

Goldsborough Creek Post-Dam Removal Smolt Trapping Study:

2002 Smolt Trapping Project Summary and Data Compilation for the

U.S. Army Corps of Engineers
Seattle District
Seattle, Washington

DACW67-02-P-0160

by

Joseph C. Peters

Squaxin Island Tribe
Natural Resources Department
Shelton, Washington

December 2002

Goldsborough Creek Post-Dam Removal Smolt Trapping Study

Table of Contents

	<u>Page</u>
Project Summary.....	3
Table 1. 2002 Lower Goldsborough Screw Trap Daily Catch of <i>Oncorhynchus spp.</i> and other non-salmonid species.....	5
Table 2. 2002 Lower Screw Trap Efficiencies	11
Table 3. 2002 Upper Goldsborough Screw Trap Daily Catch of <i>Oncorhynchus spp.</i> and other non-salmonid species.....	12
Table 4. 2002 Upper and Lower Screw Trap Species Over View.....	18

Goldsborough Creek Post-Dam Removal Smolt Trapping Study

Project Summary

Goldsborough Creek, located in the Hammersley Inlet-Oakland Bay Watershed, is the largest stream system within WRIA 14. Since 1885, Goldsborough Creek has been dammed at river kilometer 3.4, limiting adult salmonid migration for over 100 years. The dam has served a number of purposes from various owners: Satsop Railroad Company use was primarily a log storage pond in the late 1880's, The City of Shelton rebuilt the dam to provide Hydroelectric power, and in the 1950's the dam diverted water for the Rayonier and Simpson Timber Company. During the winter of 1996, Goldsborough dam sustained structural damage and no longer was useful. There was a fish ladder facility located near the dam, however, it was inadequate and required continual maintenance to prevent complete failure. Five salmonid species (*Oncorhynchus spp*) are known to use Goldsborough Creek, but were mostly limited to only the lower watershed below the dam. A restricted number of Coho (*Oncorhynchus kisutch*) and Steelhead (*Oncorhynchus mykiss*) each year have passed the dam site with the use of the fish ladder. Also, due to a 35-foot vertical drop over the dam spillway, outmigrating Coho smolts that were progeny of adults that were able to pass the dam site to spawn suffered mortality, resulting in decreased Coho smolt production. The fish ladder was insufficient for the passage of adult Chum (*Oncorhynchus keta*) and Cutthroat trout (*Oncorhynchus clarkii*), and Chinook (*Oncorhynchus tshawytscha*), while probably not indigenous to the watershed, have not been observed above the dam for many years.

Since the dam no longer had a use, Army Corps of Engineers, Simpson Timber Company, Squaxin Island Tribe, and other parties worked together in an effort to remove the dam and restore Goldsborough creek to its pre-dam status. Removal of the dam and restoring the creek would assume that this would improve salmon habitat and increase salmonid production into the 25 miles of mainstream and tributaries. Goldsborough Creek dam and channel reconstruction was completed September 2001.

Prior to the dam removal and channel reconstruction by the U.S. Army Corps of Engineers, a monitoring plan was put in place for pre-dam removal. Squaxin Island Tribe and US Fish and Wildlife Service (USFWS) conducted smolt trapping on Goldsborough Creek in 1999- 2001, to monitor and assess the smolt production preceding the dam removal. For results and information regarding the pre-dam removal data and results see; Squaxin Island Tribe 1999, Bernard et al. (1999), USFW 2000, Celedonia et al. (2001), and 2001, Missildine (2001).

In the spring of 2002, the Squaxin Island Tribe implemented post-dam monitoring by conducting a smolt trap project within the Goldsborough restoration site. Now that the dam has been removed all adult spawning *Oncorhynchus spp.* in Goldsborough Creek will have access to the twenty plus miles of mainstream, tributaries, and wetlands above the dam site, which will also provide prime rearing habitat for juvenile salmonids, resulting in increase smolt production above the dam site.

Squaxin Island Tribe installed two rotary-screw traps, one above the dam removal project area and one below the project area near the mouth of Goldsborough Creek. The upper screw trap was installed April

4, 2002 and was in operation until July 3, 2002. The lower trap was installed April 11, 2002 and was in operation until July 8, 2002. Both traps were checked twice daily, once in the early morning ranging 7 to 8AM and once in the late afternoon ranging 3 to 4PM. Each salmonid species (*Oncorhynchus spp.*) was identified, counted, and recorded on data sheets. In addition, fork lengths of Coho smolts were recorded. All other fish species were identified, and counted.

