Spring Chinook Salmon Production in the Deschutes Basin

Project Narrative

Project Name	Spring Chinook Salmon Production in The Deschutes River Basin
Project Number	2008-311-00
Proposer	Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO)
Short Description	Continue annual monitoring of natural and artificial production of spring Chinook salmon in streams on the Warm Springs Indian Reservation, and implement new projects to 1) increase and improve monitoring technology and methods, and 2) increase natural production on reservation streams.
Province(s)	Columbia Plateau
Subbasin(s)	Deschutes
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ABSTRACT

Over the 10 –year span of this project, the natural production of spring Chinook salmon in Shitike Creek and the Warm Springs River will be monitored. New projects will be implemented in an attempt to increase natural production. Established monitoring protocols will be continued, which include outmigrant trapping at the mouths of the streams, index reach redd counts, snorkeling to monitor juvenile rearing, and monitoring of adult spawning escapement via weir or video monitoring. New protocols will be implemented to increase and improve monitoring, including the purchase and installation of new monitoring equipment: two additional rotary screw traps will be installed to conduct outmigrant trapping in tributary streams to Warm Springs River; two Passive Integrated Transponder (PIT) tag arrays will be installed on reservation streams (one at the mouth of Shitike Creek, and one at the mouth of the Warm Springs River); and a permanent video monitoring station will be designed and installed near the mouth of Shitike Creek.

Objectives will be implemented to increase natural production of spring Chinook salmon in reservation streams. Feasibility studies will be initiated to investigate methods of supplementation, which may include the use of streamside hatchboxes, fry releases of wild-origin fry or smolts into areas with limited production, development of acclimation facilities, and development of a tribal production facility. The outplanting of hatchery Chinook salmon into Shitike Creek may continue as directed by the Tribal Fish and Wildlife Committee.

TECHNICAL AND SCIENTIFIC BACKGROUND

Spring Chinook salmon are an integral part of the cultural and spiritual identity of the people of CTWSRO, and are an essential aspect of tribal nutritional health. The majority of natural production of this species in the Deschutes River Basin occurs on two stream systems on CTWSRO lands: the Warm Springs River and Shitike Creek. The Warm Springs watershed covers 526 square miles, reaching from 3,775 feet in elevation in the Cascade Mountains to 1,230 feet at its confluence with the Deschutes River at RM 84. The river flows 53 miles and provides 41 miles of anadromous fish habitat. Two major tributaries, Mill Creek and Beaver Creek, also support anadromous fish. Shitike Creek drains 76 square miles, with elevations ranging from 5,280 to 1,476 feet. It extends 30 miles, providing 25.7 miles of anadromous fish habitat, and joins the Deschutes River at RM 97.

In addition to natural production, the federally operated Warm Springs National Fish Hatchery (WSNFH) is located on tribal lands and produces approximately 750,000 spring Chinook smolts annually for release into the Warm Springs River. The CTWSRO, in cooperation with the USFWS, co-manages the WSNFH (CTWSRO and USFWS 2007).

The CTWSRO has monitored the natural and artificial production of spring Chinook salmon on reservation streams for over 30 years. Monitoring efforts have included juvenile outmigration, juvenile rearing, redd surveys, and adult escapement (Table 1).

Table 1. Spring Chinook monitoring activities by the CTWSRO 1977-2008

Activity	Season	Years Conducted	
		Warm Springs River	Shitike Creek
Outmigrant Trapping	Spring/Fall	1977-2008	1995-2008
Index Site Redd Counts	Late Summer	1986-2008	1986-2008
Juvenile Rearing	Summer	2002-2004, 2006-2008	1986-1989, 2000-2004, 2006-2008
Adult Spawning Escapement	Spring/Summer	1981-2008 (@ WSNFH)	2005-2008
Outplanting of Adult Hatchery Chinook	Summer	-	2000-2008
Carcass Outplanting	Fall	2002-2008	2002-2008

