Fraser Salmon & Watersheds Program

PACIFIC SALMON FOUNDATION

Fraser Basin Council

2010/11 FINAL REPORT

FSWP File Number*	FSWP 10 D 100 HWRS

* Please use the FSWP File Number provided in previous FSWP project correspondence.

1. Project Information

1.1. Project Title

FSWP Restoration Effectiveness Monitoring

1.2. Proponent's Legal Name

BC Conservation Foundation

1.3. Project Location

Multiple River Systems - Alouette River; Chehalis River; Silverhope Creek

1.4. Contact for this report

Name: Kerry Baird	Phone: : 604-576-1433	Email: Kbaird@bccf.com

1.5 Funding Amount

Original Approved Grant Amount:	Total FSWP Expenditures:	Final Invoice Amount:	Final Non-FSWP leveraging, including cash and in-kind:
$17,066	$17,066	$3,414.20	$18,788.5

2. Project Summary

Please provide a single paragraph describing your project, its objectives, and the results. As this summary may be used in program communications, clearly state the issue(s) that were addressed and avoid overly technical descriptions. Maximum 300 words.

Mainstem river fish habitat restoration projects have been conducted in a number of impacted watersheds across the Lower Mainland/South Coast of British Columbia by the BC Conservation Foundation Fisheries Recovery Program. The primary habitat restoration methods used to improve juvenile fish rearing habitat was the Large Woody Debris (LWD) engineered style log jam, and side-channel re-connections. This FSWP project was funded to assess the biological performance, and structural integrity of the restoration projects. Rather than attempting to evaluate all restoration projects, a sub-set of projects was deemed practical. In the Fraser Valley, the Alouette and Chehalis River, and the Silverhope Creek have been selected (Appendix I – Map).

Using fish habitat restoration effectiveness monitoring industry guidelines, LWD structures, and select control sites were evaluated to determine fish abundance using underwater snorkel survey methodology. The key focus was enumerating juvenile steelhead trout (*Oncorhynchus mykiss*), and coho salmon (*Oncorhynchus kisutch*) at

treated (restored), control (un-restored), and where available, natural wood controls (natural wood). This involved summer day-time, and winter night-time snorkel survey assessments, conducted to capture data representing seasonal habitat use variability. Snorkel surveys were conducted between August through October, 2010 for summer evaluations, and February, 2011 for winter evaluations. Overall, underwater snorkel survey observations indicate a high salmonid fish use at wood restored sites, as well as natural wood sites, relative to the controls with no wood present (refer to section 3.2 "Effectiveness" for study results). Additionally, a side-channel mark and re-capture juvenile salmonid population estimate was conducted on one of two re-connected side-channels in the Silverhope Creek.

Large Woody Debris structural performance (habitat development) was rated using a standardized methodology. Of all 75 LWD restored sites that were evaluated, 94% and 92% are at or above the "meets expectations" criteria ranking for "pool development and gravel deposition" and "fish habitat cover", respectively.

OPTIONAL: **Please give a short statement (up to 100 words) of the most compelling activity or outcome from your project.**

3. Final Project Results and Effectiveness

3.1 Please copy THE EXPECTED DELIVERABLES from your detailed proposal and insert into this table. Add additional rows as needed. Then describe the FINAL DELIVERABLES (the tangible end products resulting from this work) associated with each expected Deliverable.

If FINAL DELIVERABLES differ from the original EXPECTED DELIVERABLES, please describe why, and the implications for the project.

EXPECTED DELIVERABLES	FINAL DELIVERABLES
1. A quantitative assessment of juvenile salmonid use of woody debris fish habitat structures in the south Alouette River, Chehalis River, and Silverhope Creek	Biological assessments were completed on the Alouette and Chehalis Rivers, along with Silverhope Creek. Juvenile salmonid usage was quantified and analysis, per the standards highlight by past BCCF reports.
2. A physical assessment of woody debris fish habitat structures and side-channel function to ensure structural integrity, and progressive habitat development in the south Alouette River, Chehalis River, and Silverhope Creek	Physical assessment of BCCF habitat units occurred on the water bodies mentioned in the description. No real changes or issues were observed.
3. A fish mark and re-capture study conducted on two re-connected side-channels along the Silverhope Creek, estimating juvenile fish abundance associated with side-channel habitat	Side channel assessment was completed on one of the Silverhope side channels. The second channel was plagued with beaver problems over 2010, subsequently reducing the amount of usable fish habitat and access.

4. Install interpretive signage, illustrating results in a simplified manner, at select high traffic public locations	Project signage component of the project will be completed during the spring of 2011.
5. A peer-reviewed, Comprehensive Technical Report (CTR) integrating five years of fish habitat effectiveness evaluations conducted on Lower Mainland and Vancouver Island rivers	The five year peer-reviewed document has yet to be completed. With the information collected during 2010-2011 the data set completes the information needed for the document. Composition of the document is to start soon and will be completed mid 2011.

3.2 Please evaluate the EFFECTIVENESS of your project in achieving Project Objectives. Identify the indicators you have used to measure the effectiveness of your project. Please include any notable successes or challenges.

Effectiveness and results of the project are summarized in Appendices 2-3

3.4 IF applicable, please describe how your project has achieved one or more of the following supported processes (Section 2.2 of RFP; section 7 of detailed proposal template). If results differ from those originally anticipated, please describe.

