

**Summary of 2020 Juvenile Fish Bypass Operations at Wells Hydroelectric Project
November 23, 2020**

Douglas PUD operated the Wells bypass system in 2020 as guided by the Wells HCP Coordinating Committee-approved *2020 Bypass Operating Plan* (BOP). The plan was developed to provide non-turbine passage during 95 percent of the juvenile Plan Species migration passing Wells Dam. Bypass operations were initiated on April 9 at 00:00 hours, and operated continuously until terminated at 24:00 hours on August 19, for a total of 133 days.

The BOP included measures for complying with Federal Energy Regulatory Commission (FERC) requirements for maintaining minimum automatic-gate-opening capacity under the *Wells Project Emergency Action Plan* (EAP). The BOP also included Washington Department of Ecology requirements for compliance with total dissolved gas (TDG) standards as directed by the FERC-approved *2020 Total Dissolved Gas Abatement Plan* (GAP) for the Wells Project. Compliance with the requirements of the EAP and GAP is typically achieved by systematic removal of bypass barriers under increasing discharge, including the concentration of spill through adjacent spillways at the center of Wells Dam and spilling over the discharge from active turbine units, as described in the *2020 BOP*.

During the 2020 bypass operations, flows and involuntary spill volumes meeting the criteria for barrier removal occurred the third week of May and continued into mid-June. Flows peaked again in late June, and continued into the first week of July. As such, the bypass barriers for Spillway 6 were removed on May 28 and reinstalled on June 16; and, were again removed on June 26 and reinstalled on July 6.

Based on analysis conducted by Drs. John Skalski and Richard Townsend of Columbia Basin Research (Appendix A), Douglas PUD surpassed the HCP requirement to provide bypass operations during 95 percent of the juvenile Plan Species migrations passing Wells Dam. More specifically, Douglas PUD provided bypass passage during 100 percent of the migrations for Sockeye Salmon and subyearling Chinook Salmon, and 99.98 percent, 99.82 percent, and 99.75 percent of the yearling Chinook Salmon, Coho Salmon, and steelhead migrations passing Wells Dam in 2020.

Appendix A

Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam in 2020

COLUMBIA BASIN RESEARCH

Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam in 2020

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TO: TOM KAHLER

Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway, East Wenatchee, Washington 98802 - 4497

FROM: JOHN R. SKALSKI & RICHARD L. TOWNSEND

Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
1325 Fourth Avenue, Suite 1515, Seattle, Washington 98101-2540



1. Introduction

This analysis summarizes the outmigration timing for five HCP Plan Species (Coho Salmon, yearling and subyearling Chinook Salmon, steelhead, and Sockeye Salmon) for the period 2012–2020. Outmigration timing has been monitored either at the juvenile sampling facility at Rocky Reach Dam (Sockeye Salmon) or by detections at the Rocky Reach Bypass PIT-tag detection system (all other Plan Species). The proportions of each Plan Species covered by the bypass operations at Wells Dam can be estimated by adjusting daily counts at Rocky Reach Dam by the travel time between Wells and Rocky Reach dams.

Table 1 has the median travel times between Wells and Rocky Reach dams for PIT-tagged yearling Chinook Salmon, steelhead, and Coho Salmon detected at both sites (see Appendix Table A2), and from three years of acoustic-tag studies by Chelan PUD for Sockeye Salmon. Too few subyearling Chinook Salmon are consistently detected at both Wells and Rocky reach dams to estimate a median travel time from that data. Therefore, a median travel time (14 days) for subyearling Chinook Salmon was calculated as the median of estimated Wells-to-Rocky Reach travel times of 18,051 wild subyearling Chinook Salmon PIT tagged in Wells Reservoir and detected at Rocky Reach from 2011–2019. Subyearling Chinook Salmon travel times from Wells to Rocky Reach were estimated by halving the travel times for each group of PIT tagged fish from release to detection at Rocky Reach. With the inclusion of the 2020 run, the median travel time for Coho was 3 days, and this was also used to adjust the 2013–2020 migration coverage. The current 2020 passage evaluation utilizes these median travel times as described above for all Plan Species, as do the passage evaluations for the historical years 2012–2019 included in this report.