Monitoring of the wild and hatchery spring Chinook populations in the Warm Springs River is an essential part of fisheries management in the Deschutes River. Harvest seasons and limits at the Sherar's Falls fishery, which includes tribal platform and hook and line fisheries as well as a sport hook-and-line fishery, are directly based upon pre-season predictions of the wild spring Chinook run past the WSNFH. These preseason predictions are generated cooperatively by the CTWSRO and the USFWS, using a variety of different predictive models (e.g. Gauvin, Olsen, and Hand 2007). Most recently, the best model for predicting the number of 4-year old fish (which comprise the

majority of the run) returning to the WSNFH is a regression model using the number of 3-year old fish (jacks) returning in the previous year. Other predictive models that have been investigated include cohort ratios, smolt-to-adult (SAR) ratios, potential egg deposition, and others. One of the overall goals of CTWSRO's program of life-history-based monitoring is to generate more data that can increase the predictive capacity of such models, and aid in the development of new ones.

A stock – recruitment analysis of spring Chinook salmon in the Warm Springs River conducted by the USFWS (Cates 1992) indicated that approximately 1,377 wild adult salmon above the hatchery would provide the maximum production of progeny. The average number of wild Chinook arriving at the WSNFH between 1975 -2008 is 1304. However, the number of wild fish has fluctuated greatly in the past decade and a half (Table 2), with runs as high as 2,622 fish in 2000, and as low as 162 in 1995. Spawning escapement before hatchery operations were fully implemented in 1981 was 1904 (maximum 2878, minimum 968) adults. The CTWSRO and USFWS, in the Operational Plan for the WSNFH (CTWSRO and USFWS 2007) have a long-term goal of returning wild fish numbers to pre-hatchery escapement of 2,800 fish.

The natural production of spring Chinook in the Warm Springs Basin is spread primarily between three streams: the Warm Springs River, Beaver Creek, and Mill Creek. Prior to the year 2001, the productivity of the three streams (as measured by redd index counts) was fairly constant. However, after 2000, the proportion of redds in these tributaries has been more variable, for unknown reasons. To date, CTWRSO has monitored juvenile salmonid outmigration only at one point, near the mouth of the river. Beginning in 2009, CTWSRO will focus more efforts on quantifying the natural production of spring Chinook salmon in these tributary basins.

Beaver Creek and Mill Creek have been identified as streams for potential supplementation of wild spring Chinook salmon, as well as for habitat restoration activities (See Deschutes Habitat Restoration Program, BPA# 2008-301-00). Supplementation may be implemented in several ways, e.g. streamside hatchboxes, fry or smolt releases, or outplanting of gravid adults. The feasibility of these methods will be investigated, with possible implementation within the next 2-5 years. Additionally, supplementation efforts may be coordinated with habitat restoration activities, and will provide data related to the effectiveness of those activities.

Table 2. Wild and hatchery spring Chinook salmon at the WSNFH, 1975 – 2008.

Return Year	Wild Adults	Wild Jacks	Hatchery Adults	Hatchery Jacks
1975	2,182	0	0	0
1976	2,878	0	0	0
1977	1,505	101	0	0
1978	2,584	76	0	0
1979	1,322	73	0	0
1980	968	34	0	0
1981	1,525	54	85	0
1982	1,408	46	895	21
1983	1,523	34	355	16
1984	1,192	164	789	203
1985	1,099	56	1,073	36
1986	1,656	55	152	197
1987	1,697	86	484	258
1988	1,578	69	431	393
1989	1,344	65	2,362	176
1990	1,821	46	1,324	66
1991	773	40	600	44
1992	1,040	17	771	20
1993	528	6	295	14
1994	425	10	42	10
1995	162	75	216	75
1996	1,261	26	712	23
1997	861	9	1,129	9
1998	248	23	647	6
1999	367	127	2,644	126
2000	2,622	81	6,666	79
2001	2,155	97	4,369	97
2002	1,388	51	6,840	51
2003	1,280	120	5,906	117
2004	2,350	78	3,436	108
2005	677	30	962	201
2006	1,015	68	2,636	140
2007	367	32	1,196	366
2008	532	24	2452	245
32 Year Average	**1,304**	**55**	**1,455**	**91**