Engagement of First Nations. Please specify who, and in what capacity.	First nations groups were solicited to assist BCCF staff in the completion of project objectives, but never replied to BCCF calls for assistance.
Active partnerships with one or more organizations.	Active partnerships continue with the BC Ministry of Natural Resource Operations, Kingfishers Rod and Gun Club, Fraser Valley Conservancy and other volunteer stewardship organizations.
Engagement and participation of diverse and under-represented groups.	BCCF attempted to include as many groups in the volunteer process as possible and succeeded in some regards. BCCF utilized volunteer labor from angling groups, public members, stewardship groups, and government employees.
Relationship building, as a foundation for sustainable, enduring activities.	BCCF continued to forge new relationships with both people and organizations and hope to develop more in the future.
Capacity building, including mentorship models, leadership training and skills development.	We hope as a not- for –profit organization that the information and on-site training our volunteers receive from our staff members increases the volunteers base of knowledge.
Recognition and support of champions and their initiatives.	With the completion of the five year effectiveness monitoring document the people responsible for the development of the restoration techniques will see their hard work highlighted in the scientific community.

Opportunities to influence policy and decision making,	This project may have a future influence on the longevity and guidelines that must be followed after the completion of any restoration project.

3.5 Please describe how the benefits of this project will be sustained and/or be built upon into the future. What are the planned next steps, or recommendations for further work, if applicable?

With the completion of the five year final report it is anticipated to be accepted and used as a reference document for future habitat restoration practitioners, and potentially local governments. Evaluations of restoration methodologies will measure the success of existing work and provide guidance for adaptive management, leading to the use of the most efficient and effective techniques for greater benefits in the future.

A vision of BCCF is to have the document utilized by local/regional governments in a way that would support their position on protecting and conserving existing aquatic and riparian habitats, as well as escalating future habitat restoration action using wood. A major concern in many of our Fraser Valley watersheds is public destruction of streamside trees, or the removal of wood from within the river channel. Informing local government and enforcement of the high value of wood in rivers may be most effective by a study such as this, which quantifies and depicts high fish abundance associated with wood. Increased protection, stemming at the government level is needed to curtail destructive practices that occur in our watersheds. Through local government support, and public education, positive changes for fish and fish habitat can be achieved.

3.6. What are the top three lessons learned from this project that could be useful to communicate to others doing similar work in the Basin?

1. The use of volunteers during field work is an extremely cost effective source of good labor.
2. Partnerships are not build in one day
3. Planning and organizing of volunteers is a time consuming activity.

REQUIRED: Attach all DOCUMENTATION of Final Deliverables, and LIST attachments in Section 7. These may include technical reports, maps, photos, evidence of communications, lists of meeting participants, etc.

4. Outreach and Communications

Please describe how you have communicated project activities and results within local and basin-wide communities, across organizations and/or to decision makers.

Please list and attach copies of (or links to) any communications materials from these efforts that you have not previously submitted.

BCCF continues to seek opportunities that will promote the importance of the work we provide, and the funders who support us. BCCF and MoE staff will continue to promote project goals, objectives, deliverables, supporters, and accomplishments through various public presentations, trade shows, regional workshops/watershed committees, community events, and fundraising events.

A media release, through a “Living Rivers Georgia Basin/Vancouver Island”, communication plan will take place, highlighting how a five year study was able to quantitatively illustrate the value of wood in rivers, and high juvenile salmonid productivity associated with wood following the final year of the project 2010-2011. Additionally, once the field component is complete, and all data analyzed, and peer reviewed, study results will be incorporated into project interpretive signs.

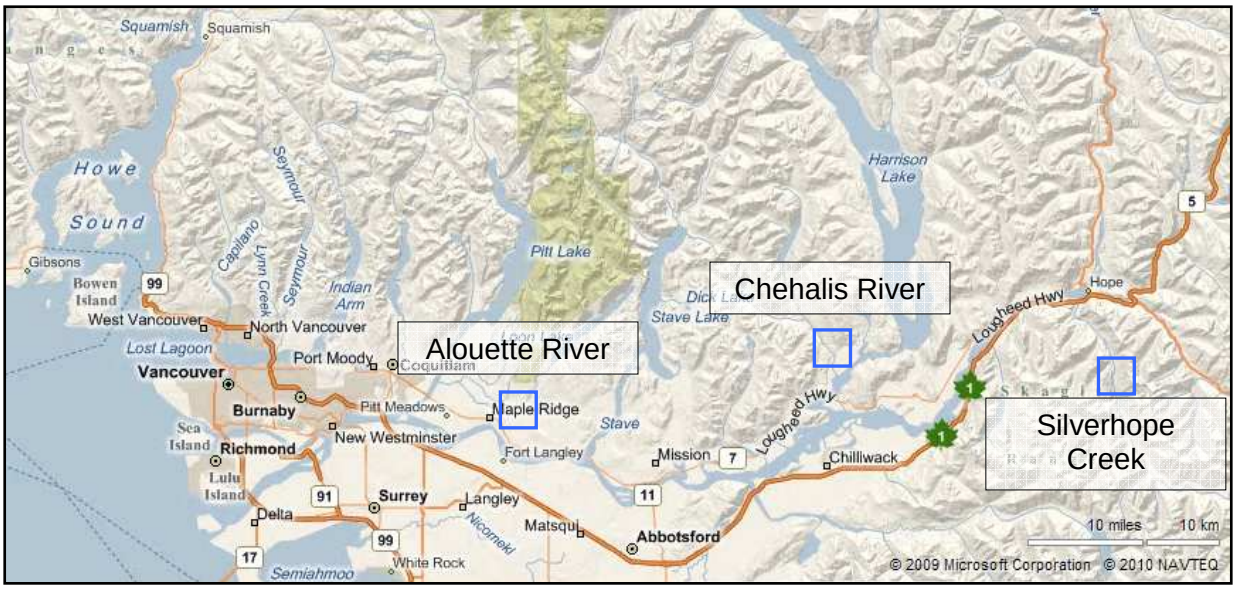
8. APPENDICES

LIST all REQUIRED DOCUMENTATION here, and attach at the end of this report. These include:

1. **Documentation of FINAL RESULTS. These may include technical reports, maps, photos, lists of meeting participants, etc. (Section 3).**
2. **Communications and Outreach materials, if applicable (Section 4)**
3. **Letters of Confirmation for non-FSWP contributions (Section 5.2)**

1. Spatial map of project activities
2. Biological and physical study results
3. Silverhope Creek Side-channel Population Estimate
4.
5.