Table 1: Median travel times between Wells and Rocky Reach dams, based on either detections of fish at both facilities (yearling Chinook and Coho salmon, steelhead), study results (Sockeye Salmon), or calculations based on assumptions of equal time spent in Wells and Rocky Reach reservoirs (subyearling Chinook Salmon).

Plan Species	Median Travel Time
Yearling Chinook Salmon	3 days
Subyearling Chinook Salmon	14 days
Steelhead	2 days
Sockeye Salmon	1 days
Coho Salmon	3 days

Plots of the annual cumulative proportion of the outmigration for spring migrants (yearling Chinook, Sockeye, and Coho salmon, and steelhead) from 2012–2020, demonstrate that start dates at Rocky Reach Dam vary by approximately 7 to 10 days, with greater variability for end dates (Figure 1). Subyearling Chinook Salmon in the summer have more variable start dates at Rocky Reach Dam than spring migrants and less variable end dates across years (see Figure 1). The timing of bypass operations at Wells Dam from 2012 through 2020 was consistent, starting at 00:00 on April 9th and running continuously through 24:00 on August 19th.

2. Results

2.1 Bypass coverage, 2012–2020

For each Plan Species, the proportions of each migration that passed Wells Dam during bypass operations in 2020 were at, or nearly, 100 percent for yearling and subyearling Chinook Salmon, steelhead, and Sockeye and Coho salmon. The 2020 results for all monitored Plan Species were consistent with historical trends, 2012–2020, and exceeded the HCP standard of providing bypass operations for 95 percent of the spring and summer outmigrations of juvenile Plan Species (Table 2).

At the request of the Wells HCP Coordinating Committee (CC), the run timing of the wild component of the yearling and subyearling Chinook Salmon populations was also analyzed independent of the HCP-standard run-at-large (combined hatchery and wild) population. Approximately 89 percent (89.2%) of the wild and approximately 100 percent (99.75%) of the run-at-large yearling Chinook Salmon passed during bypass operations, with 55 of the 507 wild tagged fish being detected passing just prior to commencement of bypass operations. For subyearling Chinook Salmon, passage proportions for wild and hatchery fish were the same in 2020, consistent with previous years, with 100 percent of the wild and 100 percent of the run-at-large subyearling Chinook Salmon passing during bypass operations. Table 2 shows the annual estimated proportion of these Plan Species, by run component, passing Wells Dam.

To assess the effectiveness of the selected start date for bypass operations, Table 3 compares the start date for bypass operations each year with the date on which the 5th percentile of the cumulative yearling Chinook Salmon outmigration passed Wells Dam that year. For spring-migrating yearling Chinook Salmon in 2020, the start date for bypass operations was 9 days earlier than needed to achieve the HCP standard of providing bypass passage for 95 percent of the migration.

Similarly, Table 4 compares the actual termination date for bypass operations with the date on which bypass operations covered 95 percent of the subyearling Chinook Salmon outmigration. In each year, an earlier (10 or more days) termination of bypass operations would have been possible without jeopardizing the achievement of the HCP standard of providing a bypass route for 95 percent of the outmigration of subyearling Chinook Salmon. For subyearling Chinook Salmon in 2020, the end date for bypass operations was 13 days later than needed to achieve the HCP standard of providing bypass passage for 95 percent of the migration.