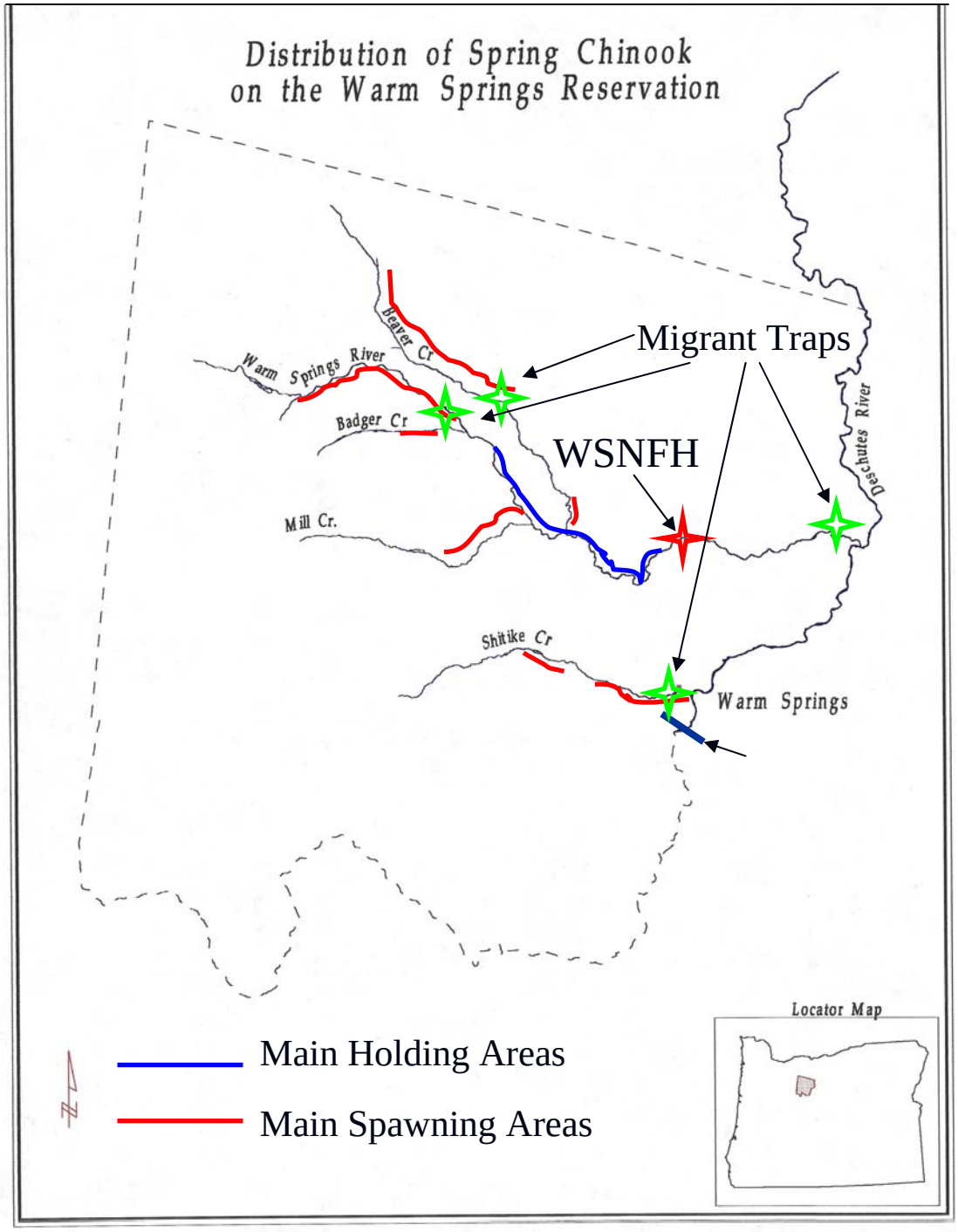

Figure 1. Distribution of spring Chinook salmon on the Warm Springs Reservation, and locations of the Warm Springs National Fish Hatchery (WSNFH) and migrant traps.