APPENDIX I – Spatial map of project activities



APPENDIX II – Biological and Physical Study results

BIOLOGICAL ASSESSMENT

A post-treatment monitoring design is commonly utilized for effectiveness monitoring of habitat restoration treatments (Roni 2005; Slaney 2006). This involved summer day-time, and winter night-time snorkel survey assessments, conducted to capture seasonal variability of habitat use. Salmonids emerge from concealment at different diel periods during summer and winter months; diurnal (summer) and nocturnal (winter). Summer surveys were completed when water temperatures and flows result in typical daytime foraging behaviour observed in salmonids. Winter snorkel surveys were completed when flows are moderated by snow-packs, and parr still inhabit over-wintering habitats before spatial re-distribution (Slaney 2006). Winter underwater fish counts are critical, because harsh over-wintering conditions have been shown to cause the highest juvenile mortality rates in coastal streams (Ward and Slaney 1988), and this is a period when steelhead parr maximize use of juvenile mainstem LWD habitat (Roni and Quinn 2001).

Underwater fish enumeration surveys, focusing on size/age classes, were used to evaluate fish abundance within the study site types. Three site categories were chosen to reflect the diversity of habitat characteristics, and illustrate the effects of woody debris at a *site* monitoring level:

a) Treated: Sites of introduced large woody debris habitat that were artificially constructed;

b) Control: Sites were selected with otherwise good fish habitat characteristics, though void of natural woody debris. These sites are chosen to represent the pre-treatment state of restored sites;

c) Wood Control: Sites were chosen to exhibit prime natural fish habitat conditions, with natural woody debris characteristics.

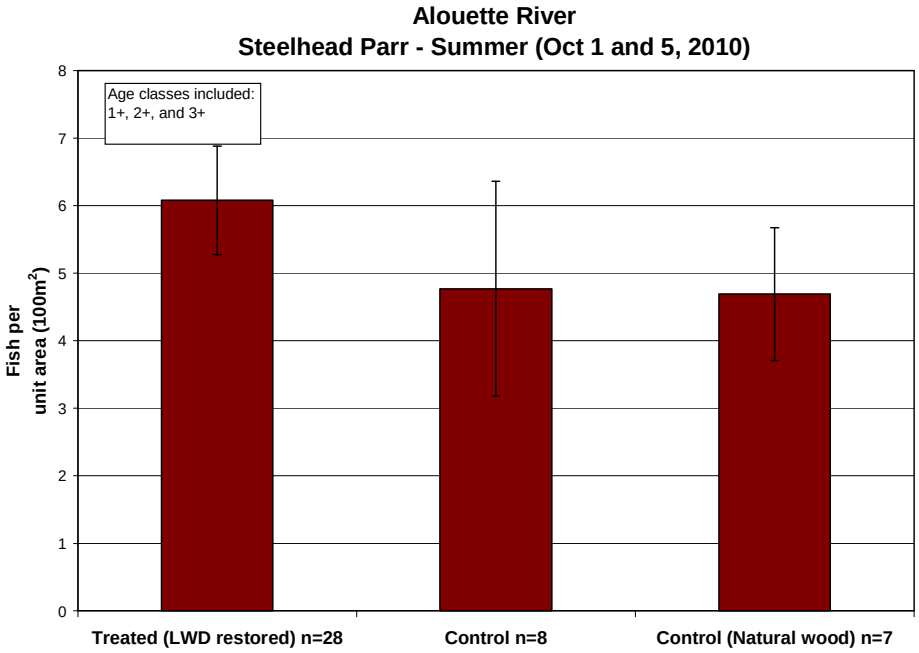
Site dimensions (per site type), were determined based on river morphology and hydraulics associated with the site. Treated sites included the entire area that was influenced by the introduced woody debris, on three sides: upstream and downstream limitations of the woody debris structures and off of the apex of the structure. Control, and wood control sites were selected predominately using longitudinal river reach characteristics to set the upper and lower survey site boundaries. Noticeable scour depth changes in a cross-sectional plane were used to determine the width of the survey site. An upper and lower riffle would typically set the longitudinal site break. Site dimensions' were visually estimated. Sites were randomly selected for "test" measurements to ensure that the site estimations that were being made by personnel were acceptable. Site dimensions were later used to express the abundance of fish observed per area (100 m^2).

