SYSTEM OPERATIONAL REQUEST: #2021-1 (updated)

WALLA WALLA DISTRICT

The following State, Federal, and Tribal Salmon Managers have participated in the preparation and support this SOR: Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Nez Perce Tribe, Yakama Nation, Confederated Tribes of the Colville Reservation, Spokane Tribe of Indians, Warm Springs Tribe, and the Columbia River Inter-Tribal Fish Commission.

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FROM: Charles Morrill, FPAC Chair

DATE: February 2, 2021 (Updated February 24, 2021)

SUBJECT: Dworshak Load Shaping

SPECIFICATIONS: The fishery managers recommend cessation of within day load shaping operations at Dworshak Dam. Any future daily[1] load-shaping operations at Dworshak Dam should not be implemented until after coordination with the fish managers has occurred to address concerns and reach consensus on future operations.

JUSTIFICATION: Within day load shaping operations at Dworshak Dam were implemented January 25 – 29, 2021 (Attachment 1) with likely impacts to treaty and non-treaty fisheries, ESA-listed juvenile fall Chinook, hatchery operations, and riverine ecological function. Daily load shaping operations occur when water releases through turbines are minimized during periods of low power demand (market value), typically nighttime, and subsequently increased when demand (market value) is high, typically daytime. Daily load shaping operations have been used infrequently at Dworshak Dam and were last implemented in 2011[2]. Consideration for contemporary use was not coordinated with Fishery Managers.

Flow increases were started each day about 4:00am, with peak flows occurring between 8:00am and 5:00pm. Base flows were ~1,600cfs and peak discharges were ~9,700cfs. These flow fluctuations occur in the North Fork Clearwater River with very little delay, however flows in downstream areas (i.e. Spaulding) do not increase until 10:00am, with peak flows reached by 1:00pm (Figures 1 and 2). Flows from the Clearwater River upstream of its confluence with the North Fork Clearwater River were ~2,900cfs. The load shaping releases nearly tripled flows in the lower Clearwater River.

End of month Flood Risk Management (FRM) pool elevation targets have guided project discharges for several decades, increases in discharge are typical over the last several days of the month to reach FRM target elevation. The Dworshak Dam January FRM elevation was 1,533 feet. Holding Dworshak discharge at minimum flows (1,600cfs) for most of January resulted in a pool elevation on January 24 of 1,534.8 feet. After the five days of load shaping operations, Dworshak pool elevation was at 1,531.7 feet (1.3 feet lower than the FRM target).

Corps of Engineers' January final snowpack estimates for the North Fork Clearwater basin was 117%. Their February final snowpack estimate is 100% of average. National Oceanic and Atmospheric Administration's current River Forecast Center (RFC) forecast is 88% of average.

Impacts on Treaty and Non-Treaty Fisheries

Nez Perce Tribe treaty fisheries for steelhead in the Clearwater river drainage typically occur from August through March, with substantial effort and harvest occurring in the North Fork Clearwater River. The Tribe expects that most of the harvest of steelhead in the Clearwater drainage occurs at this on-Reservation fishery area in the North Fork Clearwater (between the mouth and the Dworshak Dam) during this time of year.

[1] Fish managers expect that interim operations will minimize repeated increases and decreases of Dworshak flows except when necessary to meet FRM elevations and refill targets.

[2] Unit testing in January of 2020 resulting in repeated days with increased daytime flows, but the magnitude of discharge increases peaked at ~5kcfs, roughly half the 2021 operation.

Generally, 75% of the Tribe's harvest of steelhead from the North Fork Clearwater River occurs in January through March. It is expected that dramatic fluctuations in flow discharge that results from power peaking operations will affect Nez Perce treaty catch rates of steelhead. Fishery effort and harvest effectiveness will likely be impacted to some degree by the changes in Dworshak Dam flow. The degree of impact is not known at this time given we do not have experience with these types of daily flow discharges and how that affects the fishery.

We would expect that these flow fluctuations--as dramatic the amplitude and timing of them--will in all likelihood change fish movement and behavior as well as those of the tribal members who may be fishing during these kinds of operations. This will disrupt treaty fishing at a critical time and area when tribal members are fishing for steelhead for food and other uses.

Flow fluctuations would be experienced by fishers in the North Fork Clearwater River with very little delay, however tribal fishers and sport anglers in downstream areas (i.e., Spaulding) would not experience flow increases until 10:00am with peak flows reached by 1:00pm (Figures 1-3). Water level increased 2 feet during that period.

Impacts on Juveniles

ESA listed fall Chinook salmon spawn throughout the Clearwater River basin, including but not limited to, the North Fork Clearwater River and Clearwater River downstream of Orofino. Fall Chinook spawning generally occurs when river flows, including Dworshak releases, are at their lowest level. As such, Dworshak release fluctuations, after December, do not create a redd dewatering risk. However, flow fluctuations after fall Chinook fry emerge from the gravel can impact juvenile rearing location and survival. Emergence timing is influence by spawning date and water temperature, with fry emerging between late January and May. The earliest emergence occurs from redds in the North Fork Clearwater and areas immediately downstream of the confluence of the North Fork Clearwater River and Clearwater rivers (Attachment 2).