With the dam removal occurring in fall of 2001 and assuming that an increase of adult Coho migrated during 2002 above the dam site, Coho smolts outmigrating from the upper watershed of Goldsborough Creek above the dam site will not show a response due to the life cycle of Coho. Coho fry spend a year of over wintering, which would indicate that the 2002 brood would not migrate out as smolts of the Goldsborough system until spring of 2003. However, we can conclude that Chum did migrate above the dam site in the fall of 2001. Total Chum fry trapped above the dam site in 2002 resulted in 15921 captured. Pre-dam removal trapping above the dam encountered zero chum fry. For the first year of removal this indicates that the Goldsborough Creek Restoration project appears to be a success for adult Chum migrating above the dam site.

The overall Goldsborough Creek watershed estimate of Coho smolt production was based on lower trap catches. To estimate overall production the lower trap must be calibrated for trap catch efficiency. Using mark recapture methodology we were able to conduct lower screw trap efficiencies three separate times. We partial clipped the anal fin to mark a randomly selected amount of wild coho caught at the upper trap and released them at the upper trap site. We based our recapture of marked fish on the number of Coho recaptured in the lower trap allowing a 10-day period for fish to migrate to the lower trap. The efficiencies are as follows: Calibration 1 resulted in 4.81% efficiency, Calibration 2; 16.67% efficiency, and Calibration 3; 14.29% efficiency with a mean lower trap efficiency of 11.92%.

2002 numbers indicate that there was an increase in natural coho production compared to 2001 data with an estimated Coho smolt outmigration of 6090 (11.92% Trap efficiency), which can be attributed to better stream conditions and the decrease of mortality of smolts migrating over the dam spillway due to the dam removal. Now that the dam is removed and restoration of this site is underway, we anticipate that the natural production of Coho smolts will increase by spring 2003 due to the site being passable by adult coho in fall of 2001.

At this time only preliminary conclusions can be made on the success of the Goldsborough Restoration Project. The Squaxin Island Tribe feels that continued smolt monitoring is essential for at least three more years to ensure a reliable post-dam database of smolt production. If this post-dam database can show a consecutive yearly increase of smolt production above the dam site, it can be concluded that the restoration project was a success.

A summary of the 2002 Squaxin Island Tribe Goldsborough Creek Post-Dam Removal Smolt Trapping Study data is represented in the following tables: Upper and Lower trap daily catches, Lower Trap Efficiencies, and Species Overview of catch.

Table1:

2002 Lower Goldsborough Screw Trap Daily Catch of *Oncorhynchus* spp. and other non-salmonid species.

Date	<i>Oncorhynchus</i> spp						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Eulochon
4/11/2002	0	0	14	0	0	4	0	2	0	0
4/12/2002	1	0	21	0	0	0	0	2	0	0
4/13/2002	1	0	18	0	0	2	1	4	0	0
4/14/2002	7	0	45	0	0	2	0	4	0	0
4/15/2002	9	0	57	0	0	6	0	5	0	0
4/16/2002	0	0	0	0	0	0	0	0	0	0
4/17/2002	0	0	0	0	0	0	0	0	0	0
4/18/2002	5	0	0	0	0	2	0	3	0	0
4/19/2002	4	0	41	0	0	0	0	2	0	0
4/20/2002	2	0	53	0	0	1	0	10	0	0
4/21/2002	1	0	28	0	0	1	0	1	0	0
4/22/2002	1	0	63	0	0	0	1	0	0	0
4/23/2002	5	0	540	0	0	0	6	1	1	0
4/24/2002	3	0	60	0	0	0	1	6	0	0
4/25/2002	4	0	53	0	0	0	3	1	0	0
4/26/2002	10	0	65	0	0	0	0	8	0	0

Table 1. Con't.

