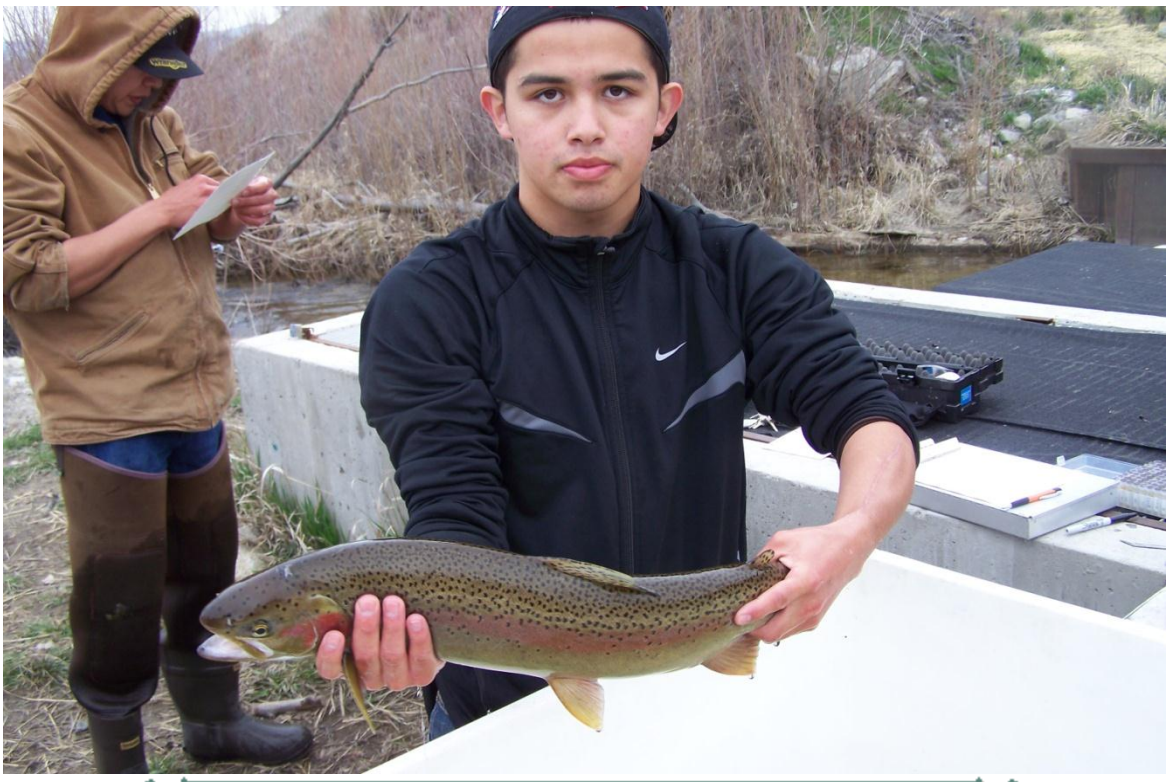
2010 Cassimer Bar Hatchery Annual Report



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Introduction

Upper Columbia summer steelhead populations have had a long history of decline resulting in protection under the Endangered Species Act (ESA) since 1997. Several reasons for this decline exist including overharvest, habitat degradation/alteration, hydro-system mortality and past hatchery practices.

The Okanogan steelhead population continues to be at high risk of extinction for abundance, productivity, spatial distribution and diversity. National Oceanic and Atmospheric Administration (NOAA) Fisheries 2008 Supplemental Comprehensive Analysis (SCA) identified the Okanogan River steelhead population at high extinction risk for abundance (1996-2006 natural origin geomean abundance of 104 steelhead, compared to the recovery abundance target of 1,000). The SCA assessed the Okanogan population to be at high risk relative to productivity with a recruit/spawner value of 0.06 for brood years 1980-1999 (NOAA 2008). The SCA also identified diversity and spatial distribution as high risk, primarily due to large hatchery influence by non-local stock (Wells stock) and spawner distribution primarily limited to 2 major spawning aggregates in the U.S portion of the Basin (NOAA 2008).