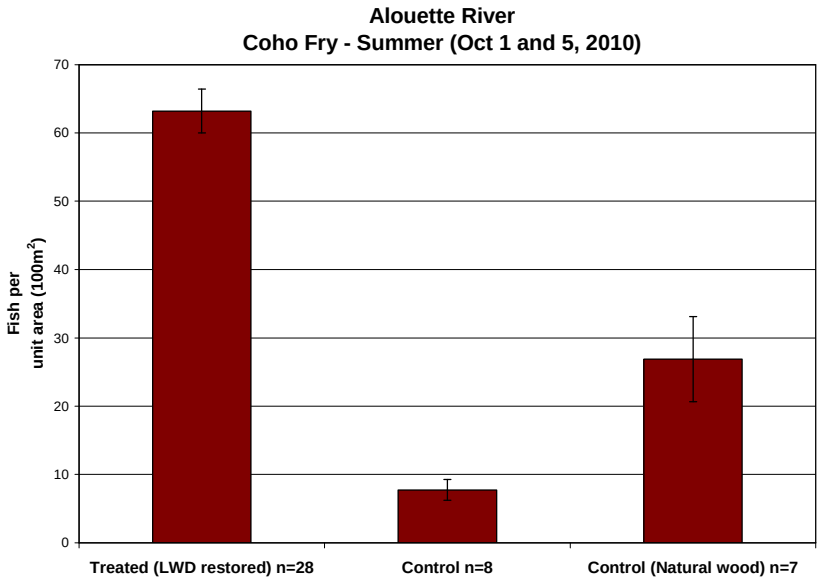
Systematic underwater fish counts, targeted steelhead parr, and steelhead fry and coho fry; however, all species observed were counted. Fish were counted by age class based on length estimations made visually by experienced snorkelers. Day-time counts were conducted after mid-day when water temperatures increased and fish activity peaked. Winter swims were conducted after darkness, or after 2100 hrs, to ensure that sun light would not trigger fish concealment behaviors.

Standard counting lanes were used with the lane width set according to the observers' visual (fish-detectable) distance. All three swimmers record fish straight ahead, and towards the stream bank from them (constitutes their lane); until the next swimmers lane. Winter, night-time enumerations are carried-out identical to summer day time swims, though sealed underwater LED (light Emitting Diode) dive lights are used. Night-time swims were conducted at a slower pace to ensure complete enumeration of habitat occurred with the dive lights.

ALOUETTE RIVER - Summer

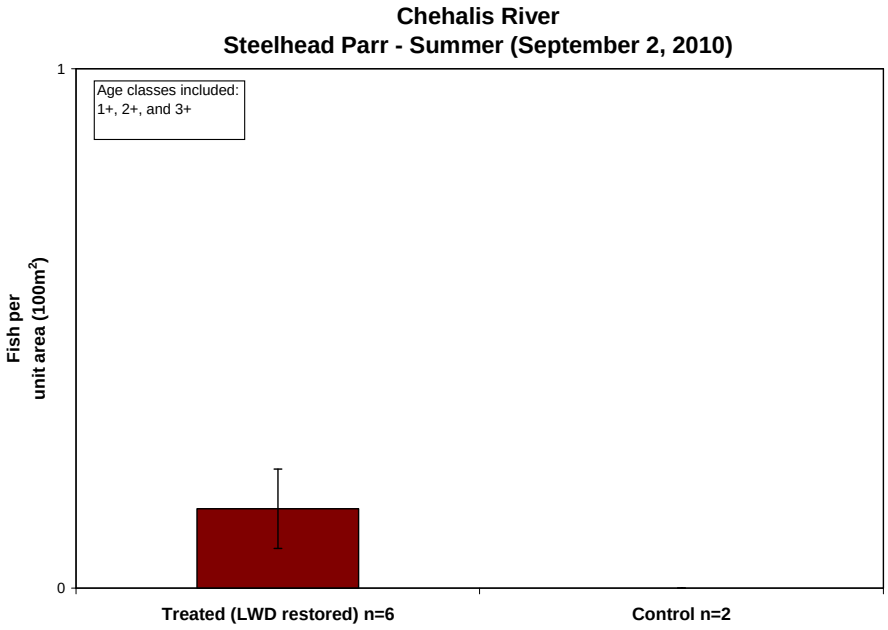
Summer				Steelhead			
Site Type	**Total Area Surveyed (m^2)**	**Fish Abundance**	**Co**	**0+**	**1+**	**2+**	**3+**
LWD Sites n=28	2469	Total Count	1473	378	87	30	5
		Avg. per 100 m^2	63	15	4	1	0
		Age class composition (%)	N/A	75.6	17.4	6.0	1.0
Control Sites n=8	669	Total Count	51	86	21	11	1
		Avg. per 100 m^2	8	12	3	2	0
		Age class composition (%)	N/A	72.3	17.6	9.2	0.8
Wood Control Sites n=7	690	Total Count	198	66	21	5	2
		Avg. per 100 m2	27	10	4	1	0
		Age class composition (%)	N/A	70.2	22.3	5.3	2.1

