

Hypothesis testing statement(s)

**SCHEDULE:** 2020

**D R A F T *FY 20 JPL-xx-xx-SYS***

**Table 1. Proposed Interim Measures to monitor with PIT tags for efficacy and delayed mortality (Grayed out columns to be determined with fish managers).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **IM** | **Location, operation (briefly)** | **Timing (estimate)** | **PIT tag release timing** | **Release numbers** |
| **5** | Detroit, no turbines operated except for station service 6-10am, 6-10pm; ~elev 1450-1500; Screwtrap below Big Cliff for timing, size data  Need PIT tag for downstream survival | Fall 2020; ~ Nov 1 -Feb 1 | Before: Oct During: Nov | **1000 ChS each group** |
| **6** | Big Cliff, reduce TDG with spillgates and feedback–monitor when over 110% saturation  Consider adding netpen below to monitor outmigrating juveniles affected by TDG |  |  |  |
| **7** | Detroit, spill for temperature management until drawn down below spillway crest; screwtrap below Big Cliff for timing, size data. Also need information on temperature effects on fish behavior downstream. Need PIT tag for downstream survival | 2020- Summer | During: | **Blocks**  **Spill on/**  **Off** |
| **9** | Foster, Night spillway from 7 PM - 7AM from Oct 1 - Dec 15, March 1 - June 15. Consider 8pm start for March-June to increase hatchery retention in fishery. [Coordinate with IM.10] | 2020- Fall  2021- Spring | **Before: Sept**  **During: Oct** | **1000 ChS each group**    **Surplus StW surrogate** |
| **10** | Foster, operate turbines, spill gates and fish weirs to improve adult collection temperatures, reduce TDG downstream. [Modify, coordinate with IM.9] | July 2020 months | During AWS on/off? |  |
| **15** | Operate for split gates in Cougar TC tower to minimize RO or turbine passage, when over 1570 ft, increase RO flows at 1516-1570 ft [or below 1516?] screwtrap below for timing, size data.  Need PIT tag for downstream survival, passage efficiency comparing operations | 2020 | Before: During: | **1000 PIT tagged juveniles above before & during the operation** |
| **16** | Limit Cougar refill to 1600 ft > Feb 1, release to 1570 ft by Sept 1 (vs mid Nov). Use approved table of RO/turbine day & night splits for RO passage. Screwtrap will be operated below Cougar  Need PIT tag for downstream survival, passage efficiency comparing operations | 2021  Fall outmigrants to leave earlier | Before: [RO split] During: | **1,000 PIT tagged juveniles** |
| **17** | Delay refill of Cougar Reservoir to maintain a lower pool (1532?) Feb 1 -May 1. With hydrologic modeling and NMFS input, balance fish passage, downstream flows & temperature. Use approved table such as IM.16 shows for RO/turbine split. As above, screwtrap will be operated below Cougar  Need PIT tag for downstream survival, passage efficiency comparing operations | 2021  Spring fry outmigrate | Before: [RO split] During: | **PIT tag smaller size cutoff?** |
| **20** | Hills Creek, RO only spill 6-10 PM, >elevation is less than or equal to 50 feet over the turbine intakes (~Dec 1 to Mar 1). Rotary screwtrap will be installed and operated below Hills Creek Dam [RO or both channels] to provide information on migration timing and size.  [Until it is possible to coordinate with operation at Lookout Point, consider tradeoffs for alternatives ] | 2020 |  |  |
| **21** | Lookout Point, refill to 900 ft; operate spillway gates to provide surface spill in the spring and summer when conditions allow. [Coordinate with Hills Creek levels]  Dexter Dam, daily limit turbine operations 6-10 pm, unless high TDG; rotary screwtrap belowDexter Dam to provide information on the migration timing and size  Need PIT tags to get downstream survival. | 2020 | **May, June Also, Tag Tag instream Juveniles at NFMF, and /or Middle Fork above LOP** | **1000 per group for juvenile releases; in river tags TBD by run size and effort** |
| **22** | Transport juvenile spring Chinook salmon around the Reservoir and Fall Creek Dam during their migration season (approximately January to May), note trapping efficiency is expected to be 5 to 10% without guidance structures installed.  Count collected, transported, and released fish by date, & numbers by length class. | 2021, Winter |  | **Tag all fish released** |
| **23** | Surface spill from Fall Creek Reservoir from May 1 –Jul 1 when above spillway crest, depending on hydrology; spillway 791.6 elev usually reached by March. Screwtrap to collect data on number, size, and species of fish | 2021  May soonest |  | **Consider IM.22 fish w/PIT tags to hold for operaton** |

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