For the past decade, the Colville Tribes have been engaged in efforts to identify and address factors limiting steelhead production in the Okanogan River tributaries, primarily focused on habitat improvements and hatchery reform to address non-local steelhead hatchery releases in the Okanogan River Basin.

Historically, most summer steelhead artificial propagation efforts for the Okanogan River Basin were supported by Wells Hatchery operated by Washington State Department of Fish and Wildlife (WDFW) and funded by Douglas County Public Utility District (DCPUD) with additional annual operation and maintenance costs provided by Grant County Public Utility District (GCPUD). The original objective of the Wells Hatchery program releases in the Okanogan River Basin was to provide harvest; however, following ESA listing of summer steelhead, the program transitioned to a conservation orientated program. Currently GCPUD funds a 100,000 steelhead smolt program in the Okanogan basin. This provides both a locally adapted (ad-present) and recreational harvest (ad-clipped) steelhead program.

Broodstock for Wells Hatchery program are collected at Wells Dam and constitute a composite collection of natural origin Methow and Okanogan River stocks and hatchery origin steelhead from the Wells Hatchery. Wells Hatchery releases in the Okanogan River Basin totals approximately 100,000 smolts annually and are typically hatchery x hatchery (2^{nd} generation hatchery progeny) A major concern with the Wells Hatchery program is the possible negative effect of a composite stock broodstock and large hatchery origin composition within the broodstock would have on the natural productivity and development of local survival attributes of the natural steelhead population in the Okanogan Basin. This concern was reiterated in the SCA (NOAA 2008).

To address the possible impact of the release of non-local hatchery steelhead in the Okanogan River Basin, during 2002, the Colville Tribe, with support from NOAA Fisheries and funding from the Pacific Coast Salmon Recovery Fund, initiated a locally-adapted pilot broodstock program in Omak Creek, a tributary to the Okanogan River Basin.

Beginning in 2007, Grant County Public Utility District (GCPUD), through the Priest Rapids Project Settlement Agreement process began providing, in entirety, the operation and

maintenance funding for implementation of a locally-adapted steelhead production program at Cassimer Bar Fish Hatchery (CBFH). Current production target at CBFH is 20,000 yearling steelhead smolts for release in the Okanogan River Basin. The program is permitted under ESA through Section 10(a)(1)(A)(Permit 1412).

Components of the current Scope of Work funded by GPUD include: 1) annual broodstock collection of up to 16 adults from Omak Creek; 2) transfer of broodstock from Omak Creek to Cassimer Bar FH; 3) conduct spawning and egg incubation at CBFH; 4) rear summer steelhead to approximately 18-20 per lbs. by release date; 5) annually tagging of up to 20,000 juvenile steelhead; 6) release of approximately 20,000 yearling steelhead smolts in the Okanogan River Basin; 7) maintain Cassimer Bar FH and provide fish health treatments as prescribed by state fish pathologist; 8) evaluate survival of out-migrating steelhead smolts released from Omak Creek; 9) conduct snorkel surveys and estimate juvenile abundance in Omak Creek and up to three additional tributaries and 10) provide summary report of the program.

Data and information included in this annual summary report for the period of January 1, 2010 - December 31, 2010 includes: 1) Brood year (BY) 2010 adult broodstock collection and adult enumeration for Omak Creek and Bonaparte Creek; 2) BY 2010 spawning and rearing; 3) BY 2009 rearing and release; 4) smolt -to- adult return rates (SAR) for completed brood years; 5) juvenile emigration monitoring; and 5) juvenile abundance estimates in Omak Creek and three additional tributaries to the Okanogan River.

Acknowledgements

We would like to acknowledge Grant County PUD, funding agency for the summer steelhead program. In addition, we would like to thank the Okanogan Basin Monitoring and Evaluation Program for contributing information regarding adult spawner abundance estimates and protocols for data collection. Data collection was completed by Ernest Timentwa and Oliver Pakootas. Spawning and rearing data was provided by Anthony Cleveland, Hatchery Manager at Cassimer Bar Fish Hatchery.

Methods

Broodstock Collection

Traps were installed in Omak and Bonaparte creeks. Both traps have cod trigger fingers to reduce fish escapement. An aluminum cover prevents escapement and reduces fish stress.