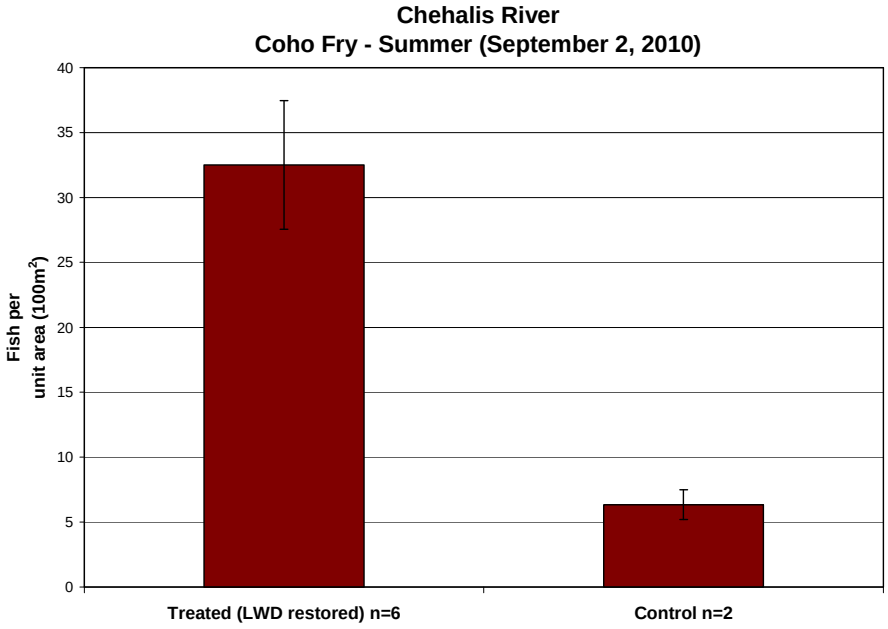




CHEHALIS RIVER - Summer

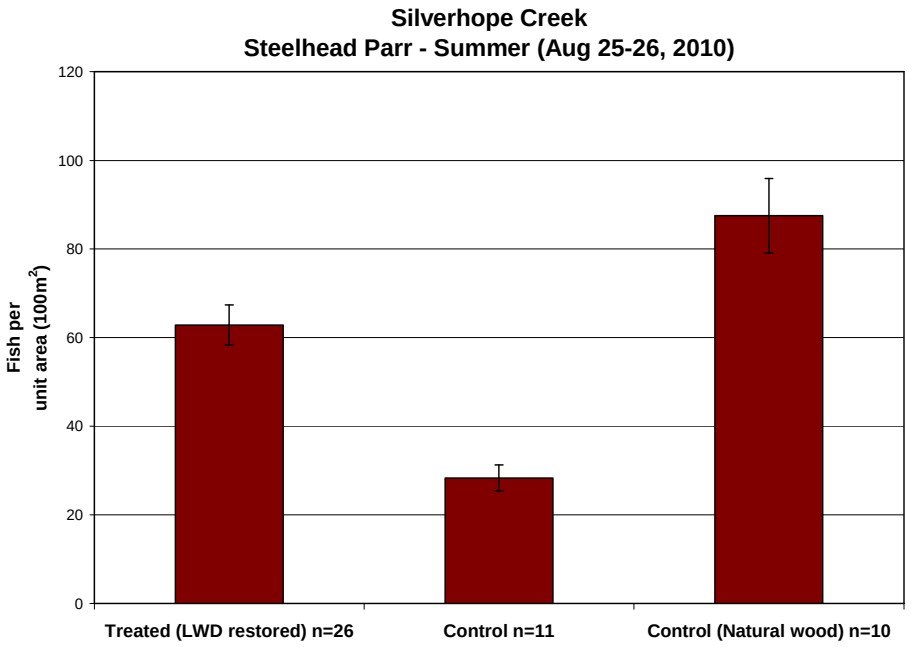
Summer				Steelhead			
Site Type	**Total Area Surveyed (m^2)**	**Fish Abundance**	**Co**	**0+**	**1+**	**2+**	**3+**
LWD Sites n=6	605	Total Count	191	32	0	1	0
		Avg. per 100 m^2	33	5	0	0	0
		Age class composition (%)	N/A	97.0	0.0	3.0	0.0
Control Sites n=2	240	Total Count	15	12	0	0	0
		Avg. per 100 m^2	6	5	0	0	0
		Age class composition (%)	N/A	100.0	0.0	0.0	0.0

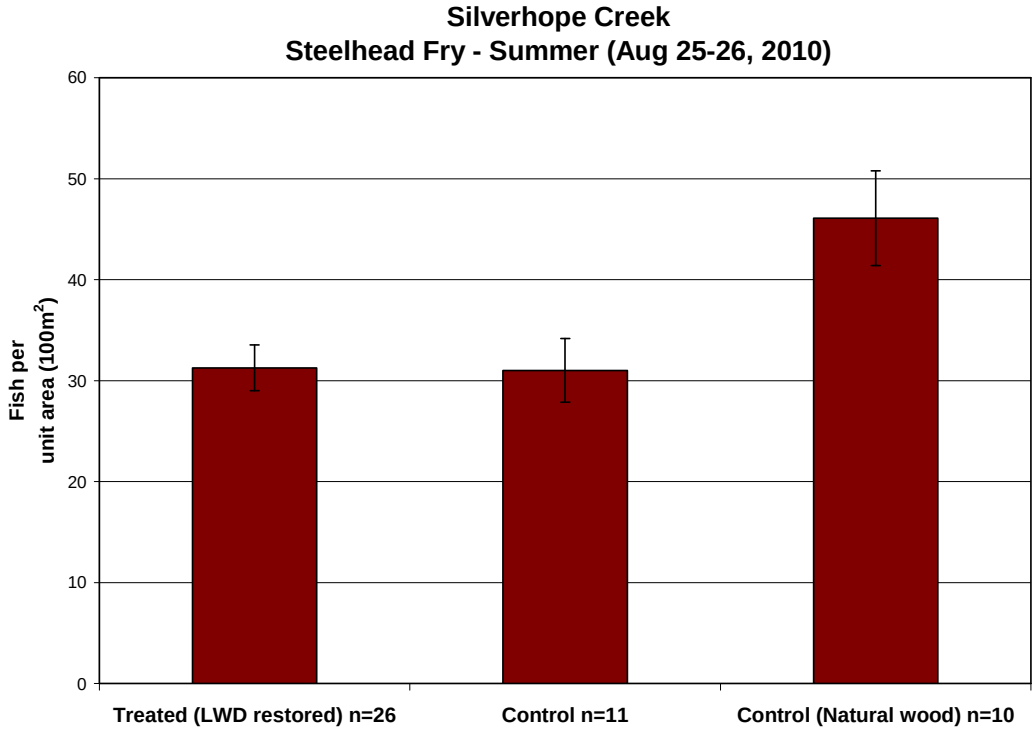

Chehalis River
Steelhead Parr - Summer (September 2, 2010)
Age classes included:
1+, 2+, and 3+
Fish per unit area (100m2)
1
0
Treated (LWD restored) n=6
Control n=2