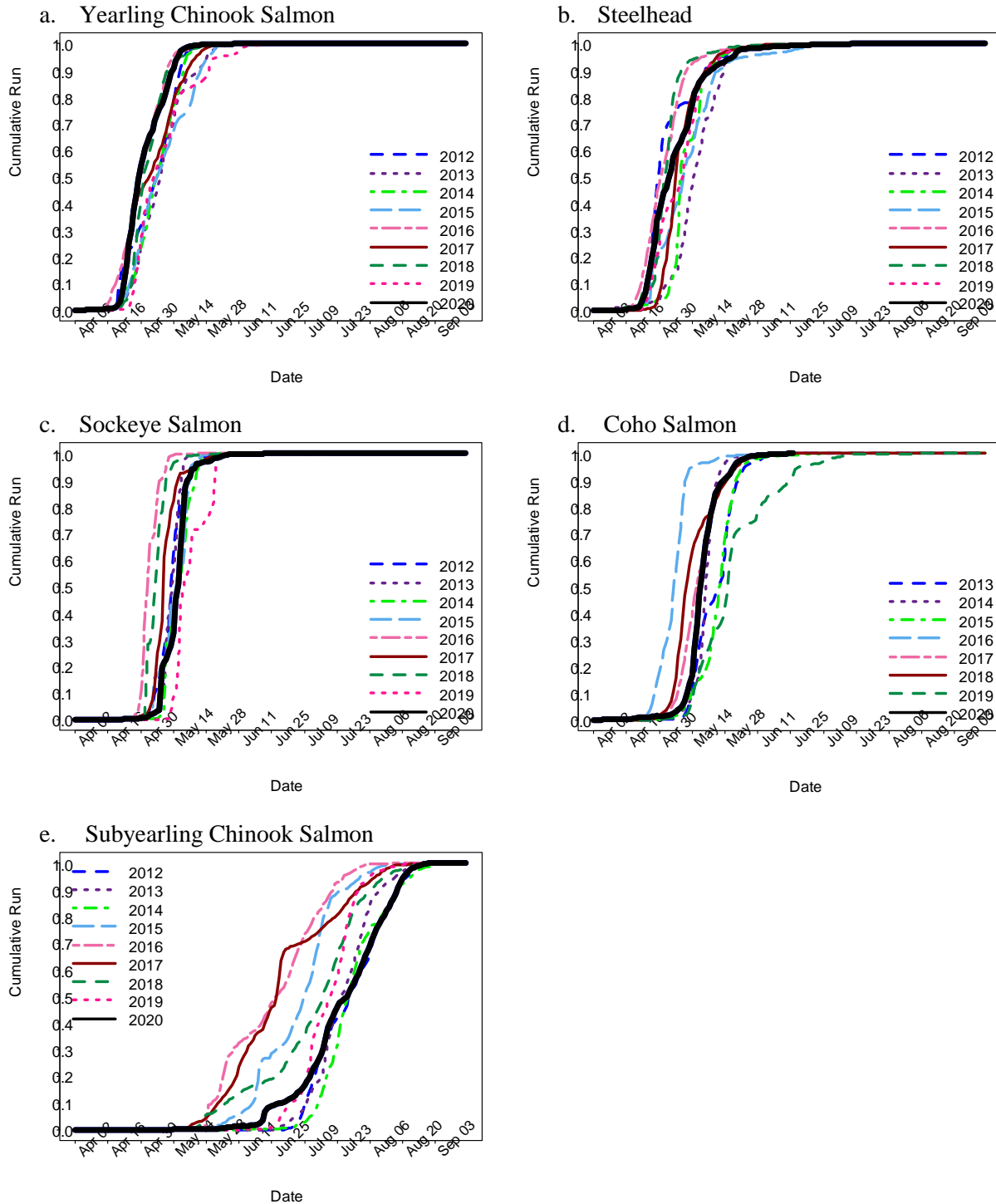


Figure 1. Passage distributions at Rocky Reach Dam juvenile collection facility for spring and summer migrating stocks, 2012–2020. Cumulative proportions for sockeye are based on the expanded counts obtained from daily sampling at Rocky Reach from 1 April – 31 August; wild and hatchery yearling and subyearling Chinook, steelhead and coho were based on PIT-tagged releases above Wells Dam. Bold black line represents 2020 passage timing.