Impacts on Hatcheries

Four hatchery facilities operate in the Clearwater basin downstream of Dworshak Dam. The water quantity and quality of Dworshak releases impact three of these hatcheries.

Big Canyon Fall Chinook Acclimation Ponds (FCAP) – This fall Chinook acclimation site uses portable water intake tubes that are highly influenced by river volume and require adjustments as flows change. After the facility is set up in March, intake hoses are manually adjusted by staff, hoses are extended into the river as flows drop and shortened as flows increase. Load shaping flows would increase risk of pump failure and risk of acclimation staff injury.

Dworshak Hatchery – The primary water intake for Dworshak Hatchery pulls water from the North Fork Clearwater River, downstream of Dworshak Dam. Abrupt flow increases dislodge algae and other materials which then accumulate on intake screens and requires continual cleaning by hatchery staff for hours after the flow change. The intensity of screen cleaning may decrease if flow changes are repeated daily but will still require close monitoring. In addition,

some dislodged algae makes it into the fish rearing vessels and may be a contributing factor in disease outbreaks.

Nez Perce Tribal Hatchery (NPTH) – The Clearwater River is the primary water source for Nez Perce Tribal Hatchery; Dworshak released water influences the NPTH water temperature. Fluctuating water volumes from Dworshak Dam increases the variability in lower Clearwater River water temperatures requiring additional monitoring and potentially manipulation of NPTH water temperature with chillers.

Impacts on Riverine Ecological Function

Load following operations cause abrupt changes in water velocity and water levels with widely documented negative impacts on many aspects of river ecosystems (Cushman 1985; Melcher et al. 2017). For example, these types of operations can alter fish habitat use (e.g., Scruton et al. 2003) and growth rates (e.g., Korman and Campana 2009), change patterns of macroinvertebrate drift (e.g., Miller and Judson 2014), and decrease primary production (e.g., Hall et al. 2015).

References

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Melcher, A. H., T. H. Bakken, T. Friedrich, F. Greimel, N. Humer, S. Schmutz, B. Zeiringer, and J. A. Webb. 2017. Drawing together multiple lines of evidence from assessment studies of hydropeaking pressures in impacted rivers. Freshwater Science 36:220-230.

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Scruton, D. A., L. M. N Ollerhead, K. D. Clarke, C. Pennell, K. Alfredsen, A. Harby, and D. Kelley. 2003. The behavioural response of juvenile Atlantic salmon (Salmo salar) and brook trout (Salvelinus fontinalis) to experimental hydropeaking on a Newfoundland (Canada) river. River Research and Applications 19:577-587.

