

Wind River Watershed Restoration

U.S. Geological Survey Annual Report

April 2006 to March 2007

by:

Patrick J. Connolly, Lead Research Fish Biologist,
Ian G. Jezorek, Fishery Biologist,
and
Carrie S. Munz, Fishery Biologist

U.S. Geological Survey
Western Fisheries Research Center
Columbia River Research Laboratory
Cook, WA 98605

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Introduction

This report summarizes work completed by U.S. Geological Survey's Columbia River Research Laboratory (USGS-CRRL) in the Wind River subbasin during the period April 2006 through March 2007 under Bonneville Power Administration (BPA) contract 26922. During this period, we collected temperature, flow, and habitat data to characterize physical habitat condition and variation within and among tributaries and mainstem sections in the Wind River subbasin. We also conducted electrofishing and snorkeling surveys to determine juvenile salmonid populations within select study areas throughout the subbasin. Portions of this work were completed with additional funding from U.S. Fish and Wildlife Service (USFWS) and the Lower Columbia Fish Enhancement Group (LCFEG). Funding from USFWS was for work to contribute to a study of potential interactions between introduced Chinook salmon *Oncorhynchus tshawytscha* and wild steelhead *O. mykiss*. Funding from LCFEG was for work to evaluate the effects of nutrient enrichment in small streams.

A statement of work (SOW) was submitted to BPA in March 2006 that outlined work to be performed by USGS-CRRL. The SOW was organized by work elements, with each describing a research task. This report summarizes the progress completed under each work element.

Work elements

A: 165. Produce Environmental Compliance Documentation

Title: Obtain fish sampling permits

Description: Submit applications for permits and supply annual collection reports to permitting agency.

Federal and state permits were obtained for 2006 sampling, and all collection reports were submitted to National Oceanic and Atmospheric Agency, National Marine Fisheries Service and to Washington Department of Fish and Wildlife.

B: 158. Mark/Tag Animals

Title: PIT tag steelhead and Chinook parr and brook trout

Description: About 3,000 juvenile steelhead and other salmonids collected during population assessments will be PIT tagged.

During 2006, we PIT tagged 1,431 juvenile steelhead *Oncorhynchus mykiss* (FL 70-mm or longer) through instream electrofishing efforts in the Wind River subbasin (Table 1). In the mainstem Wind River above rkm 24.0, we tagged 51 juvenile Chinook *O. tshawytscha* (FL 65-mm or longer). In the Little Wind River, we tagged 3 juvenile Chinook and 47 juvenile coho salmon (FL 65-mm or longer). All PIT tagging followed the procedures and guidelines outlined by Columbia Basin Fish and Wildlife Authority (1999).

We also tagged steelhead parr at the four smolt traps operated by WDFW in the Wind River subbasin (Table 2). The smolt traps were operated from early May 2006 through June 2006. During this time, we tagged 1,293 parr collected in the smolt traps.

C: 157. Collect/Generate/Validate Field and Lab Data

Title: Assess fish populations in selected streams

Description: Assess population growth, abundance, density, and other life-history characteristics for juvenile steelhead and other salmonids in selected stream sections.

During summer 2006, CRRL personnel conducted pass-removal or mark/recapture electrofishing on four stream sections to estimate populations of juvenile steelhead/rainbow trout, hereafter referred to as steelhead, and Chinook salmon (Tables 3 and 4), and to assess population abundance and density. For pass-removal electrofishing estimates, habitat units were divided into strata (e.g., pools, glides, riffles, and side channels) and a systematic sample were shocked. Two or more electrofishing passes were made following removal-depletion methodology (Zippin 1956; Bohlin et al. 1982; White et al. 1982). The field guides of Connolly (1996) were used to determine the number of passes necessary to insure a controlled level of

precision in the population estimate ($CV < 25\%$ for age-0 salmonids and $CV < 12.5\%$ for age-1 or older salmonids) was achieved within each sampling unit for each species and age group. These methods were chosen to minimize the number of units sampled and the number of passes per unit.

At all sites, juvenile steelhead were tagged with passive integrated transponder (PIT) tags, which uniquely identify individuals, enabling growth and life-history data to be collected. These four sites (Martha Creek control and treatment, and Cedar Creek control and treatment) were done in concert with research funded by Lower Columbia Fish Enhancement Group to evaluate nutrient addition using carcass analogs. Population data from these efforts will be compared with past values and related to adult and smolt data collected by WDFW.

Additional electrofishing occurred throughout spring, summer, and fall to recapture PIT-tagged fish and record growth and movement data. Electrofishing and PIT tagging was also conducted in the Little Wind River, though population electrofishing was not done. We electrofished during August and September at five sites in the mainstem of the Wind River between river kilometer (rkm) 24.0 and 37.5, to PIT tag juvenile steelhead and juvenile Chinook salmon. This work was partially funded through the USFWS to investigate interactions between wild steelhead and wild spawned hatchery-origin Chinook salmon, but these data will contribute to our database of growth and life-histories of steelhead and Chinook salmon from the Wind River.

We snorkeled the mainstem Wind River between rkm 24.0 and 40.5 to estimate populations of juvenile steelhead and Chinook salmon (Tables 3 and 4). We performed a stratified-systematic survey following the first phase methodology of the basinwide visual estimation technique (Hankin and Reeves 1988; Dolloff et al. 1993), where we measured all habit units within a stream section but snorkeled a subsample of units within each strata (pools, glides, riffles, and side channels). We counted age-0 and age-1 or older steelhead and Chinook salmon. The reach from rkm 35.3 to 40.5 was snorkeled each year since 2000, the reach from rkm 26.0 to rkm 30.0 was snorkeled since 2004, and the reach from rkm 24.0 to 26.0 was snorkeled in 2005 and 2006. Population estimates for each reach were generated by expanding

direct-snorkeler counts (Tables 5 and 6). We also snorkeled three 100-m sites in Trout Creek (Table 7), two of which have been sampled each year since 1998, one since 1999. Data from both the mainstem Wind and Trout Creek will contribute to long term monitoring and limiting factors analysis.