Table 2. Total proportion of Plan Species in relation to bypass operations at Wells Dam, based on travel times between Wells and Rocky Reach dams, the cumulative proportion of the annual migration of each stock at Rocky Reach, and the start and stop dates of Wells bypass operations, 2012–2020. At the request of the CC, supplemental information on wild-origin PIT-tagged fish releases above Wells Dam were also included for both yearling and subyearling Chinook Salmon migrations for the years 2012–2020.

		Proportion passed		Annual migration proportion							
Spring Outmigration	Yearling Chinook +	<i>Hatchery & Wild:</i>	2012	2013	2014	2015	2016	2017	2018	2019	2020
		prior to Bypass Ops period	0.0022	0.0019	0.0023	0.0021	0.0027	0.0013	0.0005	0	0.0025
		during Bypass Ops period	0.9978	0.9981	0.9977	0.9979	0.9973	0.9987	0.9995	1.0000	0.9975
		after Bypass Ops period	0	0	0	0	0	0	0	0	0
		<i>Wild Only:</i>	2012	2013	2014	2015	2016	2017	2018	2019	2020
		prior to Bypass Ops period	0.0438	0.1024	0.0773	0.1121	0.1839	0.0519	0.1000	0	0.1085
	during Bypass Ops period	0.9562	0.8976	0.9227	0.8879	0.8161	0.9481	0.9000	1.0000	0.8915	
	after Bypass Ops period	0	0	0	0	0	0	0	0	0	
	Steelhead+	prior to Bypass Ops period	2012	2013	2014	2015	2016	2017	2018	2019	2020
		during Bypass Ops period	0.0014	0.0079	0.0021	0.0029	0.0022	0	0.0001	0	0.0002
after Bypass Ops period		0	0	0.0004	0.0002	0.0001	0	0	0	0	
Sockeye	prior to Bypass Ops period	2012	2013	2014	2015	2016	2017	2018	2019	2020	
	during Bypass Ops period	1.0000	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
	after Bypass Ops period	0	0.0001	0	0.0001	0	0	0	0	0	
Coho +	prior to Bypass Ops period		2013	2014	2015	2016	2017	2018	2019	2020	
	during Bypass Ops period		0.9999	0.9999	0.9996	0.9982	1.0000	1.0000	0.9999	0.9982	
	after Bypass Ops period		0	0	0	0	0	0	0	0	
Subyearling Chinook+	<i>Hatchery & Wild:</i>	2012	2013	2014	2015	2016	2017	2018	2019	2020	
	prior to Bypass Ops period	0	0	0	0	0	0	0	0	0	
	during Bypass Ops period	1.0000	1.0000	0.9967	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
	after Bypass Ops period	0	0	0.0033	0	0	0	0	0	0	
	<i>Wild Only:</i>	2012	2013	2014	2015	2016	2017	2018	2019	2020	
	prior to Bypass Ops period	0	0	0	0	0	0	0	0	0	
during Bypass Ops period	1.0000	1.0000	0.9967	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		
after Bypass Ops period	0	0	0.0033	0	0	0	0	0	0		

+ Proportion estimated using only PIT-tagged releases above Wells Dam.

Table 3. Comparisons of the actual start date for bypass operations at Wells Dam versus the date on which the 5th percentile of the PIT-tagged yearling Chinook Salmon migration passed Wells Dam each year, 2012–2020. Operations begin at 00:01 for the date listed in column 2. “Bypass start date compared to actual 5% passage date” (column 6) indicates whether the bypass start date was before or after the date on which the 5th percentile of the yearling Chinook Salmon migration passed Wells Dam, and by how many days. “Wild Only” passage dates shown for reference.