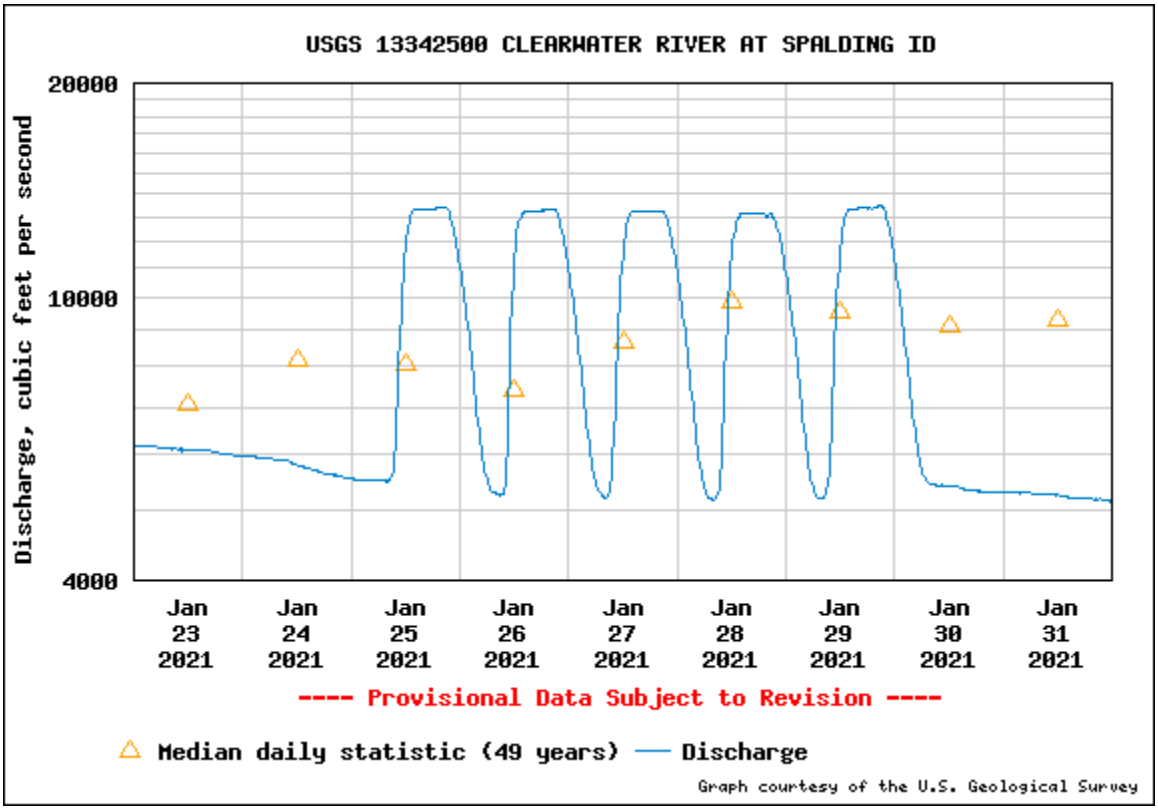

Figure 1. Discharge of the Clearwater River at Spaulding, ID (USGS data - https://waterdata.usgs.gov/id/nwis/uv/?site_no=13342500&PARAmeter_cd=00065,00060,00010).

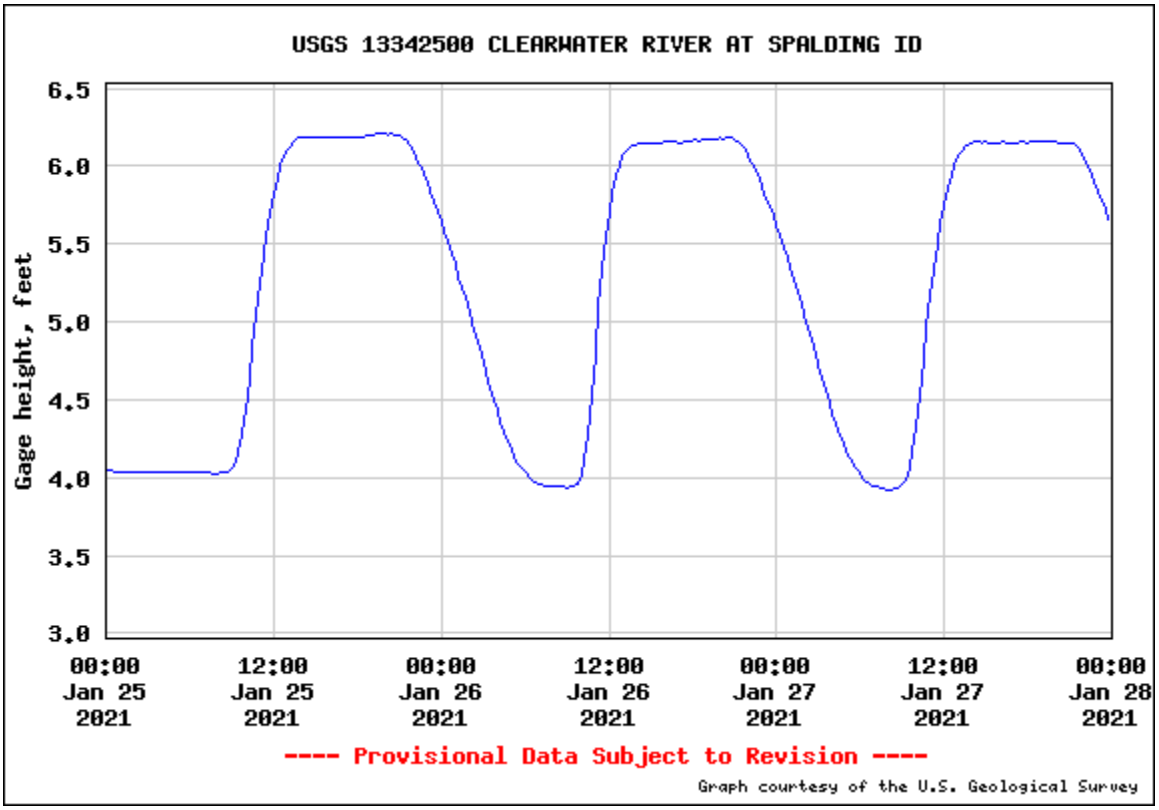

Figure 2. Gage height measured for the Clearwater River at Spaulding, ID showing the timing of water level increases.