RATIONALE AND SIGNIFICANCE TO REGIONAL PROGRAMS

The Columbia Basin Accords describe objectives for habitat and non-hatchery commitments (BPA MOA, Section III.A.2) including actions benefiting species addressed under the Northwest Power Act (category 3). The project described in this narrative, which is a continuation and expansion of existing monitoring efforts, is a new RM&E project under this category.

The stock of spring Chinook salmon in the Deschutes basin is fairly healthy and productive but their spawning and rearing areas are concentrated in small geographic areas (NPPC 2005). Currently, spring Chinook salmon in the Deschutes River are not listed under the Endangered Species Act. However, the Mainstem Amendments to the to the Columbia River Basin Fish and Wildlife Plan (NPCC 2003) outlines biological objectives to, "*…improve the life-cycle survival of important populations of listed and unlisted salmon, steelhead, resident fish, and wildlife … success in protecting and enhancing abundant and diverse naturally spawning populations of salmon and steelhead and other native fish requires an emphasis on protecting, enhancing, connecting, and restoring habitats and populations that are relatively productive.*" Inherent in these objectives is the protection of important non-listed tributary populations, including spring Chinook salmon in the Deschutes River.

The Warm Springs River and Shitike Creek are within the boundary of the lower Westside Deschutes Assessment Unit, as defined in the Deschutes Subbasin plan (NPCC 2005). This assessment unit includes the 100 miles of mainstem lower Deschutes River, Shitike Creek, and the Warm Springs River (Section ES.2, page ES-3, and Section 4.1, page 4-2). Chinook Salmon are one of five aquatic focal species identified by the subbasin plan (section 3.2.1, page 3-1). Although spring Chinook salmon in the Deschutes River Basin are not listed under the Endangered Species Act, they are of strong ecological and cultural value both to tribal and local citizens, and are a keystone species in the Deschutes Basin.

The Deschutes Subbasin Plan (NPCC 2005) outlines the following goals and objectives for spring Chinook salmon in the Lower Westside Deschutes Assessment unit:

- Achieve and maintain an annual run of 2,600 to 2,800 adult spring Chinook to the Deschutes River destined for the Lower Westside Deschutes Assessment Unit streams (Ecosystem Diagnosis and Treatment model projection (EDT)).
- Achieve a spawning escapement of 2,200 to 2,300 adult wild spring Chinook salmon above the barrier dam at Warm Springs National Fish Hatchery.
- Achieve a spawning escapement of 400 to 500 adult wild spring Chinook salmon into Shitike Creek.
- Increase spring Chinook salmon population life history diversity from 95% to 98% (EDT projection).
- Increase spring Chinook salmon population productivity from 5.4 to 7.0 (EDT projection).

- Increase spring Chinook salmon habitat capacity by the equivalent of 702 adult fish (EDT projection).

Achievement of these goals will require monitoring of the status and trend of spring Chinook populations, both basin wide and on smaller scales.

Additionally, cooperative efforts between fish production monitoring and habitat restoration activities will be necessary. The limiting factors most directly related to the attainment of these goals are habitat quality issues, which include lack of habitat complexity and quantity, water temperate issues, increases in fine sediment, and altered hydrology. In addition to the specific objectives and work elements outlined in this narrative, there will also be cooperative efforts between the CTWRSO Fish Production Program and the CTWSRO Deschutes Habitat Restoration to identify and address limiting factors in specific areas. Projects will be developed aimed at identifying specific problems, implementing fixes, and monitoring the effectiveness of those efforts.

In 1995, Columbia River Inter-Tribal Fish Commission (CRITFC), of which the CTWSRO is an active member, published a plan to restore anadromous fish populations to historic levels in the Columbia Basin above Bonneville Dam. This document was called *Wy-Kan-Ush-Me Wa-Kish-Wit* (CRITFC 1996). The goal of this plan was to halt the decline of salmon, sturgeon and lamprey populations within 7 years, and lists a number of objectives that are focused on enhancing wild populations of salmon. Among the objectives is to develop and initiate supplementation projects to enhance runs of wild fish in their native habitats.