Traps are checked daily to remove debris and captured fish. Large numbers of fish require the trap to be checked multiple times a day to ensure fish health and safety. Fish are netted into a tank with MS-222 and sedated. Adult fish are measured (fork length, FL), sexed, scale sampled, DNA sampled, sampled for a Passive Integrated Transponder (PIT) and Coded-Wire Tags (CWT), Visual Implant Elastomer (VIE) tags, fin clips and any injuries or abnormalities.

Adult not destined for CBFH are placed in a recovery tank, recovered and released immediately upstream from the weir. Fish taken for broodstock are transferred to a tank truck filled with tempered water. The transport tank is supplied with compressed oxygen and is supported with recirculation aerators to provide additional oxygen. Fish transported to Wells Hatchery are checked by the hatchery manager to determine ripeness.

After no fish have been observed in the trap for two weeks, the traps are removed and stored in a secure location for maintenance and repair prior to the next season.

Juvenile Collection

A five-foot rotary screw trap (RST) was installed at the mouth of Omak creek to collect juvenile fish. Omak Creek RST protocols follow developed procedures by Integrated Status and Effectiveness Monitoring Program (ISEMP). The trap is equipped with a live-box and a self-cleaning screen that helps remove medium to small debris from the live-box.

To minimize stress on fish and comply with limits and restrictions listed in the permit issued under the Kelt Reproductive Success Project (06-09-CRITFC49), when flows are too low (under 25CFS) or too high (over 70 CFS), the cone is pulled until flows stabilize within the acceptable range. During peak migration the trap is checked multiple times a day to ensure fish health and confirm proper operation.

All juvenile steelhead are measured to the nearest millimeter (mm), scales taken, DNA collected, and scanned for a PIT and code-wire tag. Fish are returned to a recovery tank supplied with compressed oxygen until recovered and then released downstream of the trap.

Spawning

Fish collected for broodstock are held in circular tanks at CBFH until spawned. A 12 gauge needle attached to a flow meter/compressor at 7 psi is used to expel ripe eggs. Males are stripped of milt with a small amount of air into a bag and kept cool until egg fertilization is needed. Due to the small number of spawners and variability of maturation a 1:2 factorial spawning matrix (one female and two males) to facilitate genetic diversity and ensure fertilization (i.e. avoid complete loss of a females production due to a non-viable male).

Females are lethally spawned and ovarian samples taken for virology tests. Males are live-spawned and are used multiple times for fertilization. After males have been used they are sacrificed for virology tests. All samples are sent to the Washington State Department of Fish and Wildlife Virology Lab in Olympia.

Rearing and Release

Eggs are fertilized and segregated into Heath trays for incubation. Heath stacks consist of eight trays per stack with a top tray not utilized for incubation. A steady flow of well water is passed through a degassing tower and filter into each stack. To provide artificial conditions vexar is used as a substitute for substrate in each tray.

Upon egg delivery each female is designated to one tray and water hardened in a solution of 100 ppm Iodophore for disinfection. Dead eggs are picked by hand and egg loss is enumerated. Fertile eggs are weighed and enumerated by weight for each tray. Once eggs reach the eyed-stage of development they are monitored daily and picked to remove unfertilized eggs. The number of eyed eggs and hatched eggs are documented.

Hatched alevins are transferred to a trough and are taught to feed with starter feed. Fry are sampled on a weekly basis to monitor growth and adjust feed frequency. Mortalities are collected daily and recorded. By June fish have reached parr stage and are transferred to raceways.

Raceway released fish are PIT and or coded wire tagged. Fish destined for Omak creek are inserted with both CWT and PIT tags. Additional fish for the Similkameen and Okanogan

Rivers are coded wire tagged and ad-clipped, so fish can be identified and used as harvest fish in the Okanogan.

Fish will achieve smolt size by March of the following year and at this time half the fish are taken to the St. Maries Acclimation Pond on Omak Creek and the remainder stay at the hatchery for Okanogan and Similkameen Rivers. Acclimation fish at St. Maries are fed twice a week to achieve size. Random samples of 200 fish are taken weekly to determine growth rates and ensure fish meet size goals prior to release. Morts are picked daily.