Chehalis River
Coho Fry - Summer (September 2, 2010)
Fish per unit area (100m2)
40
35
30
25
20
15
10
5
0
Treated (LWD restored) n=6
Control n=2

SILVERHOPE CREEK - Summer

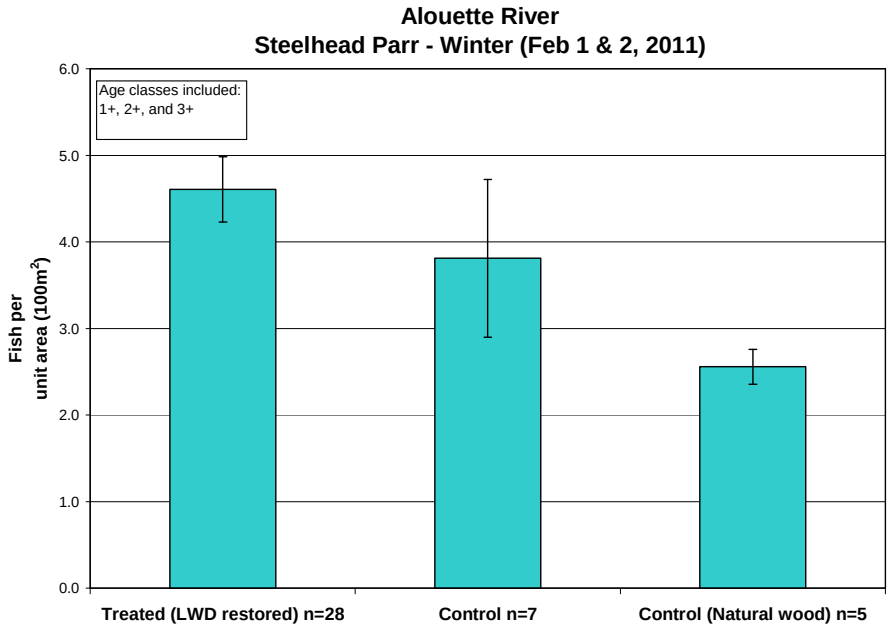
Summer			Steelhead			
Site Type	**Total Area Surveyed (m^2)**	**Fish Abundance**	**0+**	**1+**	**2+**	**3+**
LWD Sites n=26	3454	Total Count	906	1385	426	63
		Avg. per 100 m^2	31	46	15	2
		Age class composition (%)	32.6	49.8	15.3	2.3
Control Sites n=11	1150	Total Count	335	268	51	4
		Avg. per 100 m^2	31	24	4	0
		Age class composition (%)	50.9	40.7	7.8	0.6
Wood Control Sites n=10	886	Total Count	374	482	206	47
		Avg. per 100 m^3	46	59	24	5
		Age class composition (%)	33.7	43.5	18.6	4.2