D: 162. Analyze/Interpret Data

Title: Analyze and interpret data

Description: Data from Work Elements A-D will be integrated with data from past years (1998-2005) in multiple analyses in support of producing journal articles and presentations at professional meetings.

All data from 2006 have been entered into electronic format, proofed, and added to appropriate databases for integration and analysis. We have begun analysis and writing on several topics for the planned Technical Report. As discussed with the COTR, the report will contain two chapters on the following subjects:

- 1) Ecological interactions between hatchery and wild fish in the Wind River, WA
- 2) Bioenergetics modeling to assess the energetic cost of Hemlock Dam on the growth potential of juvenile steelhead.

E: 159. Submit/Acquire Data

Title: Submit PIT-tag data to PTAGIS database

Description: Submittal of PIT-tag data to the regional PTAGIS database maintained by PSMFC.

All PIT-tagging and recapture data were entered, proofed, and submitted to the PTAGIS database.

F: 157. Collect/Generate/Validate Field and Lab Data

Title: Describe physical habitat conditions

Description: Thermal, flow, and habitat conditions will be surveyed in select stream sections based on where fish assessment work is conducted.

During 2006, we maintained thermographs at 32 sites in the Wind River subbasin (Table 8). These thermographs were in the stream all year and were downloaded during both spring and fall. An additional nine thermographs were deployed by Underwood Conservation District (Table 9). Data from these were incorporated in the USGS database of stream temperatures in the Wind River subbasin. Mean, minimum, and maximum temperatures during July, August, and September at each site are presented in Table 10.

Flow measurements were taken at eight locations throughout the subbasin (Table 11). We measured flow at each site about every two weeks from June through October to record base flow.

G: 99. Outreach and Education

Title: Meetings for coordination and presentations to public

Description: Participate in Watershed Council meetings, serve on its Technical Committee, and present findings to public and scientific groups.

Technical Advisory Committee meetings were attended by USGS personnel, and most of the Watershed Council meetings were attended by USGS personnel.

H: 132. Produce (Annual) Progress Report

Title: Annual Report: 2004-05

Description: Provide 2004-05 Annual Report summarizing fish assessment work conducted in 2004 and 2005.

The Annual Report for 2004 to 2005 has been submitted to BPA.

I: 119. Manage and Administer Projects

Title: Submit next year's SOW, Budget, and Property Inventory

Description:

Documents for FY2007 were submitted and accepted.

J: 141. Produce Pisces Status Report

Title: Periodic Status Reports for BPA

Description: Submit a quarterly status report to BPA via Pisces, indicating the status of each milestone.

Status reports were submitted via PISCES for 2006 activities.

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Table 1. Total number of juvenile steelhead/rainbow trout that were captured and PIT tagged in the Wind River subbasin from 1999 to 2006. Watersheds and streams are listed in an upstream to downstream pattern within a watershed.

Watershed	Number of PIT tags deployed ^a								
	Stream reach or section	1999	2000	2001	2002	2003	2004	2005	2006
Upper Wind River									
	Wind River – ab. Paradise Cr.	0	36	15	119	43	0	0	0
	Paradise Creek	68	85	17	49	129	15	0	0
	Wind River - mining reach	59	61	36	0	115	0	0	93
	Ninemile	0	0	0	123	0	0	0	0
	Dry Creek – lower	44	115	142	220	170	7	0	0
	Trapper Creek	0	101	30	132	0	0	440	112
	Subtotal	171	398	240	644	457	22	440	205
Trout Creek									
	Trout Creek – upper	0	0	14	0	0	0	0	7
	Crater Creek – lower	27	24	49	88	135	3	51	25
	Trout Creek – 33 bridge	18	26	18	50	52	0	15	46
	Compass Creek – lower	0	0	71	4	99	15	0	51
	East Fork Trout Creek – lower	0	0	7	0	0	0	17	0
	Layout Creek – upper	0	0	127	5	133	25	0	0
	Layout Creek - lower	69	89	36	126	67	0	4	0
	Trout Creek – 43 bridge	0	46	116	49	132	0	25	0
	Trout Creek mainstem – ab, PCT	---	---	---	---	---	21	0	0
	Trout Creek mainstem – bl. PCT	---	---	---	---	---	18	0	0
	Trout Creek mainstem – ab. Hemlock lake	---	---	---	---	---	137	0	0
	Trout Creek mainstem – fish weir ^b	---	---	---	---	---	426	0	0
	Trout Creek mainstem – in Hemlock lake ^c	---	---	---	---	---	75	0	0
	Trout Creek mainstem – bl. Hemlock lake	---	---	---	---	---	80	0	0
	Planting Creek - lower	0	0	90	4	58	3	0	0
	Martha Creek – upper	---	---	---	---	---	310	251	221
	Martha Creek – lower	0	114	0	88	121	389	173	201
	Subtotal	114	299	528	420	797	1,502	536	551

Continued.

Table 1. Continued.

Watershed Stream reach or section	Number of PIT tags deployed ^a							
	1999	2000	2001	2002	2003	2004	2005	2006
Wind River								
Wind River – ab. Smolt trap	---	---	---	---	---	28	74	74
Wind River – bl. Smolt trap	---	---	---	---	---	5	0	0
Wind River – ab. Beaver campground	---	---	---	---	---	393	53	73
Wind River – bl. Beaver campground	---	---	---	---	---	17	91	96
Wind River - canyon	0	0	12	0	0	0	0	0
Subtotal	0	0	12	0	0	443	218	243
Panther Creek								
Mouse Creek	0	0	0	0	74	0	0	0
Upper Panther	0	0	0	0	1	0	0	0
Eightmile Creek - upper	0	0	23	2	0	0	193	29
Eightmile Creek - lower	0	0	20	6	84	27	142	16
Cedar Creek – upper	--	--	--	--	--	340	321	110
Cedar Creek – lower	0	0	0	0	111	327	394	154
Subtotal	0	0	43	8	271	694	1050	309
Little Wind								
	--	--	--	--	--	--	82	115
Total	285	697	823	1,072	1,525	2,661	2,326	1,431

^a 400 kHz tags used 1999-2003. 134 kHz tags used in 2004 and 2005.