To release fish screens are pulled at the outflow of the pond so fish can leave volitionally. Remaining fish on station are crowded, netted, weighed, scanned for Pit tags and loaded into transport trucks and direct released into Omak Creek just downstream of the acclimation pond.

Fish Abundance Surveys

The Okanogan Basin Monitoring and Evaluation Program (OBMEP) conduct snorkel surveys in the mainstem Okanogan and its tributaries to determine fish abundance. Habitat panel sites were determined, adapted from Hillman 2006, to determine fish population size and community structure at various sites in the Okanogan Basin. A random rotating panel design is used consistent with the Environmental Monitoring and Assessment Program (EMAP) adopted from the upper Columbia monitoring and evaluation program (Hillman 2004).

Juvenile Migration

Travel times from Omak Creek to Columbia River dams can be determined by an online database http://www.ptoccentral.org/dbaccess/InStrmDtctn/InStrmDtctn_query.html. Detections are filtered and separated by detection site to determine life history patterns. PIT tags can be used to determine juvenile survival and smolt to adult returns.

Results

Adult Enumeration

Adult enumeration in Omak Creek was facilitated by the operation of a semi-permanent weir, approximately 1.61 km upstream from the confluence of the Okanogan River (rkm 51.5), and a temporary weir located on Bonaparte Creek, approximately 0.03 km upstream from the confluence of the Okanogan River (rkm 1.25). The weirs on Omak Creek and Bonaparte Creek were installed on February 20 and 21, 2010, respectively and operated through July 31, 2010.

A total of 206 steelhead were collected at the Omak Creek weir in 2010. An estimated 165 natural origin steelheads was calculated (Table 1). Hatchery origin of fish in Omak Creek was 19.9 percent (Table 1). Natural origin of fish in Omak Creek was 80.1 percent.
At total of 77 steelheads were collected at Bonaparte Creek in 2010. An estimated 32 natural origin steelhead was calculated (Table 2). Hatchery origin of fish in Bonaparte Creek was 58.4 percent. Natural origin of fish in Bonaparte Creek was 41.6 percent. (Table 2).

Broodstock Collection

Adult steelhead were collected for broodstock between 22 March, 2010 and 7 April, 2010. Broodstock were transported to CBFH for spawning. All steelhead not collected for broodstock were biologically sampled (sex, origin, scale and genetic sampled) and released immediately upstream of the weir.

In 2010 a total of 17 steelhead were collected for broodstock from the Omak Creek and Bonaparte Creek weirs (Table 3). Broodstock collected in Omak and Bonaparte creeks included fourteen natural origins and three hatchery origin steelhead for a natural origin composition of 82.4 percent (Table 3).

Broodstock Sex Ratio

Male to female sex ratio for the brood year 2010 similar to BYs 2004, 2005, and 2009 and represents a departure from the sex ratio observed in BY 2006, 2007 and 2008 (Table 3).

Broodstock Survival

Broodstock survival collected in 2010 was 100 percent. This is consistent with broodstock survivals rates for 2003-2004 and 2006-2009 (Table 4).

Spawning and Early Rearing

A total of 39,539 green eggs were taken for the 2010 BY, resulting in 36,174 eyed-eggs and 33,748 fry (Table 5). Green egg -to-eyed egg survival and eyed egg- to- fry survival was 91.5% and 93.3%, respectively (Table 5).

Monthly survival for juvenile steelhead reared at CBFH ranged from a low of 99.0% in December 2010 to a high of 99.9% in July 2010 (Table 6). May-December 2010 cumulative survival was 96.5% (Table 6). A lone fish health issue was identified in a fish health exam conducted on December 3, 2010, indicated the presence of external bacterial cold-water disease. Treatments began on December 4, 2010 (Potassium Permanganate for 3 consecutive days for a 1-hour drip @ 1 ppm) and again on December 14, 20 and 27 (1 hour drip treatment at 1.0 ppm). Mortalities dropped sharply after the initial 3-day treatment to 35-37 mortalities per week through December 2010.