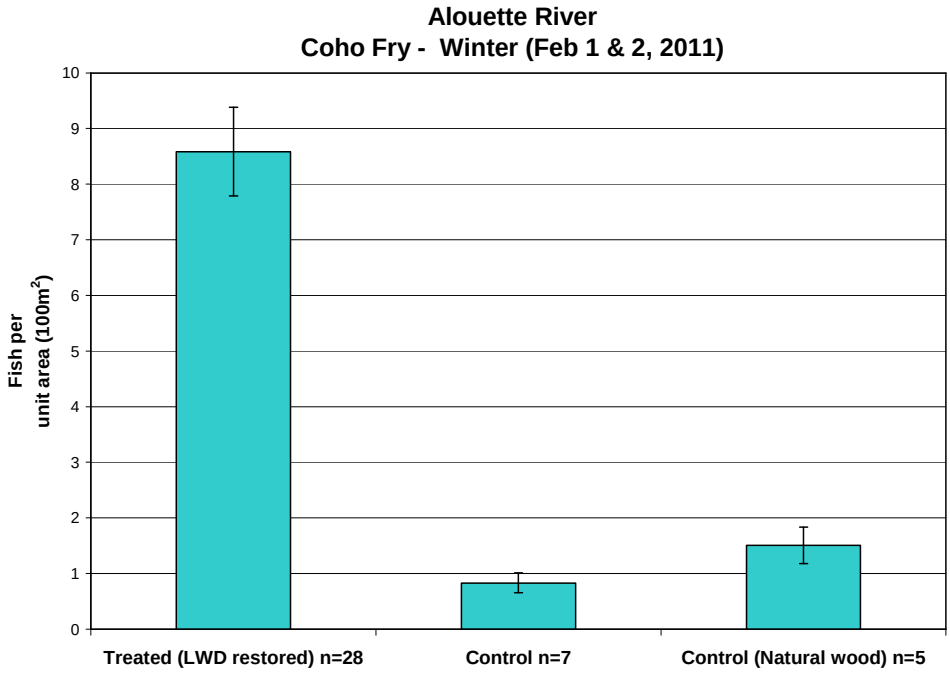




ALOUETTE RIVER - Winter

Winter				Steelhead			
Site Type	**Total Area Surveyed (m^2)**	**Fish Abundance**	**Co**	**0+**	**1+**	**2+**	**3+**
LWD Sites n=28	2496	Total Count	207	128	100	12	0
		Avg. per 100 m^2	9	5	4	1	0
		Age class composition (%)	N/A	53.3	41.7	5.0	0.0
Control Sites n=7	583	Total Count	6	17	16	10	0
		Avg. per 100 m^2	1	2	2	2	0
		Age class composition (%)	N/A	39.5	37.2	23.3	0.0
Wood Control Sites n=5	488	Total Count	8	4	13	0	0
		Avg. per 100 m2	2	1	3	0	0
		Age class composition (%)	N/A	23.5	76.5	0.0	0.0

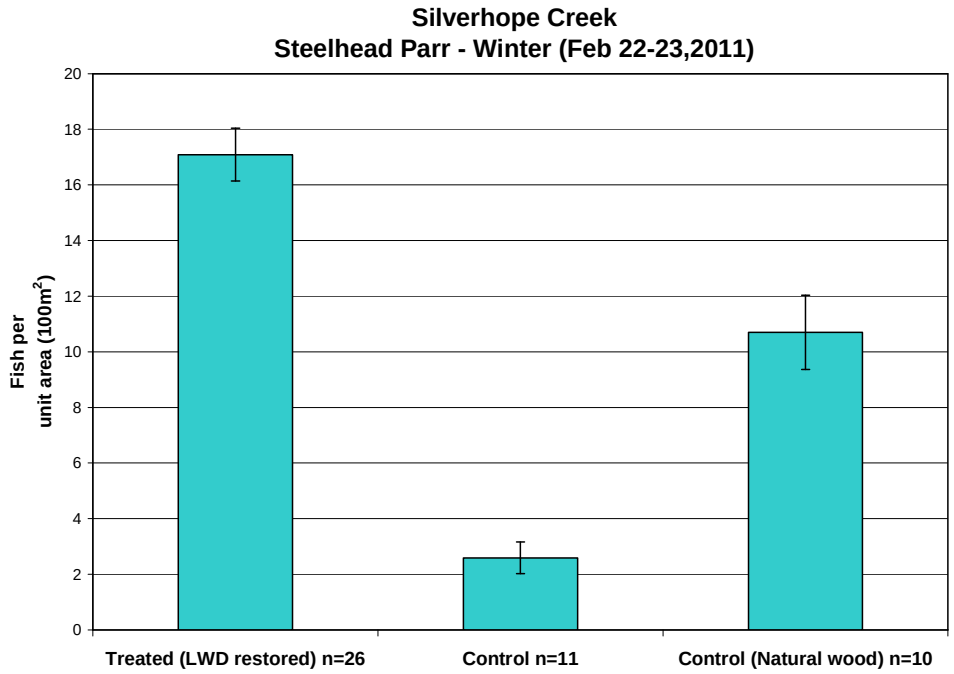


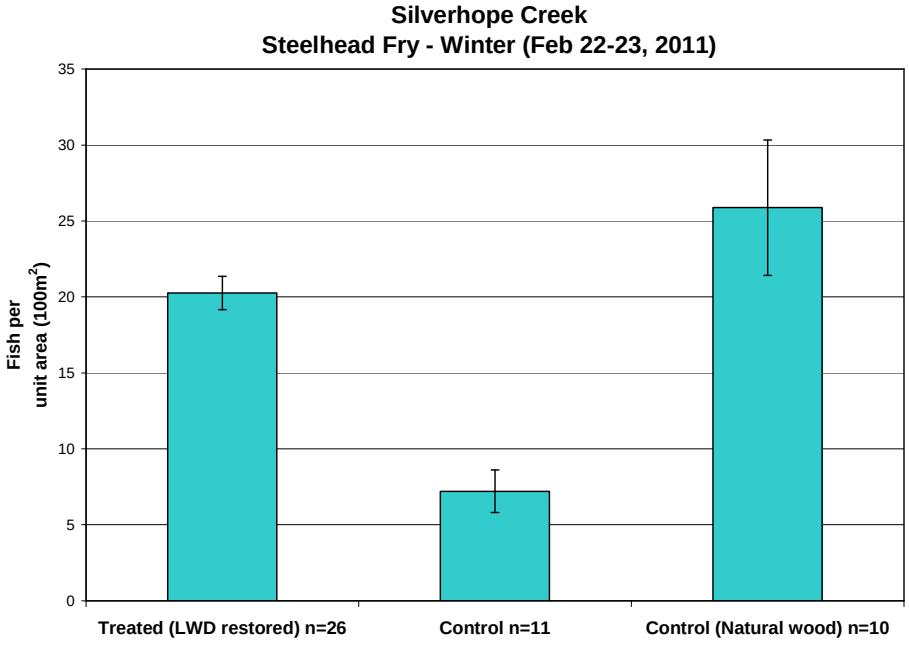


SILVERHOPE CREEK - Winter

Winter			Steelhead			
Site Type	**Total Area Surveyed (m^2)**	**Fish Abundance**	**0+**	**1+**	**2+**	**3+**
LWD Sites n=26	3454	Total Count	534	329	99	18
		Avg. per 100 m^2	20	13	4	1