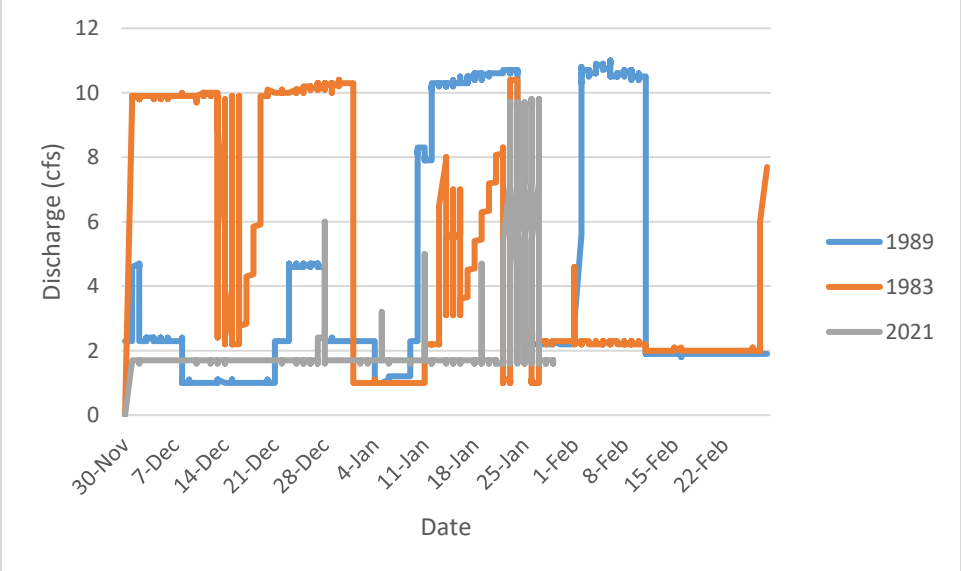

Figure 3. Winter operations in 2021 compared to 1983-1984 (load following period) and 1989-1990 (post-load following period).

Attachment 1

Increased Dworshak Operation Summaries Jan 25-29,2021

Monday Jan 25, 2021

Hour	Total Outflow kcfs	Generation Flow kcfs	Spill kcfs	Forebay Elevation	Tailwater Elevation	Average Head	Peck Gage Elevation
1	1.70	1.60	0.00	1534.85	970.80	564.05	4.67
2	1.70	1.60	0.00	1534.82	970.79	564.03	4.67
3	1.70	1.60	0.00	1534.83	971.19	563.64	4.67
4	3.70	3.60	0.00	1534.82	973.61	561.21	4.67
5	5.40	5.30	0.00	1534.81	975.25	559.56	5.40
6	7.20	7.10	0.00	1534.78	976.51	558.27	6.13
7	8.40	8.30	0.00	1534.73	977.70	557.03	6.73
8	9.70	9.60	0.00	1534.67	978.03	556.64	7.15
9	9.60	9.50	0.00	1534.63	977.97	556.66	7.49
10	9.60	9.50	0.00	1534.58	978.02	556.56	7.49
11	9.60	9.50	0.00	1534.54	977.99	556.55	7.49
12	9.60	9.50	0.00	1534.47	978.00	556.47	7.47
13	9.60	9.50	0.00	1534.42	977.99	556.43	7.47
14	9.70	9.60	0.00	1534.37	978.04	556.33	7.47
15	9.70	9.60	0.00	1534.30	978.04	556.26	7.47
16	9.70	9.60	0.00	1534.27	978.11	556.16	7.50
17	9.50	9.40	0.00	1534.22	977.29	556.93	7.50
18	8.10	8.00	0.00	1534.19	976.66	557.53	7.50
19	7.10	7.00	0.00	1534.15	975.90	558.25	7.50
20	5.40	5.30	0.00	1534.13	975.03	559.10	7.02
21	3.60	3.50	0.00	1534.13	972.49	561.64	6.69
22	1.60	1.50	0.00	1534.13	970.85	563.28	5.52
23	1.60	1.50	0.00	1534.14	970.79	563.35	5.52
24	1.60	1.50	0.00	1534.14	970.77	563.37	4.74
AVG	6.46	6.36	0.00	1534.46	975.33	559.14	6.50
MAX	9.70	9.60	0.00	1534.85	978.11	564.05	7.50
MIN	1.60	1.50	0.00	1534.13	970.77	556.16	4.67

