Tulalip Tribes Natural Resources Department Report

SKYKOMISH RIVER JUVENILE SALMON OUT-MIGRATION STUDY PROGRESS REPORT

March – June 2021

by
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INTRODUCTION

Due to considerable declines in salmon populations, fisheries managers and stakeholders have been working collaboratively to restore salmon runs in the Snohomish watershed. In 1994, a partnership of 41 organizations formed the Snohomish Basin Salmon Recovery Forum (Forum) in order to implement a watershed scale, scientifically-based, adaptive management strategy to better manage salmon recovery. In May of 1999, the National Marine Fisheries Service (NMFS) listed the Puget Sound Chinook Salmon *Oncorhynchus tshawytscha* as threatened under the federal Endangered Species Act (ESA). This listing included Chinook Salmon from the Snohomish River basin, which includes sub-populations from the Skykomish and Snoqualmie Rivers. Decreases in many runs of Puget Sound Coho Salmon *Oncorhynchus kisutch* have also resulted in a designation as a species of concern under the ESA. This report focuses mostly on Chinook and Coho Salmon because recovery efforts targeted at these species will also help other federally listed salmonid stocks in the watershed.

In 2005, the Forum adopted the *Snohomish River Basin Salmon Conservation Plan* in order to improve the effectiveness of salmon habitat, harvest, and hatchery management on a watershed scale. In order to inform this decision-making with the best available science, it is necessary to gather and analyze data on Chinook and Coho Salmon abundance, productivity, survival, escapement, spatial structure, and diversity within the Snohomish system (Snohomish Basin Salmonid Recovery Technical Committee, 2005). Information about the trends and inter-annual variability in these population parameters is critical to inform salmon recovery efforts, provide basic information on the productivity and capacity of the system, and can lead to significant improvements in harvest management modeling and run forecasting. Additionally, the monitoring of production and survival along with other physical, chemical, and biological conditions provides a means to evaluate habitat restoration effectiveness, recovery actions, habitat conditions, and potential ecological trajectories in the basin**.**

A key method for monitoring Snohomish salmon populations is the operation of rotary screw traps in the Skykomish and Snoqualmie rivers. Over the last 20 years, these projects have sampled out-migrating juvenile Chinook and Coho Salmon as they emigrate to the Puget Sound. The goals of these trapping efforts are to estimate Chinook and Coho Salmon natural production, migration patterns, and freshwater survival. These goals are accomplished through the direct quantification of juvenile salmon emigrations, evaluation of trap efficiency, and assessment of influential environmental attributes.

The Tulalip Tribes' trapping project has been classified as a project of high priority because it is necessary for stock assessment, monitoring and run forecasting. The Tulalip Tribes have worked in close collaboration with the Washington Department of Fish and Wildlife, NOAA Fisheries, the University of Washington, Long Live the Kings, Seattle City Light, the U.S. Geological Survey, the Northwest Indian Fisheries Commission, and other agencies in an effort to monitor Snohomish basin salmon and steelhead.

SKYKOMISH RIVER TRAPPING SITE

The Skykomish River trap site is located at river mile 26.5 of the Skykomish River (Figure 1). The wetted width of the Skykomish River at this point is ~325 ft. during the spring out-migration period and the channel's bank full width is ~490 ft. The channel's maximum depth at the site is ~5 ft. at summer low-flow level and approaches ~18.5 ft. at bankfull depth. Summer low-flow at this location is ~3,030 cfs and mean annual discharge is ~4,070 cfs. The channel gradient is < 1% and substrate is principally gravel and cobble. When fishing, the trap is positioned in the thalweg of the river, near the center of the channel. Land use adjacent to the project site is principally agriculture; however, riparian vegetation is relatively intact (with some supplemental plantings). Existing riparian vegetation is primarily cottonwood and alder while planted riparian vegetation includes cedar and spruce. At the immediate trapping site, the right-bank is composed of a gravel bar adjacent to a cottonwood stand. The left bank is just downstream of a rip-rapped section with planted riparian vegetation integrated into a cottonwood stand. This land is being purchased by the Tulalip Tribes for future stream restoration. Adjacent to this land is an active farm (Kubo, Finley, Nelson, 2013).