In 1992, CTWSRO and the Bureau of Indian Affairs (BIA) completed two Integrated Resource Management Plans (IRMPs) for forested and non-forested reservation lands. These plans established goals and objectives for sustaining or improving fish and aquatic resources within the boundaries of Warm Springs Reservation and adjacent waters within tribal ceded lands (CTWSRO 1992*a*; CTWSRO 1992*b*). The primary goal of these plans in regard to fisheries management is to 1) "maintain and enhance populations of resident and anadromous fish to meet the cultural, subsistence and recreational needs of tribal members," and 2) "manage watershed processes to maintain or improve functional aquatic habitats for fish and other water-dependent resources."

The federally operated Warm Springs National Fish Hatchery (WSNFH) is located on tribal lands leased to the US Fish and Wildlife Service. This facility produces approximately 750,000 spring Chinook smolts annually for release into the Warm Springs River, and blocks passage to hatchery fish upstream of the hatchery. The CTWSRO, in cooperation with the USFWS, co-manages the WSNFH to be, "*…compatible with, and complimentary to CTWSRO fishery management goals*" (CTWSRO and USFWS 2007). The CTWSRO will maintain its involvement in the management and operation of the WSNFH.

RELATIONSHIP TO OTHER PROJECTS

Table 3. Relationship to other projects

Funding Source	Project #	Project Title	Relationship (brief)
USFWS	13310-7-J141	Cooperative Agreement between USFWS and CTWSRO	Evaluate the effect of hatchery operations at the Warm Springs National Fish Hatchery on wild fish populations in the Deschutes River Basin.
PCSRF	2007-03-01	Fish Production Assessment on the Warm Springs Reservation VII	Monitor spring Chinook and steelhead on reservation streams; provide equipment and infrastructure to improve monitoring efforts.
BPA	2008-301-00	CTWSRO Deschutes Habitat Restoration	Develop habitat restoration activities directed at increasing salmonid production in reservation streams; share personnel to monitor effectiveness of habitat restoration activities.
BPA	2008-305-00	CTWSRO Steelhead Production and Monitoring	Share personnel and equipment to monitor production of steelhead in reservation streams; investigate methods of increasing steelhead production.
BPA	2008-307-00	CTWSRO Sockeye Development	Share personnel and equipment to monitor kokanee population dynamics in Lake Billy Chinook; investigate methods of reestablishing sockeye runs in the Deschutes Basin.

PROJECT HISTORY

This is a new BPA Program.

PROPOSAL BIOLOGICAL OBJECTIVES, WORK ELEMENTS AND METHODS

Objective 1) Provide management direction, planning, and administration of BPA projects

Work element # 119: Manage and Administer Projects
Title: Fish Production Program, Annual Project Planning and Administration

The CTWSRO will be implementing several new BPA-funded programs in 2009. Three of these: Chinook Production Monitoring, Steelhead Production Monitoring, and Sockeye Development (See Table 3) will be administered under the CTWRSO Fish Production Program. As such, many of the duties, tasks, and equipment involved with data collection for these projects will be shared by CTWSRO personnel.

Objective 2) Estimate the number of wild juvenile Chinook salmon migrating out of the Warm Springs River and Shitike Creek.

Work element #157: Collect / Generate / validate field data:
Title: Juvenile Salmonid outmigrant trapping in the Warm Springs River and Shitike Creek.

Task 1: Juvenile salmonid outmigrant monitoring at the mouth of the Warm Springs River
Description: An 8-foot rotary screw trap will be operated during the spring (March – June) and fall (October-December) emigration periods to capture and enumerate juvenile salmonids migrating out of the Warm Springs River.

Task 2: Juvenile salmonid outmigrant monitoring at the mouth of Shitike Creek
Description: A 5-foot rotary screw trap will be operated during the spring (March –June) and fall (October-December) emigration periods to capture and enumerate juvenile salmonids migrating out of Shitike Creek.