Brood Year 2010 juveniles were code-wire tagged (100%) and PIT tagged (19,898 fish) at CBFH (Table 5). Average length weight and Co-Variance (CV) varied between the months of June and December 2010. Average length (mm), weight (g) and length CV were 32.2; 0.23; 6.3 and 151.6; 34.2; 12.9, respectively (Table 7).

BY 2009 Rearing and Release

Juveniles were reared at CBFH (January – late March) on 100% ground water. An estimated 11,868 juveniles, including 8,267 PIT tagged fish and 3,601 CWT only, were transferred to St. Maries Acclimation Pond on 27 March, 2010. Fish on station at the CBFH included 8,323 PIT tagged and 3,608 CWT only fish for a total of 11,931 (Table 8).

Monthly survival and cumulative survival were high at the CBFH (Table 8). A combined survival for acclimated and direct plant groups is reported (Table 5). An average fork length of 180 mm was reported at release (Table 9).

An estimated 23,618 juvenile steelhead were released in to Omak Creek during the month of April 2010 (Table 10). Fish acclimated at St. Maries Acclimation Pond volitionally emigrated from the pond between April 16 and April 23, 2010. Juvenile steelheads reared at CBFH were direct released into Omak Creek immediately downstream from the St. Maries Acclimation Pond between April 23 and April 27, 2010.

Juvenile Collection

A five foot rotary screw trap was installed in Omak Creek on March 22, 2010 and removed on June 30, 2010. Trap operation was sporadic throughout the trap period due to high flows.

In 2010, a total of 3,252 juvenile O. mykiss were trapped at the Omak Creek rotary screw trap. This included 297 natural origin juveniles (Table 11). Non-target species included bridge lip sucker (BLS) mountain whitefish (MWF) and eastern brook trout (EBT) (Table 11).

Due to the sporadic trap operation in 2010 trap efficiency trials were limited and subsequent expansions, to provide total estimated natural origin O. mykiss with a high confidence was not possible.

Juvenile Abundance Estimates

In mid-August – early October, 2010, the Colville Tribe's Fish and Wildlife staff conducted snorkel surveys in 22 water bodies of the Okanogan River Basin (11 in the United States (US) and 11 British Columbia (BC). Included in the surveys were 47 of 51 EMAP sites in the Okanogan Basin.

Twenty-one species of fish were observed in this survey (Table 12). Most abundant species observed was O. mykiss (N= 2,622) and only 0.4 percent were greater than 300 mm (Miller et al. 2011). The highest densities of juvenile O. mykiss were in Mclean Creek in BC (9,450 fish/ha.) followed by Tonasket Creek in the US (9,017 fish/ha.) (Table 12). Salmon Creek averaged 2,384 fish/ha. (Table 12). Omak Creek averaged 838 fish/ha. (Table 12).

Smolt to Adult Return

Locally adapted smolts are stocked in Omak Creek. Prior to 2007, all fish were stocked above Mission Falls in Omak Creek near Stapaloop Creek. Smolt to adult returns indicates a poor juvenile survival for those years fish were stocked above Mission Falls (Table 13). Adult returns for 2010 were estimated to be 0.56 percent to Wells Dam. Return rates for 2010 are assumed higher due to stocking below Mission Falls over the last three years.

References

Arterburn, John. 2007. Okanogan Basin Monitoring and Evaluation Program Field Manual; Redd Survey Methodology. Colville Confederated Tribes.

Arterburn, John. 2007. Okanogan Basin Monitoring and Evaluation Program Field Manual; Snorkel Survey Methodology. Colville Confederated Tribes.

Colville Confederated Tribes. 2010. Hatchery and Genetic Monitoring Plan.

Dasher, Rhonda. 2007, revised 2011.Colville Confederated Tribes, Sampling Protocol for Adult and Juvenile Steelhead on Omak Creek.

Hatchery Scientific Review Group. Report to Congress on Columbia River.

Basin Hatchery Reform. 2009. www.hatcheryreform.us

Miller, Brian, Panther, J., Arterburn, J.. 2010. Confederated Tribes of the Colville Reservation, 2010 Okanogan Basin Steelhead Escapement and Spawning Distribution.

Moran, Lawrence. 1993. Random Genetic Drift.