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Eulochon
4/27/2002	8	0	21	0	0	0	0	0	0	0
4/28/2002	16	0	55	0	0	1	2	3	0	0
4/29/2002	16	0	2	0	0	3	0	6	0	0
4/30/2002	9	0	54	0	0	1	0	12	0	0
5/1/2002	14	0	57	0	0	0	0	6	0	0
5/2/2002	17	0	101	0	0	1	0	3	0	0
5/3/2002	13	0	109	0	0	0	0	14	0	0
5/4/2002	11	1	35	0	0	0	0	8	0	0
5/5/2002	7	0	33	0	0	2	2	2	0	0
5/6/2002	20	0	56	0	0	0	3	10	0	0
5/7/2002	0	0	15	0	0	0	0	3	0	0
5/8/2002	9	0	7	0	0	1	1	3	0	0
5/9/2002	12	0	15	0	0	0	0	4	0	0
5/10/2002	19	2	27	0	1	0	0	2	2	0
5/11/2002	29	0	23	0	0	0	0	15	0	0
5/12/2002	32	0	55	0	0	0	0	12	0	0
5/13/2002	22	0	0	0	0	1	0	26	0	0

Table 1. Con't.

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Eulochon
5/14/2002	14	0	17	0	1	3	0	11	0	0
5/15/2002	41	0	4	0	2	4	0	16	0	0
5/16/2002	19	0	0	0	1	2	2	17	0	0
5/17/2002	15	1	11	0	0	4	0	9	0	1
5/18/2002	28	0	2	0	0	1	2	10	0	0
5/19/2002	31	0	0	0	0	4	2	11	0	0
5/20/2002	23	0	0	0	0	1	0	11	0	0
5/21/2002	29	0	0	0	1	2	0	5	0	0
5/22/2002	23	0	3	0	1	3	2	9	0	0
5/23/2002	19	0	2	0	0	5	1	14	0	0
5/24/2002	13	0	4	0	0	1	2	5	0	0
5/25/2002	8	0	1	0	1	1	1	5	0	0
5/26/2002	10	0	0	0	1	1	0	2	0	0
5/27/2002	11	0	0	0	0	3	1	3	0	0
5/28/2002	8	0	0	0	0	4	0	6	0	0
5/29/2002	5	0	2	0	0	2	0	6	0	0
5/30/2002	11	0	0	0	1	2	0	8	0	0

Table 1. Con't.

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Eulochon
5/31/2002	6	0	0	0	0	1	1	8	0	0
6/1/2002	3	0	1	0	0	1	0	8	0	0
6/2/2002	4	0	0	0	0	0	0	5	0	0
6/3/2002	0	1	0	1	0	2	1	3	0	0
6/4/2002	2	0	0	0	1	1	1	5	0	0
6/5/2002	2	0	1	1	0	3	1	6	0	0
6/6/2002	6	0	0	0	0	0	2	6	0	0
6/7/2002	5	0	0	0	0	1	0	2	0	0
6/8/2002	5	0	0	1	0	0	0	6	0	0
6/9/2002	1	0	0	0	0	0	1	3	0	0
6/10/2002	0	0	0	0	0	1	4	5	0	0
6/11/2002	2	0	0	0	0	2	2	2	0	0
6/12/2002	5	0	0	0	0	0	3	5	0	0
6/13/2002	0	0	0	1	0	2	2	5	1	0
6/14/2002	0	0	0	0	0	0	0	0	0	0
6/15/2002	6	0	0	2	1	1	0	0	0	0
6/16/2002	6	0	0	0	0	5	0	13	0	0

Table 1. Con't.

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Eulochon
6/17/2002	3	0	1	3	0	0	1	6	0	0
6/18/2002	5	0	0	1	0	2	0	3	0	0
6/19/2002	6	0	0	1	0	1	1	3	0	0
6/20/2002	0	0	0	0	0	1	0	0	0	0
6/21/2002	4	0	0	1	0	1	1	3	0	0
6/22/2002	5	0	0	2	0	5	1	2	0	0
6/23/2002	9	0	0	1	0	0	5	3	0	0
6/24/2002	1	0	0	1	0	8	0	1	0	0
6/25/2002	6	0	0	1	0	1	4	3	0	0
6/26/2002	0	0	0	0	0	0	0	0	0	0
6/27/2002	2	0	0	0	0	2	1	4	0	0
6/28/2002	6	0	0	0	0	2	1	2	0	0
6/29/2002	1	0	1	0	0	0	2	2	0	0
6/30/2002	3	0	0	0	0	2	7	5	0	0
7/1/2002	1	0	0	1	0	3	5	2	0	0
7/2/2002	3	0	0	0	0	4	4	3	0	0
7/3/2002	1	0	0	0	0	1	3	2	0	0

Table 1. Con't.