Task 3: Juvenile salmonid outmigrant monitoring in the middle Warm Springs River
Description: A 5-foot rotary screw trap will be operated during the spring (March –June) and fall (October-December) emigration periods to capture and enumerate juvenile salmonids migrating out of the upper Warm Springs River. Trap will be placed at approximately RM 28.

Task 4: Juvenile salmonid outmigrant monitoring in Beaver Creek
Description: A 5 foot rotary screw trap will be operated during the spring (March –June) and fall (October-December) emigration periods to capture and enumerate juvenile salmonids migrating out of Upper Beaver Creek. Trap will be placed at approximately RM 8.

Methods for all tasks: Traps will be run 4 or 5 days a week. All fish collected from the traps will be anesthetized using MS-222, identified to species, tallies and placed in a recovery bucket. The first 20 of each species on each day will be measured and weighed. All fish will be returned to the river after recovery. On the first 3 days of each week, all juvenile salmonids will be marked with a fin clip (upper or lower caudal on a rotating weekly basis) and released approximately 1/2 mile upstream of the trap. Recaptured individuals will be counted, but not measured or weighed. This mark / recapture method will be used as a method of estimating trap efficiency and assist in generating population estimates.

Work Element # 156: Develop R, M & E Methods and Designs.
Title: Mill Creek juvenile monitoring
Task: Investigate methods of monitoring juvenile salmonid production in Mill Creek.
Description: Although Mill Creek does support anadromous spring Chinook salmon, the creek is most likely too small for deployment of a 5 foot screw trap. The CTWSRO will investigate other methods of monitoring production of juvenile salmon, which may include trapping, seining, mark - recapture efforts, or other methods.

Work Element #162 Analyze/Interpret Data
Title: Juvenile Chinook Outmigration Estimates

Task: The data collected at the screw traps will be used to generate estimates of the number of juvenile Chinook salmon outmigrating from the Warm Springs River, tributaries to the Warm Springs River, and Shitike Creek in the spring and fall. Estimates will be generated for 3 groups of fish: age-0 spring migrants (fry), age-1 fall outmigrants, and age-1 spring migrants (smolts).

Methods: Population estimates will be generated using three methodologies: weekly data, seasonal data, and a bootstrap program on seasonal data. For each period of trapping, estimates will be generated for each group of fish (species and age) based on the number of unmarked fish caught, the number of fish marked, and the number of marked fish recaptured. The total estimate from each week will be summed to generate a seasonal estimate. Results from all three methodologies, including 95% confidence intervals, will be reported for each season and for each brood year.

Objective 3) Count the number of Chinook salmon redds in index reaches in the Warm Springs River Basin and Shitike Creek.

Work element #157: Collect / Generate / validate field data:
Title: Index Reach Redd Counts on CTWS Reservation Streams.

Task: Conduct index reach redd surveys in the Warm Springs River (six reaches)
Task: Conduct index reach redd surveys in Beaver Creek (five reaches)
Task: Conduct index reach redd surveys in Mill Creek (at least three reaches. Counts may be expanded to cover all stream reaches available to anadromous fish)

Task: Conduct index reach redd surveys in Badger Creek (one reach)
Task: Conduct index reach redd surveys in Shitike Creek (six reaches)

Methods: A team of two or three surveyors will begin surveys at the top of each reach and walk downstream. For each survey, the date, time, and water temperature are recorded. When a redd is identified, it will be counted, and the area of the stream channel (left bank, right bank, or mid-channel) will be recorded. Typically each reach will be surveyed three times over the course of a six week period. Redd counts are summarized by reach, stream, and basin, and provide a method of comparing production from year to year, as well as helping to refine adult-to-redd ratios. Spawning escapement of adult fish is conducted at the WSNFH on the Warm Springs River, and is completed under the USFWS Cooperative agreement (see Table 3), and at a to-be-constructed video monitoring station on Shitike Creek (See Objective 5). Video counts of adult spawning escapement in Shitike Creek have been conducted at a temporary picket weir since 2005, which will be continued until the new monitoring station is installed and operational.