^b Fish weir operated in lower Trout Creek, just above Hemlock from 7/20/04 to 8/24/04.

^c These fish were captured by hook and line.

Table 2. Number of steelhead/rainbow trout parr PIT tagged at each of four smolt traps within the Wind River subbasin during April through July 2000 to 2006. Readings are from a hand-held Global Positioning System (GPS) using North American Datum 1927. Steelhead parr 70 mm or larger were tagged seven days each week throughout the period listed.

Smolt Trap	GPS Reading		2006 Tagging dates; (Number of tagging days)	Number of 134.2 kHz PIT tags deployed						
	North	West		2000	2001	2002	2003	2004	2005	2006
Upper Wind	45° 52.501'	121° 58.629'	2 May 2006 to 3 July 2006 (28)	547	290	316	626	569	752	760
Trout Creek	45° 48.241'	121° 56.330'	2 May 2006 to 9 June 2006 (18)	125	19	317	210	498	93	100
Panther Creek	RNO ^a		2 May 2006 to 3 July 2006 (28)	92	26	312	322	515	425	433
Lower Wind	RNT ^b			0	0	0	50	7	0	0
Total				764	335	945	1,208	1,589	1,270	1,293

^a RNO = Reading not obtainable by GPS because of basin topography.

^b RNT = Reading not taken.

Table 3. Surveys conducted from 1997 to 2001 by the USGS-CRRL using snorkeling or the removal method with electrofishing within the Wind River subbasin. Sites are listed from upstream to downstream within a watershed relative to the mainstem.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of section (km)	Year electrofished ^a (Yes/No)					Year snorkeled (Yes/No)				
			1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Upper Wind												
Wind R. – ab. Paradise Cr.	40.0	3.8	N	N	N	Y	N	N	N	N	Y	N
Paradise Cr. – lower ^b	0 (at mouth)	0.5	N	N	Y	Y	N	N	Y	N	N	N
Paradise Cr. – middle	1.3	0.8	N	N	N	N	N	N	N	N	Y	N
Paradise Cr. – upper	2.6	0.7	N	N	N	N	N	N	N	N	Y	N
Wind R. – mining reach	35.4	4.6	N	N	N	N	N	N	N	N	Y	Y
Falls Cr. – lower	0 (at mouth)	0.8	N	N	N	N	N	N	N	N	Y	N
Falls Cr. – upper	1.6	0.5	N	N	N	N	N	N	N	N	Y	N
Wind R. – (Trapper-Falls Cr.)	30.0	5.4	N	N	N	N	N	N	N	N	Y	N
Ninemile Cr.	1.5	0.8	N	N	N	N	N	N	N	N	Y	N
Dry Cr. – lower	3.4	0.5	N	N	N	Y	Y	N	N	N	N	N
Dry Cr. – middle	4.5	0.7	N	N	N	N	N	N	N	N	Y	Y
Dry Cr. – upper	5.9	0.6	N	N	N	N	N	N	N	N	Y	N
Big Hollow Cr. ^b	0 (at mouth)	0.5	N	Y	N	N	N	N	N	N	N	N
Trapper Cr. – lower	0 (at mouth)	1.0	N	N	N	N	N	N	Y	N	Y	N
Trapper Cr. – middle1	2.9	0.6	N	N	N	Y	N	N	N	N	N	N
Trapper Cr. – middle2	3.7	0.8	N	N	N	N	N	N	N	N	Y	N
Trapper Cr. – upper	4.8	0.6	N	N	N	N	N	N	N	N	Y	N

Continued.

Table 3. Continued.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of section (km)	Year electrofished ^a (Yes/No)					Year snorkeled (Yes/No)				
			1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Trout Creek												
Trout Cr. – upper	0 (at mouth)	0.5	Y	N	N	N	Y	N	N	N	N	N
Trout Cr. – Reach 7	14.0	1.0	N	N	N	N	N	N	N	N	N	Y
Crater Cr. – middle	0.5	0.5	N	N	N	N	Y	N	N	N	N	Y
Crater Cr. ^b	0 (at mouth)	0.5	Y	Y	Y	Y	N	N	N	N	Y	N
Trout Cr. – Reach 6	12.5	2.9	N	N	N	N	N	N	N	Y	N	Y
Trout Cr. – 33 bridge ^b	14.0	0.1	Y	Y	Y	Y	Y	N	N	N	N	N
Compass Cr. ^b	0 (at mouth)	0.5	N	N	N	N	Y	N	N	N	N	N
East Fork Trout Cr.	0 (at mouth)	0.4	N	N	N	N	Y	N	N	N	N	N
Layout Cr. – upper	2.3	0.5	N	N	N	N	Y	N	N	N	N	N
Layout Cr.	0 (at mouth)	1.0	N	N	Y	N	Y	N	N	N	Y	N
Trout Cr. – 43 bridge	11.0	0.1	N	Y	N	Y	Y	N	N	N	Y	Y
Trout Cr. – Reach 5	9.4	3.5	N	N	N	N	N	N	N	N	N	Y
Planting Cr. ^b	0 (at mouth)	0.5	Y	N	N	N	Y	N	N	N	N	N
Trout Cr. – at Planting Cr.	9.7	0.1	N	N	N	N	N	N	Y	Y	Y	Y
Trout Cr. – Reach 4	7.3	2.8	N	N	N	N	N	N	N	N	N	Y
Trout Cr. – Canyon	9.0	0.1	N	N	N	N	N	N	N	Y	Y	Y
Trout Cr. – PCT Bridge	8.0	0.1	N	N	N	N	N	N	Y	Y	Y	Y
Trout Cr. – Reach 3	6.7	0.6	N	N	N	N	N	N	N	N	N	Y
Trout Cr. – Reach 2	5.7	1.0	N	N	N	N	N	N	N	N	N	Y
Trout Cr. – bl. Smolt Trap	6.0	0.1	N	N	N	N	N	N	Y	Y	Y	Y
Trout Cr. – All Reaches	5.7	12.1	N	N	N	N	N	N	N	N	N	Y
Martha Cr. ^b	0.9	0.4	Y	Y	N	N	N	N	N	N	N	N