Narum, Shawn, R., Boe, S., Morgan, P., Powell, M. 2006. Small-Scale Genetic Structure and Variation in Steelhead of the Grande Ronde, Oregon, USA, Transactions of the American Fisheries Society 135:979-986.

National Oceanic and AtmosphericAdministration. 2006. 50CFR Parts 223 and 224, Federal Register Volume 71, No. 3.

Pearsons, Todd. 2009. Monitoring and Evaluation Plan for Grant PUD's Salmon and Steelhead Supplementation Programs.

Priest Rapids Salmon and Steelhead Settlement Agreement, FERC Project 2114, 12/13/2005 Quantitative Consultants, 2010 Subbasin Integrated Status and Effectiveness Monitoring Project

(ISEMP). 2009. Remote PIT Tagging Protocol.

Rayton, Michael. 2006. Okanogan Basin Monitoring and Evaluation Program; Rotary Screw trap Protocols. Colville Confederated Tribes.

Suzuki, D.T., Griffiths, A.J.F., Miller, J.H. and Lewontin, R.C.. 1989. An Introduction to Genetic

Analysis 4th ed. W.H. Freeman Pp.704.

Appendix A-Tables

Table 1: Omak Creek adult steelhead enumeration by origin and year (2003-2010).

Watershed									
Okanogan River		Hatchery				Natural			
	Year	Male	Female	Total	%Hat.	Male	Female	Total	%Wild
Omak Creek									
	2004	63	33	96	90.6	8	2	10	9.4
	2005	83	62	145	98.0	0	3	3	2.0
	2006	21	76	97	92.4	2	6	8	7.6
	2007	39	15	54	69.2	15	9	24	30.8
	2008	39	15	54	69.2	15	9	24	30.8
	2009	22	9	31	66.0	12	4	16	34.0
	2010	25	16	41	19.9	111	54	165	80.1

Table 2: Bonaparte Creek adult steelhead enumeration by origin and year (2006-2010).

Watershed									
Okanogan River		Hatchery				Natural			
	Year	Male	Female	Total	%Hat.	Male	Female	Total	%Wild
Bonaparte Creek									
	2006	10	0	10	83.3	2	0	2	16.7
	2007	140	0	140	85.9	23	0	23	14.1
	2008	13	0	13	50.0	13	0	13	50.0
	2009	16	8	24	72.7	6	3	9	27.3
	2010	45	0	45	58.4	32	0	32	41.6

Table 3: Steelhead broodstock collection summary for Omak creek and Bonaparte creek between the years of 2003 and 2010.

Watershed		Hat.	Wild	Total	%Hat.	%Wild	M:F Ratio
Okanogan River	Year	M:F	M:F	All	M:F	M:F	All
Omak Creek							
	2003	NA	NA	4	33.3	75.0	NA
	2004	4:7	4:1	16	68.8	31.3	1:1
	2005	NA	NA	19	85.2	15.8	1.11:1.0
	2006	NA	NA	11	72.7	27.3	0.27:1.0
	2007	0:7	4:1	12	58.3	41.7	0.50:1.0
	2008	1:0	3:4	8	8.3*	91.7*	2.0:1.0*
	2009	1:1	3:3	8	31.3*	68.8*	1.0:1.0*
	2010	1:1	7:7	16	17.6*	82.4*	1.0:1.0*
Bonaparte Creek							
	2008	0:0	2:2	4			
	2009	1:2	3:2	8			
	2010	1:0	0:0	1			

***** Bonaparte Creek brood stock was added to the locally adapted steelhead collection.

Table 4: Cassimer Bar Fish Hatchery broodstock collection and survival between the years of 2003 and 2010.

Watershed	Year	Collected	Spawned	% Survival
Okanogan River				
	2003	4	4	100
	2004	16	16	100
	2005	19	15	78.9
	2006	11	11	100
	2007	12	12	100
	2008	12	12	100
	2009	16	16	100
	2010	17	17	100

Table 5: Okanogan Basin Locally-adapted steelhead hatchery egg-take, fecundity and life stage survival between the years of 2004-2010.