Migration Year	Actual bypass start date	Cumulative proportion passed before 4/9	Proportion Covered by Bypass Ops	Date on which the 5th percentile passed	Bypass start date compared to actual 5% passage date
Hatchery & Wild					
2012	April 9	0.0022	0.9978	April 17	8 days before
2013	April 9	0.0019	0.9981	April 20	11 days before
2014	April 9	0.0023	0.9977	April 19	10 days before
2015	April 9	0.0021	0.9979	April 20	11 days before
2016	April 9	0.0027	0.9973	April 14	5 days before
2017	April 9	0.0013	0.9987	April 19	10 days before
2018	April 9	0.0005	0.9995	April 21	12 days before
2019	April 9	0	1.0000	April 23	14 days before
2020	April 9	0.0025	0.9975	April 18	9 days before
Wild Only					
2012	April 9	0.0438	0.9562	April 12	3 days before
2013	April 9	0.1024	0.8976	April 6	3 days after
2014	April 9	0.0773	0.9227	April 7	2 days after
2015	April 9	0.1121	0.8879	April 4	5 days after
2016	April 9	0.1839	0.8161	April 4	5 days after
2017	April 9	0.0519	0.9481	April 8	1 day after
2018	April 9	0.1000	0.9000	April 3	6 days after
2019	April 9	0	1.0000	April 15	6 days before
2020	April 9	0.1085	0.8915	April 5	4 days after

Table 4. Comparison of the actual stop date for bypass operations at Wells Dam versus the stop date necessary to have covered at least 95% of the subyearling Chinook Salmon outmigration each year (operations end at 24:00), 2012–2020. In each year, bypass operations ended well after the dates on which standards were achieved. “Wild Only” passage dates shown for reference.

Migration Year	Actual bypass stop date	Cumulative proportion passed by 24:00 on 8/19	Date on which the 95% standard was achieved	bypass end date compared to actual 95% passage date
Hatchery & Wild				
2012	August 19	1.0000	August 7	12 days after
2013	August 19	1.0000	August 2	17 days after
2014	August 19	0.9967	August 9	10 days after
2015	August 19	1.0000	July 18	32 days after
2016	August 19	1.0000	July 11	39 days after
2017	August 19	1.0000	July 25	25 days after
2018	August 19	1.0000	July 29	21 days after
2019	August 19	1.0000	July 22	28 days after
2020	August 19	1.0000	August 6	13 days after
Wild Only				
2012	August 19	1.0000	August 7	12 days after
2013	August 19	1.0000	August 2	17 days after
2014	August 19	0.9967	August 9	10 days after
2015	August 19	1.0000	July 23	27 days after
2016	August 19	1.0000	July 15	35 days after
2017	August 19	1.0000	July 27	23 days after
2018	August 19	1.0000	July 30	20 days after
2019	August 19	1.0000	July 22	28 days after
2020	August 19	1.0000	August 7	12 days after

3. Discussion

In 2020, bypass operations covered between 99.75 percent and 100 percent of the outmigrations of the five Plan Species at Wells Dam, exceeding the requirements of the Wells HCP. The coverage rates achieved this year are typical of past performance in 2012–2019 (see Table 2). At the Coordinating Committee’s request, separate analyses were performed of the run timing of PIT-tagged wild yearling and subyearling Chinook Salmon (2012–2020; see Tables 2–4). The April 9 start date for bypass operations was four days short of providing bypass operations for 95 percent of the PIT-tagged wild yearling Chinook Salmon migration but exceeded the HCP criteria of providing 95-percent bypass coverage for the combined wild and hatchery PIT-tagged yearling Chinook Salmon in 2020 and all prior years analyzed (see Table 3). Eighty percent (44 of 55) of the early passing wild yearling Chinook Salmon were tagged and released as fall parr (fall 2019) in the Twisp, Methow, or Chewuch rivers.

Several differences between the yearling tag groups used in this comparison complicate definitive inferences from the analysis and warrant further investigation. In 2020, the stock composition of the hatchery component comprised 82 percent spring Chinook Salmon, 18 percent summer Chinook Salmon, while the wild component were virtually 100 percent spring Chinook Salmon, with 1 wild yearling of unknown origin (based on species identification at the time of tagging). The small sample size of the wild component attributed relatively greater weight to each individual detected (507 this year). Also, each hatchery release above Wells Dam included similar numbers of PIT-tagged fish, providing a valid representation of the distribution of detection timing for all hatchery programs and fish. In contrast, very few PIT-tagged fish were released from the various wild spawning aggregates above Wells, rendering an incomplete representation of the actual distribution of run timing for wild fish in general. These differences in sample composition, sample sizes, and run sizes confound comparisons between the wild and hatchery components of the yearling Chinook Salmon population.