Continued.

Table 3. Continued.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of section (km)	Year electrofished ^a (Yes/No)					Year snorkeled (Yes/No)				
			1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Panther Creek												
Mouse Cr. ^b	0 (at mouth)	0.5	N	N	N	N	N	N	N	N	N	N
Eightmile Cr. – upper	0.7	0.5	N	Y	N	N	N	N	N	N	N	N
Eightmile Cr. – lower	0 (at mouth)	0.6	Y	Y	N	N	N	N	N	N	N	N
Cedar Cr.	1.0	0.6	N	N	N	N	N	N	N	N	N	N

^a Electrofishing sampling conducted during August through mid-October – except Dry Creek in 2001.

^b Locations sampled in 1984 by Crawford et al. (1985).

Table 4. Surveys conducted from 2002 to 2006 by the USGS-CRRL using snorkeling, or the removal or mark/recapture method with electrofishing within the Wind River subbasin. Sites are listed from upstream to downstream within a watershed relative to the mainstem.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of section (km)	Year electrofished ^a (Yes/No)					Year snorkeled (Yes/No)					
			2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	
Upper Wind													
Wind R. – ab. Paradise Cr.	40.0	3.8	Y	N	N	N	N	N	N	N	Y	Y	Y
Paradise Cr. – lowerb	0 (at mouth)	0.5	Y	Y	N	N	N	N	Y	N	N	N	N
Paradise Cr. – middle	1.3	0.8	N	N	N	N	N	N	Y	N	N	N	N
Paradise Cr. – upper	2.6	0.7	N	N	N	N	N	N	Y	N	N	N	N
Wind R – mining reach	35.4	4.6	N	N	N	N	N	N	Y	Y	Y	Y	Y
Falls Cr. – lower	0 (at mouth)	0.8	N	N	N	N	N	N	Y	N	N	N	N
Falls Cr. – upper	1.6	0.5	N	N	N	N	N	N	Y	N	N	N	N
Wind R – (Trapper-Falls Cr.)	30.0	5.4	N	N	N	N	N	N	Y	N	Y	Y	Y
Ninemile Cr.	1.5	0.8	Y	N	N	N	N	N	N	N	N	N	N
Dry Cr. – lower	3.4	0.5	Y	Y	N	N	N	N	N	N	N	N	N
Dry Cr. – middle	4.5	0.7	N	N	N	N	N	N	Y	N	N	N	N
Dry Cr. – upper	5.9	0.6	N	N	N	N	N	N	Y	N	N	N	N
Big Hollow Cr.b	0 (at mouth)	0.5	N	N	N	N	N	N	N	N	N	N	N
Trapper Cr. – lower	0 (at mouth)	1.0	N	N	N	N	N	N	Y	N	N	N	N
Trapper Cr. – middle1	2.9	0.6	Y	N	N	Y	N	N	N	N	N	N	N
Trapper Cr. – middle2	3.7	0.8	N	N	N	Y	N	N	N	N	N	N	N
Trapper Cr. – upper	4.8	0.6	N	N	N	N	N	N	N	N	N	N	N
Wind River – bl. smolt trap	28.0	2.0	N	N	N	N	N	N	N	N	Y	Y	Y
Wind River – ab. Beaver camp	26.0	2.0	N	N	N	N	N	N	N	N	Y	Y	Y
Wind River – bl. Beaver camp	24.0	2.0	N	N	N	N	N	N	N	N	N	Y	Y

Continued.

Table 4. Continued.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of section (km)	Year electrofished ^a (Yes/No)					Year snorkeled (Yes/No)				
			2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
Trout Creek												
Trout Cr. – upper	0 (at mouth)	0.5	N	N	N	N	N	N	N	N	N	N
Trout Cr. – Reach 7	14.0	1.0	N	N	N	N	N	N	N	N	N	N
Crater Cr. – middle	0.5	0.5	N	N	N	N	N	N	N	N	N	N
Crater Cr.b	0 (at mouth)	0.5	Y	Y	N	Y	N	N	N	N	N	N
Trout Cr. – Reach 6	12.5	2.9	N	N	N	N	N	Y	N	N	N	N
Trout Cr. – MS33 bridge ^b	14.0	0.1	Y	Y	N	Y	N	N	N	N	N	N
Compass Cr. ^b	0 (at mouth)	0.5	N	N	N	N	N	N	N	N	N	N
East Fork Trout Cr.	0 (at mouth)	0.4	N	N	N	N	N	N	N	N	N	N
Layout Cr. – upper	2.3	0.5	N	N	N	N	N	N	N	N	N	N
Layout Cr.	0 (at mouth)	1.0	Y	N	N	N	N	N	N	N	N	N
Trout Cr. – MS43 bridge	11.0	0.1	Y	Y	N	Y	N	Y	N	Y	Y	N
Trout Cr. – Reach 5	9.4	3.5	N	N	N	N	N	N	N	N	N	N
Planting Cr.b	0 (at mouth)	0.5	Y	N	N	N	N	N	N	N	N	N
Trout Cr. – at Planting Cr.	9.7	0.1	N	N	N	N	N	Y	Y	Y	Y	N
Trout Cr. – Reach 4	7.3	2.8	N	N	N	N	N	N	N	N	N	N
Trout Cr. – Canyon	9.0	0.1	N	N	N	N	N	Y	Y	Y	Y	Y
Trout Cr. – PCT Bridge	8.0	0.1	N	N	N	N	N	Y	Y	Y	Y	Y
Trout Cr. – Reach 3	6.7	0.6	N	N	N	N	N	N	N	N	N	N
Trout Cr. – Reach 2	2.7	1.0	N	N	N	N	N	N	N	N	N	N
Trout Cr. – bl. Smolt Trap	3.0	0.1	N	N	N	N	N	Y	Y	Y	Y	Y
Trout Cr. – All Reaches	2.7	12.1	N	N	N	N	N	N	N	N	N	N
Martha Cr. – upper	2.0	0.5	N	N	Y	Y	Y	N	N	N	N	N
Martha Cr. ^b - lower	0.9	0.5	N	N	Y	Y	Y	N	N	N	N	N