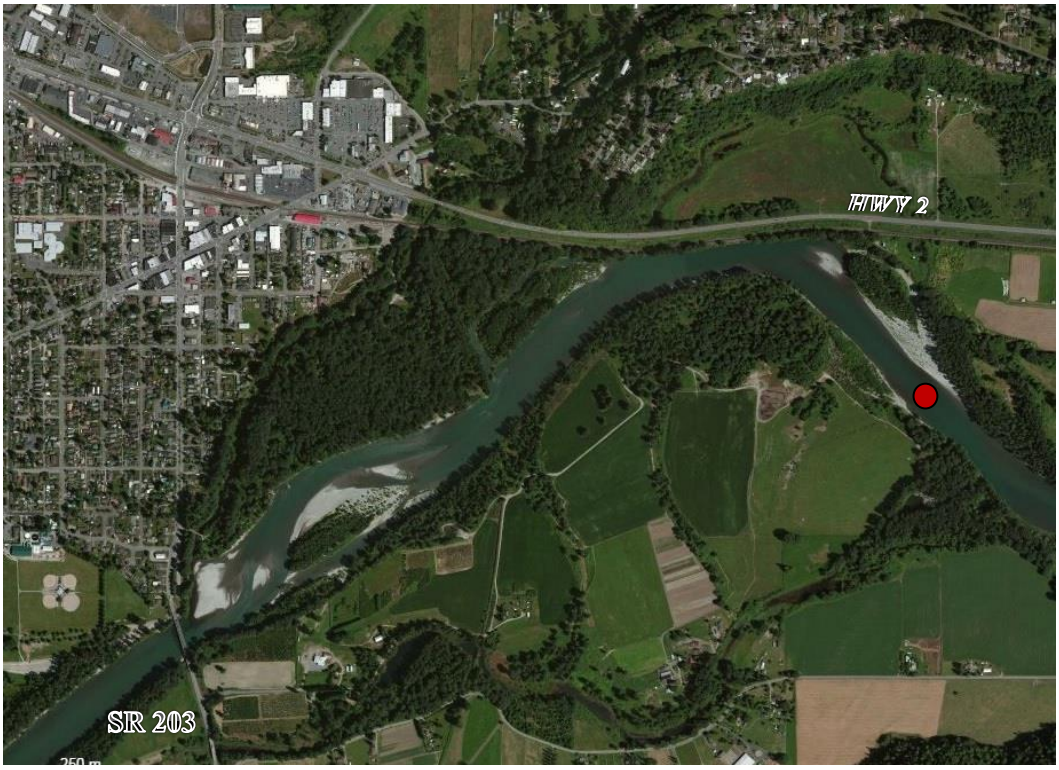

Figure 1: Aerial photograph of the trap site at river mile 26.5 on the Skykomish River. The red dot indicates the approximate trap fishing position.

SUMMARY OF SAMPLING OPERATIONS

Sampling dates are stratified by statistical week (SW) in order to more accurately compare results from year to year. Table 1 shows the dates of statistical weeks from the 2021 sampling season. In 2021, trapping was conducted from March 4th to May 5th (SW10- SW19). Normally sampling occurs from SW7 to SW25 with some variability in timing. Trapping started late this year due to high flows and ended early due to a large Cottonwood tree that became lodged just upstream of the trap. A small log jam formed on the tree, which created a serious safety issue during the late season high flows. Additionally, both traps were staffed by a smaller crew due to COVID-19 hiring restrictions. The trap was only operated for approximately 287 hours within an eight-week period. Of those hours, 141 were fished at night, representing 49% of the total trapping effort. This sampling effort was much lower than previous years and does not provide a large enough sample size to analyze production or compare CPUE to previous years.

Table 1. Statistical weeks and corresponding dates for 2021 sampling season.