Tuesday Jan 26, 2021

Hour	Total Outflow kcfs	Generation Flow kcfs	Spill kcfs	Forebay Elevation	Tailwater Elevation	Average Head	Peck Gage Elevation
1	1.60	1.50	0.00	1534.14	970.78	563.36	4.55
2	1.60	1.50	0.00	1534.16	970.78	563.38	4.55
3	1.60	1.50	0.00	1534.15	970.77	563.38	4.55
4	2.20	2.10	0.00	1534.15	972.59	561.56	4.55
5	4.60	4.50	0.00	1534.13	975.00	559.13	4.63
6	7.30	7.20	0.00	1534.10	976.63	557.47	4.63
7	8.40	8.30	0.00	1534.09	977.60	556.49	6.70
8	9.70	9.60	0.00	1534.02	978.01	556.01	7.09
9	9.60	9.50	0.00	1533.97	977.86	556.11	7.44
10	9.60	9.50	0.00	1533.91	977.98	555.93	7.46
11	9.70	9.60	0.00	1533.88	978.02	555.86	7.46
12	9.60	9.50	0.00	1533.84	978.02	555.82	7.46
13	9.70	9.60	0.00	1533.78	978.06	555.72	7.46
14	9.70	9.60	0.00	1533.75	978.09	555.66	7.46
15	9.70	9.60	0.00	1533.69	978.02	555.67	7.46
16	9.70	9.60	0.00	1533.63	978.02	555.61	7.46
17	9.50	9.40	0.00	1533.59	977.30	556.29	7.49
18	8.10	8.00	0.00	1533.55	976.62	556.93	7.49
19	7.10	7.00	0.00	1533.53	976.02	557.51	7.49
20	5.40	5.30	0.00	1533.52	974.77	558.75	6.99
21	3.60	3.50	0.00	1533.52	972.94	560.58	6.13
22	1.70	1.60	0.00	1533.52	970.88	562.64	5.49
23	1.60	1.50	0.00	1533.52	970.79	562.73	5.49
24	1.60	1.50	0.00	1533.54	970.77	562.77	4.75
AVG	6.37	6.27	0.00	1533.82	975.26	558.56	6.34
MAX	9.70	9.60	0.00	1534.16	978.09	563.38	7.49
MIN	1.60	1.50	0.00	1533.52	970.77	555.61	4.55

Wednesday Jan 27, 2021

Hour	Total Outflow kcfs	Generation Flow kcfs	Spill kcfs	Forebay Elevation	Tailwater Elevation	Average Head	Peck Gage Elevation
1	1.60	1.50	0.00	1533.54	970.80	562.74	4.56
2	1.60	1.50	0.00	1533.54	970.77	562.77	4.56
3	1.70	1.60	0.00	1533.54	971.38	562.16	4.56
4	3.70	3.60	0.00	1533.53	973.53	560.00	4.56
5	5.50	5.40	0.00	1533.51	975.21	558.30	5.36
6	7.20	7.10	0.00	1533.48	976.52	556.96	6.09
7	8.30	8.20	0.00	1533.42	977.54	555.88	6.71
8	9.70	9.60	0.00	1533.39	977.95	555.44	6.71
9	9.70	9.60	0.00	1533.32	978.02	555.30	7.46
10	9.60	9.50	0.00	1533.29	977.96	555.33	7.48
11	9.60	9.50	0.00	1533.24	977.98	555.26	7.45
12	9.70	9.60	0.00	1533.18	978.01	555.17	7.45
13	9.60	9.50	0.00	1533.12	977.97	555.15	7.45
14	9.70	9.60	0.00	1533.08	978.05	555.03	7.45
15	9.70	9.60	0.00	1533.02	978.01	555.01	7.45
16	9.70	9.60	0.00	1533.00	978.02	554.98	7.45
17	9.60	9.50	0.00	1532.90	977.41	555.49	7.47
18	8.10	8.00	0.00	1532.90	976.62	556.28	7.47
19	7.10	7.00	0.00	1532.86	975.91	556.95	6.95
20	5.30	5.20	0.00	1532.85	974.70	558.15	6.63
21	3.50	3.40	0.00	1532.86	972.40	560.46	6.08
22	1.70	1.60	0.00	1532.85	970.81	562.04	5.44
23	1.60	1.50	0.00	1532.85	970.74	562.11	5.44
24	1.70	1.60	0.00	1532.86	970.76	562.10	4.68
AVG	6.47	6.37	0.00	1533.17	975.29	557.88	6.37
MAX	9.70	9.60	0.00	1533.54	978.05	562.77	7.48
MIN	1.60	1.50	0.00	1532.85	970.74	554.98	4.56

Thursday Jan 28, 2021

Hour	Total Outflow kcfs	Generation Flow kcfs	Spill kcfs	Forebay Elevation	Tailwater Elevation	Average Head	Peck Gage Elevation
1	1.60	1.50	0.00	1532.86	970.74	562.12	4.51
2	1.60	1.50	0.00	1532.86	970.73	562.13	4.51
3	1.80	1.70	0.00	1532.86	971.52	561.34	4.53
4	3.70	3.60	0.00	1532.85	973.68	559.17	4.53
5	5.50	5.40	0.00	1532.83	975.37	557.46	5.35
6	7.20	7.10	0.00	1532.78	976.41	556.37	5.35
7	8.30	8.20	0.00	1532.75	977.39	555.36	6.70
8	9.80	9.70	0.00	1532.69	978.00	554.69	7.07
9	9.70	9.60	0.00	1532.64	977.96	554.68	7.45
10	9.60	9.50	0.00	1532.59	977.96	554.63	7.45
11	9.70	9.60	0.00	1532.55	977.95	554.60	7.45
12	9.70	9.60	0.00	1532.50	978.04	554.46	7.45
13	9.70	9.60	0.00	1532.46	978.01	554.45	7.45
14	9.70	9.60	0.00	1532.39	977.99	554.40	7.42
15	9.70	9.60	0.00	1532.36	978.05	554.31	7.42
16	9.80	9.70	0.00	1532.30	978.04	554.26	7.42
17	9.70	9.60	0.00	1532.26	977.63	554.63	7.44
18	8.20	8.10	0.00	1532.22	976.77	555.45	7.44
19	7.10	7.00	0.00	1532.18	975.78	556.40	7.38
20	5.40	5.30	0.00	1532.15	975.17	556.98	7.38
21	3.70	3.60	0.00	1532.13	972.85	559.28	6.61
22	1.70	1.60	0.00	1532.14	970.88	561.26	6.10
23	1.60	1.50	0.00	1532.17	970.77	561.40	6.10
24	1.60	1.50	0.00	1532.15	970.77	561.38	4.72
AVG	6.50	6.40	0.00	1532.49	975.35	557.13	6.47
MAX	9.80	9.70	0.00	1532.86	978.05	562.13	7.45
MIN	1.60	1.50	0.00	1532.13	970.73	554.26	4.51