Continued.

Table 4. Continued.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of section (km)	Year electrofished ^a (Yes/No)					Year snorkeled (Yes/No)				
			2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
Panther Creek												
Mouse Cr. ^b	0 (at mouth)	0.5	N	N	N	N	N	N	N	N	N	N
Eightmile Cr. – upper	0.7	0.5	N	N	N	Y	N	N	N	N	N	N
Eightmile Cr. – lower	0 (at mouth)	0.6	N	N	N	Y	N	N	N	N	N	N
Cedar Cr. – upper	2.0	0.5	N	N	Y	Y	Y	N	N	N	N	N
Cedar Cr. – lower	1.0	0.5	N	N	Y	Y	Y	N	N	N	N	N
Little Wind	0.5	0.5	N	N	N	N	N	N	N	N	N	N

^a Electrofishing sampling conducted during August through mid-October – except Dry Creek in 2001.

^b Locations sampled in 1984 by Crawford et al. (1985).

Table 5. Estimates from expanded snorkeler counts of two age classes of juvenile steelhead (STH) in the upper mainstem Wind River, summer 2006. Sites are listed from upstream to downstream.

Subwatershed Site (rkm)	Code	River kilometers snorkeled		Age-0 STH					Age-1 or older STH				
		Start	End	Total	SE ^a	CV ^b	no./m	no./m ²	Total	SE	CV	no./m	no./m ²
Upper Wind River													
Upper Mine (40.0 to 44.0)	UMIN	40.0	41.0	891	155.9	17.5	1.1775	0.1554	225	50.1	22.3	0.2969	0.0392
Mine reach (35.4 to 40.0)	MINE	35.4	40.0	8,782	818.5	9.3	1.7590	0.2031	2,046	231.0	11.3	0.4100	0.1386
Falls Cr. - Mine reach (35.0 to 35.4)	UWFM	35.0	35.4	-	-	-	-	-	-	-	-	-	-
Trapper Cr. – Falls Cr. (30.0 to 35.0)	UWTF	30.0	35.0	264	76.4	28.8	0.1147	0.0087	87	27.3	31.5	0.0375	0.0028
Beaver Cm. – Trap. Cr. (26.0 to 30.0)	MWBT	26.0	30.0	264	96.9	36.8	0.0653	0.0033	46	29.3	63.5	0.0114	0.0006
below Beaver Cm. (24.6 to 26.0)	MWBB	24.6	26.0	430	47.3	11.0	0.4065	0.0196	172	38.7	22.5	0.1624	0.0078

Table 6. Estimates from expanded snorkeler counts of juvenile Chinook salmon in the upper mainstem Wind River, summer 2006. Sites are listed from upstream to downstream.

Subwatershed Site (rkm)	Code	River kilometers snorkeled		Juvenile Chinook salmon				
		Start	End	Total	SE ^a	CV ^b	no./m	no./m ²
Upper Wind River								
Upper Mine (40.0 to 44.0)	UMIN	40.0	41.0	0	---	---	0.0	0.0
Mine reach (35.4 to 40.0)	MINE	35.4	40.0	0	---	---	0.0	0.0
Falls Cr.-Mine reach (35.4 to 40.0)	MWFM	35.0	35.4	-	-	-	-	-
Trapper Cr. – Falls Cr. (30.0 to 35.0)	MWTF	30.0	35.0	0	---	---	0.0	0.0
Beaver Cmp. – Trap. Cr. (26.0 to 30.0)	MWBT	26.0	30.0	28	18.3	65.4	0.0069	0.0003
below Beaver Cmp. (24.6 to 26.0)	MWBB	24.6	26.0	41	4.3	10.6	0.0383	0.0018

^a SE = standard error.

^b CV = coefficient of variation = (SE/total fish)*100.

Table 7. Estimates from direct snorkel counts of two age classes of juvenile steelhead/rainbow trout (STH/RBT) in five 100-m sites in mainstem Trout Creek, summer 2006. Sites are listed from upstream to downstream.

Subwatershed Site (rkm)	Code	River kilometers snorkeled		Age-0 STH/RBT					Age-1 or older STH/RBT				
		Start	End	Total	SE ^a	CV ^b	no./m	no./m ²	Total	SE	CV	no./m	no./m ²
Trout Creek													
43 Bridge (11.0 to 11.1)	MS43	11.0	11.1	-	--	--	-	-	-	--	--	-	-
Planting Creek (9.0 to 9.1)	PLAN	9.0	9.1	-	--	--	-	-	-	--	--	-	-
Canyon (7.0 to 7.1)	TCAN	7.0	7.1	85	--	--	0.7482	0.0746	143	--	--	1.2588	0.1256
PCT Bridge (5.0 to 5.1)	PCTB	5.0	5.1	114	--	--	1.3685	0.1549	85	--	--	1.0204	0.1155
Smolt Trap (3.0 to 3.1)	LTRT	3.0	3.1	173	--	--	1.4850	0.0179	20	--	--	0.1717	0.0207

^a SE = standard error.