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Eulochon
7/4/2002	1	0	0	0	0	6	1	3	0	0
7/5/2002	0	0	0	0	0	1	1	2	0	0
7/6/2002	0	0	0	0	0	2	1	3	0	0
7/7/2002	0	0	0	0	0	3	1	0	0	0
7/8/2002	1	0	0	0	0	3	4	2	0	0
TOTALS	726	5	1773	18	12	139	95	462	4	1

Table 2. 2002 Lower Trap Efficiencies

Date	Marked	Recaptured	Efficiency %
4/28/02 - 5/4/02 *	187	9	4.81%
5/15/2002 **	18	3	16.67%
6/7/2002 **	7	1	14.29%
Mean Efficiency		11.92%	

All marked fish released from the upper rotary-screw trap were given a 10 day period of recapture in the lower rotary-screw trap.

* Marked count includes 21 Cutthroat marked in the dates of April 27- April 29. 1 Cutthroat was recaptured in the lower trap. All coho trapped during these dates were marked and released for recapture.

** Marked and recaptured count represents Coho only.

Table 3.

2002 Upper Goldsborough Screw Trap Daily Catch of *Oncorhynchus spp.* and other non-salmonid species.

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Bass
4/4/2002	0	0	0	0	0	0	0	0	0	0
4/5/2002	0	0	0	0	0	0	0	0	0	0
4/6/2002	1	0	371	0	0	0	0	0	0	0
4/7/2002	0	0	441	0	0	3	2	0	0	0
4/8/2002	1	0	530	0	0	2	3	1	0	0
4/9/2002	1	0	99	0	0	2	1	1	0	0
4/10/2002	0	0	880	0	0	11	1	0	0	0
4/11/2002	16	0	456	0	0	28	0	0	0	0
4/12/2002	4	0	0	0	0	17	0	0	0	0
4/13/2002	5	0	450	0	0	7	0	0	0	0
4/14/2002	3	0	400	0	0	7	6	3	0	0
4/15/2002	0	0	0	0	0	0	0	0	0	0
4/16/2002	0	0	0	0	0	0	0	0	0	0
4/17/2002	0	0	0	0	0	0	0	0	0	0
4/18/2002	4	0	367	0	0	3	0	0	0	0
4/19/2002	5	0	378	0	0	0	0	0	0	0

Table 3. Con't

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Bass
4/20/2002	3	0	369	0	0	1	0	0	0	0
4/21/2002	4	0	503	0	0	1	4	0	0	0
4/22/2002	2	0	477	0	0	2	0	0	0	0
4/23/2002	1	0	26	0	0	0	3	5	0	0
4/24/2002	2	0	395	0	0	1	4	0	0	0
4/25/2002	11	0	818	0	0	1	2	0	0	0
4/26/2002	19	0	721	0	0	0	5	0	0	0
4/27/2002	0	0	653	0	0	5	2	2	0	0
4/28/2002	17	0	739	0	0	7	3	1	0	0
4/29/2002	37	0	387	0	0	12	5	0	1	0
4/30/2002	28	0	590	0	0	10	2	0	0	0
5/1/2002	30	0	634	0	0	11	3	1	1	0
5/2/2002	21	0	739	0	0	3	4	0	0	0
5/3/2002	18	0	819	0	0	4	5	0	0	0
5/4/2002	18	0	748	0	0	2	0	0	0	0
5/5/2002	8	0	340	0	0	4	3	1	0	0
5/6/2002	29	0	485	0	1	3	1	2	0	0

Table 3. Con't

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Bass
5/7/2002	28	0	350	0	0	5	2	0	0	0
5/8/2002	28	0	347	0	1	2	2	0	0	0
5/9/2002	0	0	4	0	0	0	1	0	0	0
5/10/2002	22	1	305	0	0	5	3	0	0	0
5/11/2002	29	0	226	0	1	4	5	0	0	0
5/12/2002	38	0	145	0	0	8	8	0	0	0
5/13/2002	24	0	108	0	0	15	14	0	0	0
5/14/2002	17	0	70	0	0	10	4	0	1	0
5/15/2002	18	0	94	0	1	8	5	1	1	0
5/16/2002	12	0	59	0	1	6	4	0	0	0
5/17/2002	4	1	78	0	1	7	3	0	0	0
5/18/2002	22	0	27	0	0	7	4	0	0	0
5/19/2002	24	0	2	0	3	4	4	0	0	0
5/20/2002	4	0	33	0	0	1	5	0	0	0
5/21/2002	10	3	24	0	1	7	1	2	1	0
5/22/2002	9	0	21	0	0	4	4	0	1	0