Watershed Okanogan River	Year	Number Females	Total Green Eggs	Eggs/ Female	Total Eyed	Grn/Eyed Survival Percent	Total Fry	Eyed-Egg/Fry Survival	Total Released (smolt)	Fry/release Survival Percent	Grn/release Survival Percent
	2004	8	31,414	3927	24,260	77.2	21,500	88.6	13,232	61.5	42.1
	2005	9	32,038	3,560	25,206	78.7	21,452	85.1	19,862	92.6	62.0
	2006	8	36,345	4,543	33,221	91.4	30,895	93.0	27,219	88.1	74.9
	2007	8	43,327	5,416	42,439	98.0	41,447	97.7	32,915	79.4	76.0
	2008	4	19,868	4,967	17,938	90.3	16,771	93.5	15,505	92.5	78.0
	2009	8	33,112	4,139	31,815	96.1	30,505	95.9	23,618	78.0	71.9
	2010	8	39,539	4,942	36,174	91.5	33,748	93.3	32,333	95.8	81.8

Table 6: Monthly cumulative survival for BY 2010 UCR summer steelhead reared at Cassimer Bar FH, May-January 2010.

Watershed Okanogan River	Month	Start	Morts	Percent Survival	Total % Survival
	May	33,748	218	99.4	99.4
	June	33,530	85	99.8	99.2
	July	33,445	33	99.9	99.1
	August	33,412	81	99.8	98.8
	September	33,331	117	99.7	98.5
	October	33,214	171	99.4	97.9
	November	33,043	140	99.6	97.5
	December	32,903	324	99.0	96.5
	January	32,579	NA	NA	NA

Table 7: Average weight (g), length (mm) and CV of BY 2010 UCR summer steelhead reared at Cassimer Bar FH, May-December 2010.

Watershed		Start Month			End Month		
Okanogan River	Month	Avg. Wt. (g)	Avg. Length (mm)	CV Length	Avg. Wt. (g)	Avg. Length (mm)	CV Length
	May	NA	NA	NA	32.2	0.23	6.3
	June	32.2	0.23	6.3	48.8	1.17	8.3
	July	48.8	1.17	8.3	65.8	2.8	9.2
	August	65.8	2.8	9.2	83.3	6.3	10.4
	September	83.3	6.3	10.4	103.1	10.2	11.5
	October	103.1	10.2	11.5	115.3	16.4	12.9
	November	115.3	16.4	12.9	NA	NA	NA
	December	NA	NA	NA	151.6	34.2	12.9

Table 8: Monthly and Cumulative survival for BY 2009 UCR summer steelhead reared at Cassimer Bar FH, January-April 2010.

Watershed	Month	Start	End	Morts	Percent Survival	Total % Survival
Okanogan River						
	January	24068	23994	74	99.7	99.7
	February	23994	23907	87	99.6	99.3
	March	23907	23779	128	99.5	98.8
	April	23779	23618	161	99.3	98.1

Note: Total April mortality for Cassimer Bar and St. Maries acclimation pond are combined (72 and 89 fish, respectively).

Table 9: Average length (mm), weight (g) and CV for length of BY 2009 summer steelhead reared at Cassimer Bar FH and St. Maries Acclimation Pond, January-April 2010.

Watershed		Start Month			End Month		
Okanogan River	Month	Avg. Wt. (g)	Avg. Length (mm)	CV Length	Avg. Wt. (g)	Avg. Length (mm)	CV Length
	January	NA	NA	NA	137.1	28.1	17.0
	February	137.1	28.1	17.0	162.9	45.1	15.1
	March	162.9	45.1	15.1	170.2	53.8	11.0
	April[1]	170.2	53.8	11.0	180.0	65.0	18.5
	April[2]	170.2	53.8	11.0	179.0	68.0	22.9

Table 10: Summary of fish collected at the Rotary Screw Trap in Omak Creek between the years of 2006 and 2010. STHH = O. mykiss Hatchery, STHW = O. mykiss Wild, CHN = Chinook, WF = Mountian Whitefish, BLS = Bridgelip sucker.