^b CV = coefficient of variation = (SE/total fish)*100.

Table 8. Locations of thermographs that have been maintained by U.S. Geological Survey's Columbia River Research Laboratory. Sites are listed from upstream to downstream within a watershed. Coordinates were obtained from a hand-held Global Positioning System using North American Datum 1927. The word "present" indicates that the thermograph was recording data as of November 2006.

Watershed Subwatershed Subdrainage	Coordinates		Elevation (ft)	Distance upstream from mouth (km)	Date start (mm/yy)	Date end (mm/yy)
	North	West				
Trout Creek						
Trout Cr. – upper	45° 50.798'	122° 01.962'	1,920	15.2	12/96	present
Crater Cr.	45° 50.769'	122° 01.997'	1,920	0.1	12/96	present
Trout Cr. – 33 bridge	45° 50.727'	122° 01.987'	1,900	14.4	12/96	present
Compass Cr.	45° 50.427'	122° 02.051'	1,900	0.2	12/96	present
East Fork Trout Cr.	RNO ^a		1,860	0.2	05/99	present
Trout Cr. – upper OG ^b	45° 49.867'	122° 01.428'	1,835	12.2	11/97	present
Layout Cr. - upper	RNO		1,930	2.9	05/99	present
Layout Cr. ^c	45° 49.776'	122° 01.525'	1,830	0.6	11/97	present
Layout Cr. (BLAY) ^c	RNO		1,810	0.1	07/04	present
Trout Cr. – lower OG	45° 49.656'	122° 01.278'	1,810	11.6	11/97	present
Trout Cr. – 43 bridge	45° 49.320'	122° 00.894'	1,805	11.0	08/97	present
Planting Cr.	45° 48.972'	121° 59.436'	1,730	0.2	07/97	present
Trout Cr. – ab. Hemlock	RNO		1,120	3.0	11/97	present
Trout Cr. – bl. Hemlock	45° 48.126'	121° 55.810'	1,080	2.0	10/98	present
Martha Cr. - CMCW	RNO		1,150	2.0	07/04	present
Martha Cr. - upper	RNO		1,130	1.8	05/99	present
Martha Cr. - lower	45° 47.737'	121° 55.342'	1,080	1.0	10/97	present

Continued.

Table 8. Continued.

Watershed Subwatershed Subdrainage	Coordinates		Elevation (ft)	Distance upstream from mouth (km)	Date start (mm/yy)	Date end (mm/yy)
	North	West				
Upper Wind River						
Wind R. – ab. Paradise Cr.	45° 57.047'	121° 55.815'	1,560	40.9	07/00	present
Paradise Cr.	45° 57.149'	121° 56.400'	1,550	1.0	10/98	present
Wind R – lower mining	45° 54.793'	121° 56.926'	1,360	36.5	07/00	present
Wind R. – bl. mining			1,350	35.5	07/02	present
Falls Cr.	45° 54.486'	121° 56.844'	1,340	0.1	07/00	present
Ninemile Cr.	45° 53.651'	121° 56.752'	1,300	0.2	06/00	present
Dry Cr. – 1	45° 54.127'	121° 57.874'	1,190	1.5	05/99	06/00
Dry Cr. – 2		RNO	1,250	3.3	06/00	present
Trapper Cr. – upper		RNO	1,520	2.5	05/05	10/06
Trapper Cr. - lower	45° 53.431'	122° 00.593'	1,360	1.5	10/98	present
Wind R. – bl. Trapper Cr.	45° 52.501'	121° 58.629'	1,090	30.0	10/98	present
Panther Creek						
Panther Cr. – upper	45° 50.573'	121° 51.567'	1,070	12.0	10/98	present
Eightmile Cr. – upper		RNO	1,090	0.6	07/97	present
Eightmile Cr. – lower	45° 50.393'	121° 52.069'	1,030	0.2	07/97	present
Cedar Cr. - upper		RNO	1,140	2.3	06/04	present
Cedar Cr. - lower	45° 48.176'	121° 51.404'	940	1.2	05/97	present
Panther Cr. – lower		RNO	730	4.0	07/97	present

^a RNO = Reading not obtainable.

^b OG = Restored old-growth channel.

^c During winter 03-04, Trout Creek reconnected with the old-growth channel at the mouth of Layout Creek. This caused the bottom of Layout Creek to extend approximately 600m further downstream. A new thermograph was installed (BLAY) 150m above new confluence.

Table 9. Locations of thermographs deployed and maintained by Underwood Conservation District within the Wind River subbasin during 1999-2006. Sites are listed from upstream to downstream within a subbasin. No GPS readings are available at the time of writing.