Table 3. Con't

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Bass
5/23/2002	3	2	61	0	1	7	4	0	0	0
5/24/2002	5	0	21	0	1	6	3	0	0	0
5/25/2002	1	1	26	0	2	7	1	1	0	0
5/26/2002	3	0	18	0	0	3	4	0	0	0
5/27/2002	0	0	6	0	0	0	0	0	0	0
5/28/2002	2	1	19	0	0	3	1	0	0	0
5/29/2002	3	0	0	0	1	14	5	1	1	0
5/30/2002	2	0	0	0	0	11	5	2	1	0
5/31/2002	2	2	8	0	0	2	4	0	0	1
6/1/2002	2	0	14	0	1	17	5	0	0	0
6/2/2002	5	0	0	0	1	7	3	1	0	0
6/3/2002	7	0	3	0	0	8	5	0	0	0
6/4/2002	2	0	3	0	0	12	0	2	0	0
6/5/2002	1	0	5	0	0	7	1	1	0	0
6/6/2002	7	0	4	0	0	19	2	0	0	0
6/7/2002	7	1	1	0	0	6	3	2	0	0

Table 3. Con't

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Bass
6/8/2002	4	0	2	0	0	10	3	0	0	0
6/9/2002	3	0	4	0	0	7	1	0	0	0
6/10/2002	2	0	6	0	0	5	1	0	0	0
6/11/2002	7	0	0	1	0	7	1	0	0	0
6/12/2002	4	0	2	0	0	5	4	1	0	0
6/13/2002	4	0	1	0	0	10	5	0	0	0
6/14/2002	2	0	0	0	0	1	1	0	0	0
6/15/2002	0	0	0	0	0	0	0	0	0	0
6/16/2002	6	0	0	0	0	8	4	0	0	0
6/17/2002	2	0	0	0	0	0	0	1	0	0
6/18/2002	4	0	7	0	0	3	1	0	0	0
6/19/2002	5	0	2	0	0	1	2	1	0	0
6/20/2002	4	0	0	0	0	1	0	1	0	0
6/21/2002	1	0	0	0	0	1	2	0	0	0
6/22/2002	1	0	0	0	0	1	0	0	0	0
6/23/2002	1	0	0	0	0	0	1	0	0	0
6/24/2002	0	0	0	0	0	1	2	0	0	0

Table 3. Con't

Date	<i>Oncorhynchus spp</i>						Non-salmonids			
	Coho Smolt	Coho Fry	Chum Fry	Chinook	Steelhead	Cutthroat	Lamprey	Sculpin	Stickleback	Bass
6/25/2002	2	0	0	0	0	3	6	0	2	0
6/26/2002	1	0	0	0	0	3	1	0	0	0
6/27/2002	0	0	0	0	0	1	0	1	0	0
6/28/2002	0	1	0	0	0	4	1	0	0	0
6/29/2002	1	0	0	0	0	14	5	0	0	0
6/30/2002	0	0	0	0	0	14	10	0	0	0
7/1/2002	2	0	0	0	0	6	3	1	0	0
7/2/2002	0	0	0	0	0	6	0	3	0	0
7/3/2002	0	0	0	0	0	0	1	0	0	0
TOTALS	685	13	15921	1	17	481	229	39	10	1

Table 4.
2002 Upper & Lower Goldsborough Smolt Trap Catch Summary

Species	Upper Goldsborough	Lower Goldsborough
Coho	685	726
Coho Fry	13	5
Chum	15921	1773
Chinook	1	18
Sockeye	0	0
Steelhead	3	7
Steelhead Fry	14	5
Cutthroat	271	134
Cutthroat Fry	216	5
Crawdad	25	4
Sculpin	39	462
H2O Beetle	0	1
Bass	1	0
Lamprey	229	95
Eulochon	0	1
Stickleback	10	4
Eel	4	0
Rough Skin Newt	4	0