Statistical Week	From	To
10	2/28/2021	3/6/2021
12	3/14/2021	3/20/2021
13	3/21/2021	3/27/2021
14	3/28/2021	4/3/2021
15	4/4/2021	4/10/2021
16	4/11/2021	4/17/2021
19	5/2/2021	5/8/2021

During the sampling season, a total of 14,522 salmon and trout were captured, counted and released (Appendix A). Captured unmarked Chinook Salmon included 1739 sub-yearlings (0+) and 4 yearlings (1+). The number of Chinook Salmon sub-yearlings caught at the Skykomish River trap has varied from year to year, with this year's total just below the project average of 1935 (Table 2). Captured unmarked Coho Salmon included 106 sub-yearlings and 181yearlings. The number of unmarked Coho Salmon yearlings caught in 2021 was only 5% of the project average (3813). This is likely due to the fact that sampling was halted just before the usual Coho Salmon migration period. During the trapping and handling process a total of five salmonid mortalities were reported, of which one was an unmarked Chinook Salmon. Mortality as a percentage of the total sub-yearling Chinook Salmon catch was approximately 0.06% (Appendix A).

Table 2. Annual sampling effort and catch totals for unmarked sub-yearling Chinook and yearling Coho Salmon at the Skykomish River rotary screw trap 2000-2021.

Year	Effort (Hours)	0+ Chinook	1+ Coho	Chinook CPUE	Coho CPUE
2000	308.5	1287	5972	4.17	19.36
2001	900.6	1786	5512	1.98	6.12
2002	671.7	1093	8851	1.63	13.18
2003	992.1	3394	8713	3.42	8.78
2004	1071	951	13949	0.89	13.02
2005	944.3	2411	3082	2.55	3.26
2006	1125.3	2928	6218	2.60	5.53
2007	446.8	1348	3882	3.02	8.69
2009	686.6	1650	1410	2.40	2.05

Table 2 Continued:

2010	1045.8	1989	1245	1.90	1.19
2011	666.8	765	1798	1.15	2.70
2012	1015.7	1323	3005	1.30	2.96
2013	1217.8	2446	4443	2.01	3.65
2014	888.2	1354	2625	1.52	2.96
2015	1078.7	1418	1596	1.31	1.48
2016	1031.5	490	2137	0.48	2.07
2017	843.4	3838	2154	4.55	2.55
2018	836	4407	1583	5.27	1.89
2019	985.7	3979	1699	4.04	1.72
2020	151.2	38	11	0.25	0.07
2021	287.2	1739	181	6.06	0.63
Project Average	819	1935	3813	2.5	4.95

EFFICIENCY TESTING AND RESULTS

A total of two trap efficiency tests (both with Chinook Salmon sub-yearlings) were conducted throughout the 2021 sampling season. During these tests, groups of hatchery-origin juvenile salmon were collected from Wallace River Hatchery, marked with the biological dye bismarck brown, and released approximately one mile upstream of the trap site. These releases were conducted weekly throughout the duration of the sampling season while hatchery Chinook and Coho Salmon were available. Following each release, the trap was operated continuously (except during debris removal) for a minimum of 36 hours. Efficiency calculations are expressed as the percentage of captured dyed fish in relation to the total number of dyed fish released. The results of these tests are still being evaluated, but preliminary calculations suggest that the trap was operating at an efficiency rate of 1.8% for Chinook Salmon sub-yearlings and was not tested for Coho Salmon yearlings during the 2021 sampling season (Table 3). During the 2021 season, trapping equipment was inspected and monitored frequently and the trap was found to be in fully operational condition with no escape paths detected and no major equipment malfunctions.

Table 3. Efficiency Release dates, species, and capture percentages for the Skykomish River smolt trap, 2021.

Species	Date	Released	Captured	Efficiency
Chinook	3/24/2021	1995	19	0.95%
Chinook	4/14/2021	2001	53	2.65%
Coho	-	0	0	-
	2021 Average Chinook Efficiency			1.80%
	2021 Average Coho Efficiency			-

Catch Per Unit of Effort (CPUE) analysis

A preliminary review of the data reveals that CPUE for 0+ Chinook Salmon demonstrated a likely peak in SW 15 (Figure 3). The 2021 peak out-migration timing for sub-yearling Chinook Salmon was consistent with observed seasonal norms occurring between SW11 and SW17 for all recorded years, however some of the migration may have been missed after SW 17 since the trap wasn't running for most of this period. The timing of the yearling Coho Salmon out-migration is very consistent from year to year, generally occurring from SW17 to SW21. Since the trap was only running for 40 hours during the usual Coho out-migration, it is impossible to estimate the size or timing of this run.