Watershed					
Subwatershed	Elevation	Distance upstream	Date	Date	
Subdrainage	(ft)	from mouth	start	end	
		(km)	(mm/yy)	(mm/yy)	
Upper Wind River					
Wind R. – blw. Falls Cr.	1,250	33.5	6/99	10/99	
			6/00	11/00	
			6/01	11/01	
			5/02	9/02	
			5/03	11/03	
			5/04	10/04	
			5/05	5/06	
			7/06	11/06	
Trapper Cr. at mouth ^{a, b}	1,135	0.3	6/99	10/99	
			6/00	11/00	
			6/01	11/01	
			5/02	9/02	
			5/03	10/03	
			5/05	10/05	
			7/06	11/06	
Middle Wind River					
Wind R. – at Beaver Cr. Camp Gr.	1,030	26.0	7/02	9/02	
			5/03	8/03	
			5/04	11/04	
			5/05	5/06	
			7/06	11/06	
Wind R. – at Pacific Crest Trail ^c	910	22.0	7/02	9/02	
			5/03	8/03	
			5/04	10/04	
			10/05	5/06	
			7/06	11/06	
Wind R. – at Stabler Bridge ^c	890	18.5	6/99	10/99	
			6/00	11/00	
		6/01	11/01		
			5/02	9/02	
			5/03	11/03	
			6/04	10/04	
			10/05	5/06	
			8/06	11/06	
Trout Creek					
Trout Cr. – blw. Martha Cr. ^c	865	0.2	6/99	10/99	
			6/00	11/00	
			6/01	11/01	
			5/02	9/02	
			6/04	10/04	
			10/05	5/06	
			7/06	11/06	

Continued.

Table 9. Continued.

Watershed					
Subwatershed	Elevation	Distance upstream	Date	Date	
Subdrainage	(ft)	from mouth	start	end	
		(km)	(mm/yy)	(mm/yy)	
Lower Wind River					
Bear Cr.	317	2.4	6/99	10/99	
			6/00	11/00	
			6/01	11/01	
			5/02	9/02	
			5/02	12/03	
			5/04	10/04	
			5/05	5/06	
			7/06	11/06	
Little Wind River ^{b,c}	85	0.2	6/99	10/99	
			6/00	11/00	
			6/01	11/01	
			5/02	9/02	
			5/03	11/03	
			10/05	5/06	
			7/06	11/06	
Lower Wind River ^c	80	1.5	6/99	10/99	
			6/00	11/00	
			6/01	11/01	
			5/02	9/02	
			5/03	11/03	
			5/04	11/04	
			10/05	5/06	
			7/06	11/06	

^a No data from 07/06/02 – 07/30/02 because of thermograph air exposure.

^b No data in 2004 due to thermograph loss.

^c No data in 2005 due to thermograph loss.

Table 10. Mean, minimum, and maximum water temperature recorded at sites within the Wind River subbasin during summer 2006. Data are from Onset Corporation's StowAway Thermographs, which recorded water temperature every two hours. Sites are listed from upstream to downstream within a subbasin.

Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Trout Creek									
Trout Cr. – upper Crater Cr.- site 2	4.8	4.7	4.7	6.0	6.1	5.9	7.9	7.6	7.6
Trout Cr. – 33 bridge Compass Cr East Fork Trout Cr.	10.1	10.1	8.2	14.1	13.6	11.3	18.7	16.3	14.6
Trout Cr. – upper OG ^a Layout Cr. - upper Layout Cr. - lower Layout Cr. (BLAY)	5.8	5.3	4.5	7.5	6.9	6.5	9.7	9.4	8.7
	9.5	10.3	8.4	12.3	12.4	10.7	15.4	13.8	13.2
	10.1	8.5	6.8	15.1	13.5	10.7	21.0	17.7	15.7
Trout Cr. – lower OG	6.9	6.4	5.8	10.3	9.9	8.8	15.7	14.5	13.7
	7.9	8.6	7.6	10.8	11.4	10.3	15.1	14.7	13.9
	9.8	10.7	9.2	13.5	13.9	11.8	17.8	16.8	15.2
	10.1	12.4	10.1	15.1	15.9	13.4	21.1	20.0	17.7
Trout Cr. – 43 bridge Planting Cr.	6.9	6.6	6.2	10.4	10.0	8.9	15.5	14.5	13.4
	7.8	7.5	6.5	11.9	11.8	10.0	17.0	15.4	13.1
	10.4	9.9	8.1	14.0	13.4	11.3	18.7	16.2	15.0
Trout Cr. – ab. Hemlock	11.2	11.3	8.9	16.4	15.9	12.8	22.2	20.3	17.9
Trout Cr. – blw. Hemlock Martha Cr. – (CMCW) ^b Martha Cr. - upper Martha Cr. - lower	13.2	14.7	10.2	18.7	18.5	14.6	24.2	22.0	19.3
	10.7	10.6	9.2	13.7	13.3	11.6	17.8	16.3	14.4
	11.8	12.2	10.5	14.6	14.6	12.9	18.7	17.7	17.3
	11.4	10.6	8.9	15.8	15.2	12.4	21.9	19.7	18.1
Trout Cr. – at mouth ^c	14.2	13.3	5.9	19.0	17.6	13.8	24.1	21.8	17.9

Continued.

Table 10. Continued.

Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Upper Wind River									
Wind R. – ab. Paradise Cr.	10.2	9.9	8.3	13.6	12.9	10.9	17.9	15.5	14.4
Paradise Cr.	10.6	10.6	9.5	12.9	12.5	11.2	16.2	14.6	13.5
Wind R. – lower Mine Reach	11.0	11.3	10.5	13.4	13.0	11.9	16.3	15.0	13.8
Wind R – blw. Mine Reach	11.4	---	---	14.2	---	---	17.7	---	---
Wind R. – blw. Falls Cr. ^c	9.6	8.6	7.9	13.2	12.2	10.7	16.8	14.7	13.7
Falls Cr.	8.1	7.3	6.4	12.1	11.2	9.6	16.1	13.6	13.0
Ninemile Cr.	10.6	11.4	10.1	12.4	12.3	11.2	13.7	12.8	12.3
Dry Cr.	9.8	9.8	8.5	12.3	12.6	11.5	16.8	16.9	16.5
Trapper Cr. – upper ^d	10.4	10.9	9.2	12.9	12.8	11.2	16.5	14.7	14.1
Trapper Cr. - lower	10.6	11.8	9.9	12.7	12.7	11.3	15.2	14.0	12.7
Trapper Cr. at mouth ^c	12.0	11.8	10.2	14.2	13.7	12.1	17.2	15.5	14.3
Wind R. – blw. Trapper Cr.	10.1	10.2	8.8	13.5	13.5	11.8	17.7	16.5	16.1
Middle Wind River									
Wind R. – at Beaver Cr. CG. ^c	9.6	9.0	8.3	11.9	11.3	10.2	15.8	14.8	13.4
Wind R. – at Pacific Crest Tr. ^c	10.5	10.3	9.6	13.8	13.3	12.0	17.8	16.9	14.9
Wind R. – at Stabler Bridge ^c	---	---	8.8	---	---	12.0	---	---	16.2
Lower Wind River									
Bear Cr. ^c	12.5	11.7	10.4	15.5	14.8	13.0	19.7	17.8	16.3
Little Wind River ^c	12.8	12.1	10.5	16.9	15.8	13.7	21.9	19.0	17.5
Lower Wind River site ^c	11.6	10.8	9.8	15.6	14.4	12.2	19.0	17.1	15.0