Watershed		O. mykiss			Non-target species									
Okanogan River	Year	STHH	STHW	Total	CHN	WF	BLS	EBT	NPM	Other	Total	Start	End	# Days
Omak Creek														
	2006	457	85	542	3,103	0	0	0	0	0	3,103	5/1/06	6/2/06	32
	2007	2,393	2,213	4,606	15	2	107	19	1	7	151	4/4/07	5/22/07	48
	2008	178	5,012	5,190	2,031	15	387	13	5	64	2,515	4/14/08	5/24/08	40
	2009	2,385	1,056	3,441	6	0	76	7	2	3	94	4/21/09	5/18/09	27
	2010	2,955	297	3,252	8	0	30	9	0	11	58	4/15/10	6/30/10	67

Table 11: Numbers of observed juvenile O. mykiss and observed density (fish/ha.) for snorkel surveys in the Okanogan Basin August- October 2010 (Miller et al. 2011).

Watershed Okanogan	Site	Total	Density (Fish/ha.)
United States			
	Antoine Creek	0	0
	Bonaparte Creek	179	5,761
	Loup Loup Creek	6	201
	Ninemile Creek	0[1]	0
	Okanogan River	20[2]	0.5
	Omak Creek	349[2]	838
	Salmon Creek	878[2]	2,384
	Similkameen River	79[2]	12
	Siwash Creek	0	0
	Tonasket Creek	199	9,017
	Tunk Creek	83	2,315
Canada			
	Ellis Creek	0	0
	Haynes Creek	0	0
	Inkaneep Creek	226	3,433
	McLean Creek	323	9,540
	Okanogan River	25[2]	3.7
	Park Hill Creek	4	3
	Reed Creek	0	0
	Shingle Creek	64	682
	Shuttleworth Creek	5	102
	Testalinden Creek	0	0
	Vaseux Creek	536	2,325

[1]Most of Ninemile creek was not surveyed due to hazardous conditions (Poison Ivy).
[2]Average of all snorkel estimates taken for these reaches assessments.

Table 12: Survival rates on hatchery origin steelhead for Omak creek years 2005-2010 based on juvenile PIT detection at Columbia River Dams. Total number released by year and mortality. Number of STH detected outside of the Okanagan basin at hydroelectric dames by site. Bonneville Dam Juvenile bypass (B2J), John Day Juvenile (JDJ), McNary Dam (MCJ), Rocky Reach Dam (RRJ).

Watershed	Year Released	Total Released	Mortality	Hatchery Origin		
Okanogan River				Site	Detected	Survival
Omak Creek						
	2005	17501	1023	B2J	68	0.39
				JDJ	573	3.27
				MCJ	952	5.44
				Total	**1593**	**9.10**
	2006	N/A	N/A		N/A	N/A
	2007	18034	1454	B2J	47	0.26
				JDJ	413	2.29
				MCJ	893	4.95
				Total	**1307**	**7.25**
	2008	6887	73	B2J	7	0.10
				JDJ	19	0.28
				MCJ	22	0.32
				RRJ	4	0.06
				Total	**45**	**0.65**
	2009	12256	989	B2J	42	0.34
				JDJ	254	2.07
				MCJ	176	1.44
				RRJ	17	0.14
				Total	**447**	**3.65**
	2010	12155	1492	B2J	265	2.18
				JDJ	244	2.01
				MCJ	357	2.94
				RRJ	4519	37.18
			Total	**5120**	**42.12**	

Table 13. Smolt to adult returns (SAR) and Hatchery Return Rate of Omak Creek locally-adapted steelhead back to Wells Dam for 2004 - 2010. Passive integrated transponder (PIT) detections were not corrected for tag loss, residuals or stray rate.

Release Year (RY)	Number of Broodstock (RY-1)	PIT smolts released	Adult Detections at Wells Dam	SAR (%)	#smolts per adult	HRR
2004	4	13,232	22	0.17%	3308	5.5
2005	16	19,862	7	0.04%	1241	0.4
2006	15	19,772	0	0.00%	1318	0.0
2007	11	6,753	15	0.22%	614	1.4
2008	12	13,665	0	0.00%	1139	0.0
2009	8	14,482	8	0.06%	1810	1.0
2010	8	19,898	112	0.56%	2487	14.0