Friday Jan 29, 2021

Hour	Total Outflow kcfs	Generation Flow kcfs	Spill kcfs	Forebay Elevation	Tailwater Elevation	Average Head	Peck Gage Elevation
1	1.70	1.60	0.00	1532.18	970.81	561.37	4.72
2	1.70	1.60	0.00	1532.16	970.79	561.37	4.55
3	1.70	1.60	0.00	1532.17	971.20	560.97	4.55
4	3.70	3.60	0.00	1532.15	973.55	558.60	4.61
5	5.40	5.30	0.00	1532.15	975.11	557.04	4.61
6	7.20	7.10	0.00	1532.12	976.25	555.87	4.61
7	8.30	8.20	0.00	1532.07	977.53	554.54	6.12
8	9.80	9.70	0.00	1532.01	978.01	554.00	6.71
9	9.70	9.60	0.00	1531.96	977.99	553.97	7.50
10	9.60	9.50	0.00	1531.92	977.96	553.96	7.52
11	9.70	9.60	0.00	1531.87	978.07	553.80	7.52
12	9.70	9.60	0.00	1531.83	977.99	553.84	7.52
13	9.70	9.60	0.00	1531.78	977.99	553.79	7.52
14	9.70	9.60	0.00	1531.74	978.06	553.68	7.52
15	9.70	9.60	0.00	1531.67	978.01	553.66	7.52
16	9.80	9.70	0.00	1531.60	978.03	553.57	7.52
17	9.60	9.50	0.00	1531.56	977.50	554.06	7.51
18	8.30	8.20	0.00	1531.54	976.84	554.70	7.57
19	7.50	7.40	0.00	1531.50	975.83	555.67	7.57
20	5.50	5.40	0.00	1531.49	975.05	556.44	7.13
21	3.70	3.60	0.00	1531.47	973.20	558.27	6.87
22	2.00	1.90	0.00	1531.49	971.14	560.35	6.87
23	1.70	1.60	0.00	1531.50	970.76	560.74	5.61
24	1.60	1.50	0.00	1531.50	970.76	560.74	4.96
AVG	6.54	6.44	0.00	1531.81	975.35	556.46	6.45
MAX	9.80	9.70	0.00	1532.18	978.07	561.37	7.57
MIN	1.60	1.50	0.00	1531.47	970.76	553.57	4.55

Attachment 2

TO: Technical Management Team

FR: Nez Perce Tribe Department of Fisheries Resources Management

RE: Fall Chinook salmon fry emergence timing along the Clearwater River lower reach – 2020/2021 post-season update

DATE: February 8, 2021

Previous emergence timing analysis[3] of fall Chinook salmon fry in the lower Clearwater River has shown emergence starting in late January. This memorandum provides estimates of fall Chinook Salmon fry emergence timing downstream of Dworshak Dam, specific to actual 2020/21 redd construction timing and river temperatures. The Clearwater River lower reach extends from the confluence of the North Fork (N.F.) Clearwater River down to the upper end of the east arm of Lower Granite Reservoir and the N.F. Ahsahka Islands stretch that extends from Dworshak Dam to the Ahsahka Island complex that is situated at the mouth of the N.F. Clearwater River and the upper end of the Clearwater River lower reach.

We estimated fry emergence using actual river tailrace temperatures from Dworshak Reservoir for the N.F. Ahsahka Islands stretch from the first redd survey date (10/6/2020) to 2/1/2021 and temperatures recorded from Dworshak after that time period during 2020. For the Clearwater River lower reach, we used water temperatures recorded at the USGS Spalding gauge from the first redd survey (10/6/2020) to 2/1/2021 and temperatures recorded at the same gauge after that time period (2/2/2020 onward) since temperatures were very similar during the early part of incubation during both years.