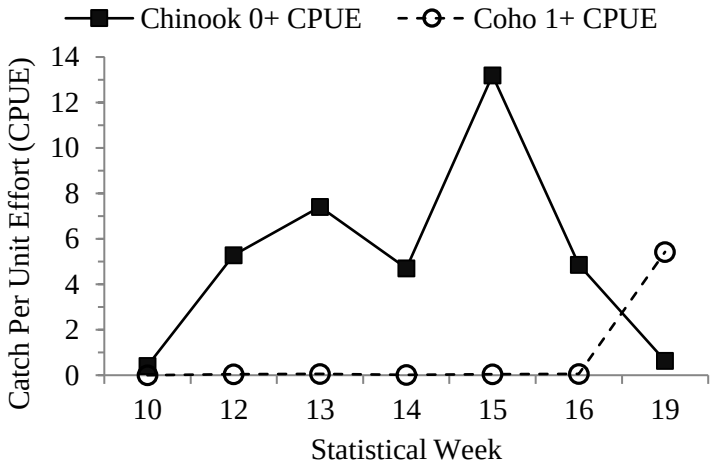

Figure 3. Sub-yearling (0+) Chinook Salmon and yearling (1+) Coho Salmon migration patterns observed at the Skykomish River trap, SW 10-19, 2021.

In general, average salmonid CPUE and total catch on the Skykomish trap have exhibited seasonal variability throughout the duration of the project due to fluctuating sampling conditions and the strength of a given year's out-migrant cohort. Analysis of seasonal CPUE averages for sub-yearling Chinook Salmon indicate that the catch rates in 2021 were the highest since sampling started (Figure 4) and far above the average of 2.5. This high average CPUE in 2021 is largely caused by a lack of sampling during low catch periods and may not indicate a larger sub-yearling Chinook Salmon run in 2021. The extremely low average CPUE for Coho Salmon in 2021 is due to sampling mostly during low catch periods. Due to these sampling biases, average CPUE should not be used to compare 2021 run size to previous years. For these reasons, Chinook and Coho Salmon CPUE from the Skykomish in 2021 should not be included in analysis or reporting in the future.

Taking into account seasonal variability and sampling conditions, the total annual catch and CPUE for sub-yearling Chinook Salmon seem to display annual variability, with a possible upward trend beginning in 2017. In 2009, the trap was moved upstream from River mile (RM) 23 to its current location at RM 26.5. This relocation excluded the Woods creek drainage from the sample, likely causing a catch decline for both species following 2009 due to decreasing drainage area sampled. Woods Creek is known to have high Coho Salmon spawning activity and little Chinook Salmon spawning. In recent years, average Chinook Salmon CPUE has risen dramatically, while average Coho Salmon CPUE has declined slightly.

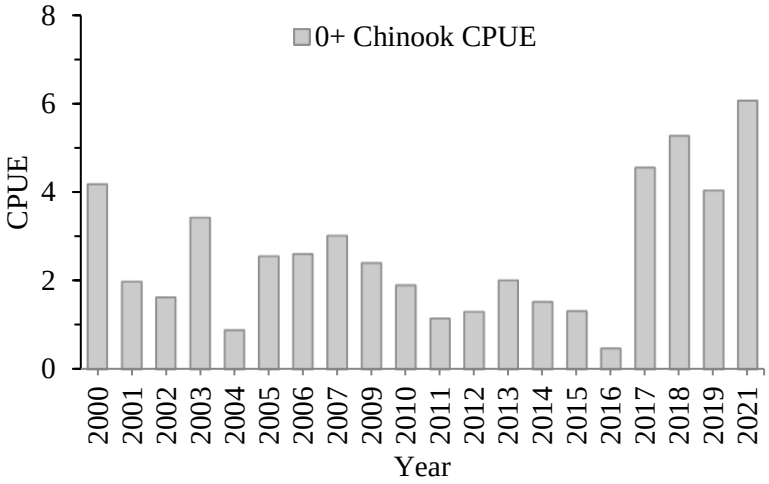

Figure 4. Sub-yearling Chinook Salmon average CPUE at the Skykomish trap; 2001-2021.