For subyearling Chinook Salmon, the end date for bypass operations in 2020 provided bypass operations for greater than 95 percent of the migration of both wild and hatchery emigrants. Indeed, the bypass termination date in use every year since 2012, has been much later (i.e., 10–39 days) than necessary for providing bypass operations for 95 percent of the migration of both hatchery and wild subyearling Chinook Salmon (see Table 4).

4. Summary

For the ninth year in row, the Wells bypass operating dates of April 9th through August 19th exceeded the HCP-required coverage for 95 percent of the migration for all five Plan Species. The wild component of yearling Chinook Salmon population appears to commence migrating earlier than hatchery yearling Chinook Salmon and earlier than observed in the historical hydroacoustic and fyke-netting data (Bickford 2003). This difference in migration timing appears to be related to the progressively earlier onset of snow melt in the Methow Basin when compared to historical run timing and streamflow data. Continued monitoring of what appears to be an earlier migration of wild Chinook Salmon migrants is warranted particularly given concerns over small sample sizes of wild fish and uncertainty regarding the degree to which the few PIT-tagged wild fish represent the actual passage-timing distribution of wild emigrants.

5. References

Bickford, S. 2003. Historical Hydroacoustic Information for Wells Dam, 1982 to 2002, and a Proposal for Future Operation of the Wells Bypass System. March 10, 2003. *Prepared for Wells Coordinating Committee, By Public Utility District No. 1 of Douglas County, East Wenatchee, WA.* 9 p., plus appendices.

6. Appendix

Using Wells Dam PIT-tag Detections

2020 was the fifth year with available PIT-tag detections at Wells Dam (WEJ), with 142 unique tag codes identified as juveniles. These comprised 31 yearling and 3 subyearling Chinook salmon, 14 Coho salmon, 94 steelhead, and no sockeye salmon. Table A1 summarizes the number of detections and estimated travel times between Wells and Rocky Reach Dam. With the exception of the steelhead, these numbers are too few to estimate any credible travel times. Pooling across the 5 years of available data, improves the available information (Table A2), but travel times are influenced by outliers (a few fish with much longer travel times). Therefore, the median travel time is recommended as the basis for adjusting the Rocky Reach detection dates to estimate Wells Dam passage date. The additional Coho this year reduced the median travel time by 2 days down to 3 days travel. This was used to update the Coho passage coverage for all years analyzed.

Table A1. Travel time summary for detected PIT-tagged fish at both Wells and Rocky Reach PIT-tag detectors in 2020.

Run Species	Detected at		Travel Time (days)		
	Wells Dam	Rocky Reach Dam	Mean (SE)	Median	Range
Yearling Chinook	31	14	8.4 (1.9)	7.1	2.2 – 28.1
Subyearling Chinook	3	0	NA	NA	NA
Coho	14	5	2.0 (0.2)	2.3	1.4 – 2.5
Steelhead	94	53	2.5 (0.4)	1.5	0.3 – 17.4
Sockeye	0	0	NA	NA	NA

Table A2. Travel time summary for detected PIT-tagged fish at both Wells and Rocky Reach PIT-tag detectors in 2016-2020.

Run Species	Detected at		Travel Time (days)		
	Wells Dam	Rocky Reach Dam	Mean (SE)	Median	Range
Yearling Chinook	212	48	7.5 (1.2)	3.3	1.3 – 37.3
Subyearling Chinook	43	9	16.4 (4.1)	17.7	1.3 – 37.1
Coho	105	31	4.8 (0.6)	3.1	0.6 – 12.0
Steelhead	603	261	6.0 (1.5)	1.8	0.8 – 244.0
Sockeye	3	1	4.1 (NA)	4.1	NA

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