Continued.

Table 10. Continued.

Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Panther Creek									
Panther Cr. – upper	6.3	6.0	5.8	7.9	7.4	6.9	10.1	9.1	8.6
Eightmile Cr. – upper	11.9	12.3	10.7	13.9	13.6	12.2	16.2	14.9	13.5
Eightmile Cr. – lower	11.8	11.2	---	14.7	14.5	---	18.3	18.4	---
Cedar Cr. – upper ^b	10.1	9.9	9.0	12.5	12.0	10.8	15.5	13.9	12.7
Cedar Cr. - lower	10.5	10.5	9.4	13.2	12.8	11.4	16.8	15.2	13.9
Panther Cr. – lower	7.6	7.0	6.4	10.8	10.1	8.9	15.2	13.7	12.4

^a OG = Restored old-growth channel.

^b Site added in 2004.

^c Thermographs deployed and maintained by Underwood Conservation District during summer 2006. All UCD thermographs were deployed on 12 July 2006.

^d Site added in 2005.

Table 11. Flow measurement locations within the Wind River subbasin, 1996-2006. Coordinates are from a hand-held Global Positioning System (GPS) using North American Datum 1927. Sites are listed from upstream to downstream within a subbasin.

Watershed Subwatershed	GPS reading		Elevation (ft)	Distance upstream (km)	Year sampled ^a										
	North	West			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Upper Wind River^b															
Wind R. – ab. Paradise Cr.	45° 57.047'	121° 55.815'	1,560	40.6	No	No	No	No	Yes						
Paradise Cr.	45° 56.951'	121° 56.957'	1,550	0.5	No	No	Yes								
Falls Cr.	45° 54.534'	121° 56.772'	1,340	0.1	No	No	No	No	Yes	Yes	Yes	No	No	No	No
Ninemile Cr.	45° 53.651'	121° 56.752'	1,300	0.2	No	No	No	No	Yes	Yes	Yes	No	No	No	No
Dry Cr. – upper	RNO ^c		1,190	1.5	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
Dry Cr. – lower	45° 54.127'	121° 57.874'	1,120	0.1	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
Trapper Cr.	45° 52.761'	121° 58.849'	1,120	0.1	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No
Wind R. – bl. Trapper Cr.	45° 52.581'	121° 58.682'	1,090	30.3	No	No	No	No	Yes						
Trout Creek^d															
Trout Cr. – upper	45° 50.794'	122° 01.961'	1,920	15.2	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Crater Cr.	45° 50.779'	122° 01.036'	1,920	0.1	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Trout Cr. – 33 bridge	RNT ^e		1,920	14.0	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Compass Cr.	45° 50.427'	122° 02.051'	1,900	0.2	No	No	No	No	No	Yes	No	No	No	No	No
East Fork Trout Cr.	RNO		1,860	0.2	No	No	No	No	No	Yes	No	No	No	No	No
Layout Cr. – upper	RNO		1,940	2.5	No	No	Yes	Yes	No	Yes	No	No	No	No	No
Layout Cr. – lower	45° 49.776'	122° 01.525'	1,830	0.1	No	No	No	Yes	Yes	Yes	No	No	No	No	No
Trout Cr. – 43 bridge	45° 49.434'	122° 00.978'	1,805	11.3	No	No	No	No	Yes						
Planting Cr.	45° 48.972'	121° 59.436'	1,730	0.1	No	Yes	Yes	No	No	Yes	No	No	No	No	No
Trout Cr. – lower	RNO		1,120	3.0	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Martha Cr.-lower	45° 47.767'	121° 55.255'	1,070	1.0	No	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
Panther Creek															
Panther Cr. – ab. Falls ^f	RNT			18.0	No	No	No	No	No	No	No	No	No	No	Yes
Panther Cr. – ab. Tenmile ^f	RNT			16.4	No	No	No	No	No	No	No	No	No	No	Yes
Tenmile Cr. ^f	RNT			1.6	No	No	No	No	No	No	No	No	No	No	Yes
Mouse Cr. ^f	RNO		1,080	0.1	Yes	No	Yes								
Eightmile Cr. – lower ^f	45° 50.393'	121° 52.069'	1,020	0.1	No	Yes	Yes	No	Yes						
Cedar Cr.	45° 48.176'	121° 51.404'	940	1.2	Yes	Yes	No	Yes	Yes						
Panther Cr. – lower ^f	RNO		1,010	4.0	Yes	No	Yes								

^a Flows generally taken at regular intervals of time, about every two weeks, from June through October.

^b In addition, a flow reading was taken on the mainstem Wind River above Paradise Cr. and below Trapper Cr. on 10/6/99.

^c RNO = Reading not obtainable by GPS because of topography of basin.

^d Trout Cr. flows in 2000 were measured once, on 10/13/00.

^e RNT = Reading not taken.

^f Only one flow measurement was taken during 2006, on 9/01/06.