Yearling Coho Salmon catch rates were in a downtrend until 2010, when the lowest documented average CPUE of 1.19 occurred (Figure 5). The overall decline in Coho Salmon catch rates is likely related to some degree to the relocation of the trap site to RM 26.5 in 2009 above the Woods Creek drainage, and a decline in the Coho Salmon escapement on the second half of the 2000s. Following relocation in 2009, catch rates have remained fairly consistent both in total catch and CPUE. Yearling Coho Salmon annual catch and CPUE seem to display annual variability, with a general downtrend since sampling started. These fluctuations are likely influenced by year to year variance in sampling season, effort distribution, hydrologic conditions and the size of a given years emigrating class.

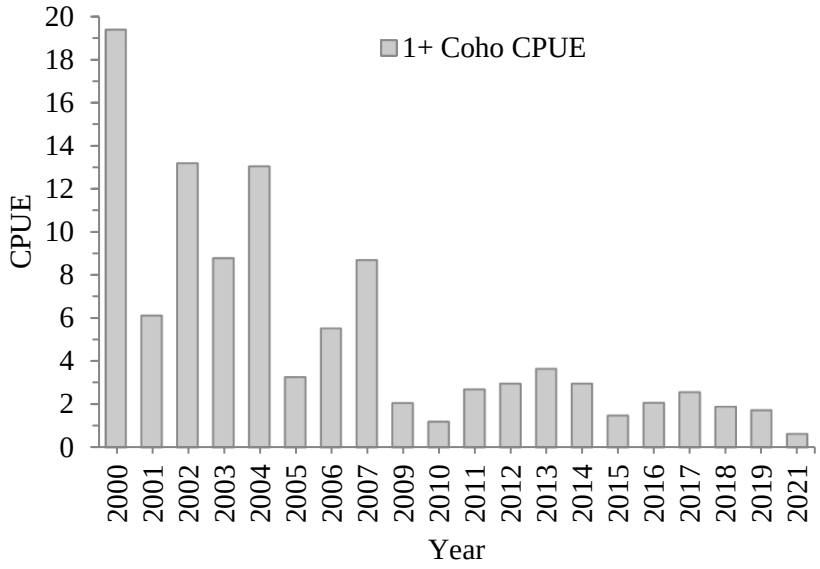

Figure 5. Yearling Coho Salmon average CPUE at the Skykomish trap by year; River mile 23: 2000-2007; River mile 26.5: 2009-2019.

DISCUSSION

This year's fishing effort of 287.2 hours was far below the average of 819. Sampling was started late and ended early with fewer days sampled per week. Due to high flows, sampling wasn't started until SW12, approximately five weeks later than the average start time. From SW12 through SW16, the smolt trap was generally fishing around 60 hours each week, usually Tuesday night through Friday morning due to limited staff availability. In SW17, a large tree came down during a high flow event and lodged directly upstream of the trap. Sampling was halted for the rest of the season for safety reasons, except for three shifts in SW19. After the sampling season ended, the tree swung downstream and off to the side, which shouldn't cause future problems.

Due to the small sample season, it is likely that production estimates and average annual CPUE are incomplete for Coho and Chinook Salmon for 2021. There were too many un-sampled weeks during periods of high variability to extrapolate from known catch rates. It is recommended that these results be excluded from future reporting to avoid inaccurate inter-annual comparisons.

Aside from the aforementioned scheduling difficulties, all trapping equipment including the trap itself, the boat, and all associated supplies were in full working order and operated as expected throughout the duration of the 2021 season with no down-time associated directly with equipment failure.

REFERENCES

Kubo, J., Finley, K., Nelson K. 2013. 2000-2012 Skykomish and Snoqualmie Rivers Chinook and Coho Salmon Out-Migration Study. Tulalip Tribes Natural Resource Division, Tulalip WA.

Seamons, T., Crewson, M., Whitney, J., Verhey, P. 2015 Progress Report: Genetic-based abundance estimates for Snohomish River Chinook Salmon. Washington Department of Fish and Wildlife. Olympia, WA; Tulalip Tribes, Tulalip WA.

Snohomish Basin Salmonid Recovery Technical Committee. 2005. Snohomish River Basin Ecological Analysis for Salmonid Conservation. Snohomish County Public Works, Surface Water Management, Everett, WA.