Spatial Distribution of Redds

This was the first year for conducting redd surveys using only small unmanned aircraft system (sUAS) on the Clearwater River lower reach and the N.F. Ahsahka Island stretch. We conducted sUAS surveys in 10 high use 1-km census transects and 10 surveys in stratified random lower use 1-km transects from Rkm 7-65. We modeled (Särndal, et al. 2003) sUAS counts to the entire lower Clearwater River to get a total redd estimate. We conducted sUAS surveys on 10/6-7, 10/27-29, 11/2-3, and 12/3 during 2020. Redds constructed before the first 10/6 survey were not modeled and could account for a small percentage of the total fry emergence timing being slightly earlier than modeled. However, construction of redds after the last 12/3 survey were thought to be near complete by that date.

A population total of 4,873 Snake River fall Chinook salmon redds were estimated in 2020, with 1,669 redds (34%) existing in areas influenced by Dworshak Dam releases. Of the portion of redds

[3] http://pweb.crohms.org/tmt/agendas/2017/0329_NPT-Memo_Clearwater-Fall-Chinook-Salmon-Fry-Emergence-Timing-Estimates-(2017).pdf and updated on December 7, 2017.

existing within the Dworshak Dam area of influence, 91.25% (n = 1,523) and 8.75% (n = 146) were estimated along the Clearwater River lower reach and the N.F. Ahsahka Islands stretch, respectively. Of the 146 redds estimated along the N.F. Ahsahka Islands stretch, all were counted in and around the northern sections of the islands and were modeled using Dworshak Reservoir release temperatures.

Mean Daily Water Temperature

Mean daily temperature data were downloaded for the period 9/6/2020 to 2/1/2021 from the USGS Spalding gauge located along the lower end of the Clearwater River lower reach and from Dworshak Dam water quality monitor for the N.F. Clearwater River.

The amount of influence water released from Dworshak Dam has on developing embryos along the N.F. Ahsahka Islands stretch is dependent on where redds are located. Redds located along the North Fork Clearwater River, and the north channel of the islands, are highly affected by Dworshak Dam operation compared to the redds located on southern, eastern, and western portions of the islands. The actual substrate temperatures the embryos were exposed to were not been measured. For the purpose of this analysis, redds were treated as one group and it was assumed that water temperature measured in the tailrace of Dworshak Dam represented the incubation temperatures in the redds. Likewise, water column temperatures measured at the Spalding gauge was assumed to represent incubation temperatures in the lower river.

Fry Emergence Timing in 2021

Emergence timing of fry was estimated separately for the Clearwater River lower reach and the N.F. Ahsahka Islands stretch by survey date. Starting on a given survey date, the daily mean water temperatures (^{0}C) were summed forward in time until the date that 1,000 temperature units were accumulated (i.e., the estimated fry emergence date). The number of redds counted during a given survey over each of the two spawning locations was divided by the 2020 total redd count made downstream of Dworshak Dam. The resulting quotients were assumed to be directly proportional to the number of fry produced, and are referred to hereafter as "percentages of the modeled fry population."

The percentages of the modeled fry population that were estimated to emerge from redds along the N.F. Ahsahka Islands stretch paired with estimated emergence dates were 3.2% on 2/10/2021 (the onset), 5.5% on 3/22/2021 (the peak), and 0.6% on 4/3/2021 (close to completion; Figure 1).

The percentages of the modeled fry abundance that were estimated to emerge from redds along the Clearwater River lower reach paired with estimated emergence dates were 8.2% on 4/11/2021 (close to the onset), 41.1% on 5/11/2021, 22.4% on 5/15/2021, and 19.6% on 6/03/2021 (close to completion; Figure 1).

Another view of the same fry emergence data as a cumulative percentage in each of the N.F. Ahsahka Islands stretch and the Clearwater River lower reach is presented in Figure 2.