		Age class composition (%)	54.5	33.6	10.1	1.8
Control Sites n=11	1150	Total Count	48	15	2	0
		Avg. per 100 m^2	7	2	0	0
		Age class composition (%)	73.8	23.1	3.1	0.0
Wood Control Sites n=10	886	Total Count	88	34	10	3
		Avg. per 100 m^3	26	8	2	1
		Age class composition (%)	65.2	25.2	7.4	2.2





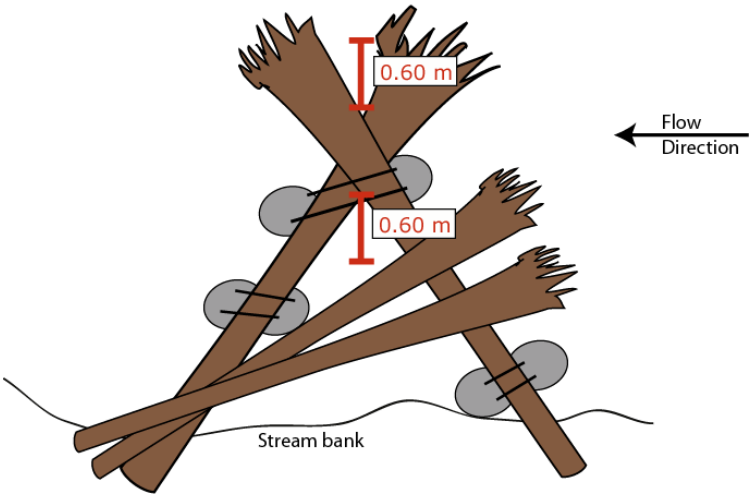
PHYSICAL EVALUATION OF LWD

Using a modified version of the Watershed Restoration Program – Forest Investment Account protocol *Guidelines for in-stream and off-channel effectiveness evaluation* (Anonymous 2003) physical stream bed changes (ie. scour) caused by the interaction of the wood structures with the natural hydraulic processes were assessed. The inspection evaluated: pool development and gravel deposition; stream bank protection; and stream/habitat cover. These three parameters were ranked using a standardized key which gives a rating from 0-4, with 4 being the optimal value. Using a measuring rod, water depths were recorded for: mean, maximum, "apex" (off of the point of the triangulated structure), and "inner v" (within the v formed in the triangulated structure) depths (figure 2). Similarly, the integrity of the structures was evaluated, and any concerns/issues documented for later adaptive response.

The LWD integrity component reviews: fastening components (epoxy adhesive, cable clamps, "farmers eye", log staples); sufficient cable attachments to secure tree bases and boulders ballast; sufficient boulder ballast; evidence of structure shifting; and any potential human, or physical hazards.

Typical Triangulated LWD Design

Top View - Illustration of "inner V" and "Apex" measurement sites



Standardized locations for measuring water depth at triangulated LWD structures. Measurements are taken in the "inner V" and off of the "Apex", as well as mean and maximum depths with the area of influence of the structure.

ALOUETTE RIVER	% Composition of Evaluated Sites	
	Pool Development and Gravel Deposition	Fish Habitat Cover
Exceeds Expectations	32	25
Between "Exceeds" and "Meets"	0	0
Meets Expectations	68	75
Between "Meets" and "Does Not Meet"	0	0
Does Not Meet Expectations	0	0
Habitat Unit Failure	0	0

ALOUETTE RIVER				
	Mean Depth (m)	Max Depth (m)	Apex Depth (m)	Inner "v" Depth (m)
Minimum	0.25	0.40	0.65	0.07
Maximum	0.95	1.50	1.00	0.80
Mean	0.60	0.95	0.83	0.44

CHEHALIS RIVER	% Composition of Evaluated Sites	
	Pool Development and Gravel Deposition	Fish Habitat Cover
Exceeds Expectations	0	0
Between "Exceeds" and "Meets"	33	33
Meets Expectations	67	50
Between "Meets" and "Does Not Meet"	0	16
Does Not Meet Expectations	0	0
Habitat Unit Failure	0	0

	Mean Depth (m)	Max Depth (m)	Apex Depth (m)	Inner "v" Depth (m)
Minimum	0.5	0.9	0.7	N/A
Maximum	0.8	1.1	1.1	N/A
Mean	0.6	1.0	0.8	N/A

APPENDIX III – Silverhope Creek Side-channel Population Estimate

Between October 20 - 22, 2010, a side-channel juvenile mark and re-capture study was performed on a restored side-channel at the Silverhope Creek. In 2008 a pilot study was conducted by BCCF in this same channel to gain an understanding so that a more thorough trapping exercise could be conducted in 2009. Deficiencies in the 2009 data were addressed by changing the trapping technique from gee trapping to electro fishing. The increased success rate of the electro fishing unit allowed BCCF to get a more precise estimation of the side channel usage by both steelhead and char juveniles.

The population estimate is 1091 steelhead juveniles, age classes 0+, 1+, and 2+. The population range is 1209 to 973. The number of steelhead juveniles per m^2 equates to 2.02. A modified version of the Lincoln-Peterson mark and re-capture estimation (Chapman 1954) has been used for this population estimate.

13.5 km Side Channel - Length= 270m & Width=2m / Area= 540m^2

		20% Rule (For the Pop. Est. results to be statistically sound; M must be greater than 20% of the Pop. Est.)
Steelhead		
M = # of marked individuals in the population	430	
C = # of individuals captured in the sample (marked + un-marked in re-capture event)	488	
R = # of marked individuals in the sample	193	
Population Estimate	**1091**	39.4
	3634.374821	
Standard error	60	
95% Conf. Interval +/-	118	
Pop. Range	**331 +/- 154**	