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APPENDIX A: SUMMARY OF 2021 TRAP CATCH AND MORTALITIES

March

	Chinook Salmon				Coho Salmon			Chum Salmon	Pink Salmon	Sockeye Salmon	steelhead		Cut. Trout	Rain. Trout	Trout Fry	Dolly/ Bull Trout	Total Salmonid Catch	Juv. Lamp.	Dace spp.	Sculpin spp.	Stickle-back
	Unm 1+	Mark 1+	Unm 0+	Mark 0+	Unm 0+	Unm 1+	Mark 1+				Unm Smolts	Mark Smolts									
Day	(68.3 hours of effort)																				
Catch	0	0	72	0	3	0	0	621	9	0	0	0	0	0	0	0	705	0	0	0	0
Morts.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Night	(68.5 hours of effort)																				
Catch	0	34	739	0	22	6	0	7261	7	0	0	0	1	0	0	0	8070	5	10	9	0
Morts.	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0
Monthly Totals	(136.8 hours of effort)																				
Catch	0	34	811	0	25	6	0	7882	16	0	0	0	1	0	0	0	8775	5	10	9	0
Morts.	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0

April

	Chinook Salmon				Coho Salmon			Chum Salmon	Pink Salmon	Sockeye Salmon	steelhead		Cut. Trout	Rain. Trout	Trout Fry	Dolly/ Bull Trout	Total Salmonid Catch	Juv. Lamp.	Dace spp.	Sculpin spp.	Stickle-back
	Unm 1+	Mark 1+	Unm 0+	Mark 0+	Unm 0+	Unm 1+	Mark 1+				Unm Smolts	Mark Smolts									
Day	(55.8 hours of effort)																				
Catch	0	2	30	1	10	0	0	275	0	0	0	0	0	0	0	0	318	0	1	0	0
Morts.	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0
Night	(63.3 hours of effort)																				
Catch	4	386	878	0	56	5	0	3852	0	0	0	8	0	0	0	0	5189	4	5	6	0
Morts.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Monthly Totals	(119.1 hours of effort)																				
Catch	4	388	908	1	66	5	0	4127	0	0	0	8	0	0	0	0	5507	4	6	6	0
Morts.	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0

APPENDIX A: SUMMARY OF 2021 TRAP CATCH AND MORTALITIES

May

	Chinook Salmon				Coho Salmon			Chum Salmon	Pink Salmon	Sockeye Salmon	steelhead		Cut. Trout	Rain. Trout	Trout Fry	Dolly/ Bull Trout	Total Salmonid Catch	Juv. Lamp.	Dace spp.	Sculpin spp.	Stickle-back
	Unm 1+	Mark 1+	Unm 0+	Mark 0+	Unm 0+	Unm 1+	Mark 1+				Unm Smolts	Mark Smolts									
Day	(22.1 hours of effort)																				
Catch	0	0	8	0	9	4	3	6	0	0	0	0	0	0	0	0	30	0	0	0	0
Morts.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Night	(9.3 hours of effort)																				
Catch	0	0	12	0	6	166	1	7	0	0	16	0	2	0	0	0	210	0	0	0	0
Morts.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monthly Totals	(31.3 hours of effort)																				
Catch	0	0	20	0	15	170	4	13	0	0	16	0	2	0	0	0	240	0	0	0	0
Morts.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Totals (287.2 total hours of effort)

	Chinook Salmon				Coho Salmon			Chum Salmon	Pink Salmon	Sockeye Salmon	steelhead		Cut. Trout	Rain. Trout	Trout Fry	Dolly/ Bull Trout	Total Salmonid Catch	Juv. Lamp.	Dace spp.	Sculpin spp.	Stickle-back
	Unm 1+	Mark 1+	Unm 0+	Mark 0+	Unm 0+	Unm 1+	Mark 1+				Unm Smolts	Mark Smolts									
Catch	4	422	1739	1	106	181	4	12022	16	0	16	8	3	0	0	0	14522	9	16	15	0
Morts.	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	5	0	0	0	0
% Mort	0.00%	0.00%	0.06%	100%	0.00%	0.00%	0.0%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%				
% of Total Catch	0.0%	2.9%	11.9%	0.0%	0.7%	1.2%	0.0%	82.6%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	99.7%	0.1%	0.1%	0.1%	0.0%