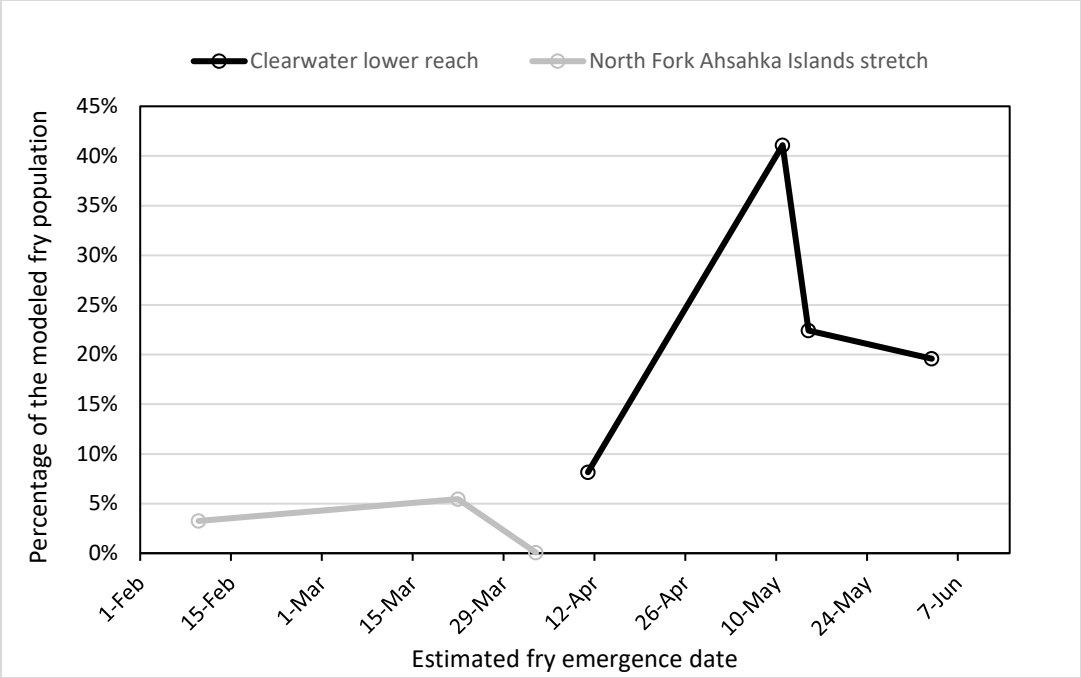

Figure 1. The percentage of the modeled fall Chinook Salmon fry population downstream of Dworshak Dam (y axis) plotted against estimated dates of emergence from redds (x axis) counted along the Clearwater River lower reach, and the North Fork Ahsahka Islands stretch, 2021. (See the text for specific percentage-date pair values).

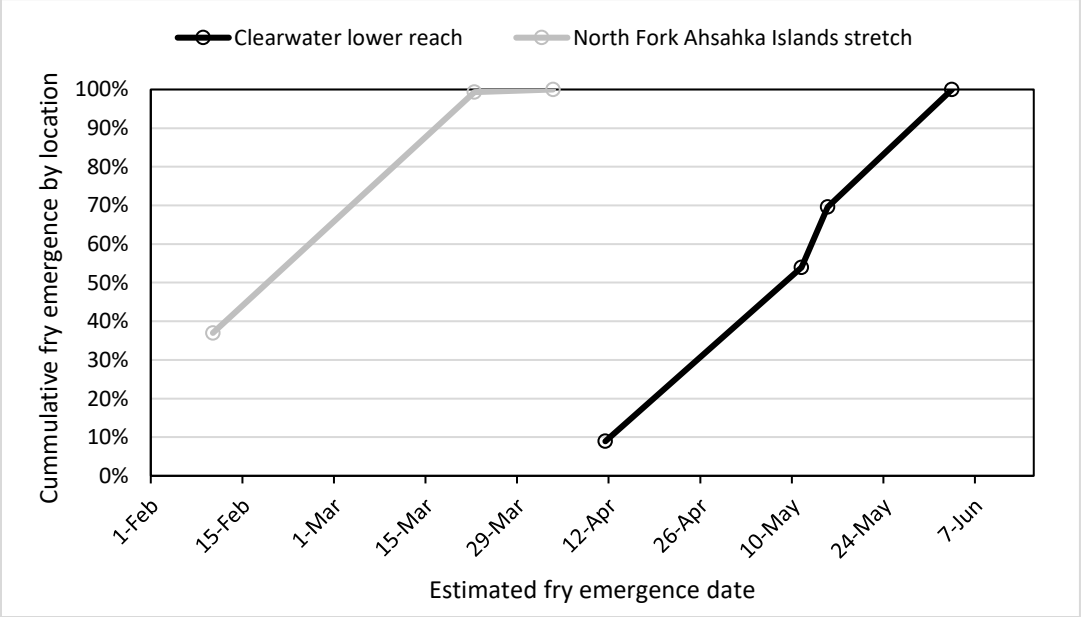

Figure 2. The cumulative (%) emergence distributions modeled for fall Chinook salmon fry downstream of Dworshak Dam (y axis) plotted separately for the Clearwater River lower reach, and the North Fork Ahsahka Islands stretch against estimated emergence dates from redds (x axis), 2021.

Contribution of Snake River fall Chinook Salmon, 2020

Fall Chinook Salmon redd surveys were conducted cooperatively by biologists from the Idaho Power Company (IPC), Nez Perce Tribe (NPT), U.S. Geological Survey (USGS), and Washington Department of Fish and Wildlife (WDFW). The proportion of all redds counted or estimated during 2020 were 43.1% in the Snake River, 41.3% in the Clearwater River subbasin, 8.1% in the Salmon River, 4.1% in the Grand Ronde, 2.8% in the Tucannon River, and 0.6% in the Imnaha River (Arnsberg et al. 2021). With a significant number of the total Snake Basin fall Chinook Salmon spawning in the lower Clearwater, it would be beneficial to the population as a whole to reduce potential adverse impacts of ramping flows from Dworshak Dam on incubating eggs and emerging fry.

References:

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