Objective 4) Estimate the summertime rearing densities of juvenile Chinook salmon in the Warm Springs River Basin and Shitike Creek

Work element #157: Collect / Generate / validate field data
Title: Juvenile salmonid rearing monitoring
Description: Monitor summertime abundance of juvenile salmonids in the Warm Springs River Basin (including Beaver Creek and Mill Creek) and Shitike Creek.

Methods: This program is a continuation of a methodology initiated by the CTWSRO in 2006. Fours streams on the reservation are sampled via snorkeling: the Warm Springs River, Mill Creek, Beaver Creek, and Shitike Creek. Each of these streams has been segmented into reaches based on geomorphological differences. These reaches also correspond to redd survey reaches (Objective 4). A subsample of pools within each of these reaches will be sampled annually. Pools are selected for daytime snorkeling using a stratified random method. A selected number of pools are repeated in day and night dives each year for direct annual comparison. Two or three divers, depending on the size of stream, start at the bottom of each pool and move upstream, counting fish by species and age class. Three passes are conducted on each pool, with divers switching lanes between passes. Habitat information is collected on each pool, including: temperature prior to and after sampling, pool length, pool width at max depth, maximum depth, depth at pool tail crest, number of pieces of large wood within bankfull channel (>3 m in length, > 10 cm at small end, Root wads may be less than 3 m), and a categorical measure of percent Undercut bank (Classes: 0-25%, 25-50%, 50-75%, 75-100%).

Work Element #162 Analyze/Interpret Data
Title: Juvenile Chinook Rearing Densities
Description: Analyze snorkeling data to estimate densities of juvenile Chinook salmon in pools, and compare pool densities between and among reaches, streams, and years.

Methods: The data collected during snorkel surveys will be used to generate a population estimate for juvenile Chinook salmon in each pool, using a bounded count methodology (Dambacher 2001). Once estimates have been created, statistical tests will be performed to: 1) look for differences in juvenile densities between and among reaches and streams; 2) Investigate relationships between fish densities and habitat variables; and 3) compare annual results to previous years' data.

Objective 5) Supplement nutrients through carcass outplants in Shitike Creek and the Warm Springs River basin.

Work Element # 157 Collect / Generate / validate field data:
Title: Carcass Outplanting

Description: Carcasses from Chinook salmon spawned at the WSNFH will be gutted and frozen on the day of spawning. Disease testing will be conducted by the USFWS. Carcasses that are declared disease free will be distributed into Shitike Creek and the Warm Springs River Basin.

Objective 6) Design and install new monitoring infrastructure in Reservation streams

Work Element # 165: Produce Environmental Compliance Documentation
Title: Permits and ESA Compliance for PIT tagging efforts
Description: Obtain local permits and ESA/NEPA compliance associated with the installation of monitoring infrastructure.

Work element # 70: Steelhead / Salmon monitoring weir or PIT tag detection station
Title: Install Video monitoring system at mouth of Shitike Creek
Description: Using a contractor, design and install video monitoring system near the mouth of Shitike Creek

Work element # 70: Steelhead / Salmon monitoring weir or PIT tag detection station
Title: Install PIT tag array at mouth of Warm Springs River
Description: Using a contractor, design and install a full duplex PIT tag array near the mouth of the Warm Springs River

Work element # 70: Steelhead / Salmon monitoring weir or PIT tag detection station
Title: Install PIT tag array at mouth of Shitike Creek
Description: Using a contractor, design and install a full duplex PIT tag array near the mouth of Shitike Creek

Objective 7) Use PIT tag technology to monitor wild spring Chinook populations.

PIT tag technology has been used successfully to monitor wild populations of salmon throughout the Columbia basin. Tagging wild juvenile spring Chinook salmon at outmigrant traps would allow for investigation into several areas of interest, including outmigrating timing, SAR rates for different tributaries, and SAR rates for fall and spring outmigrants. Tagging of wild spring Chinook on CTWSRO streams would require permission from the CTWSRO Fish and Wildlife committees. If the compliance documentation and / or tribal committee permissions cannot be obtained, work will not proceed. The following work elements would be incorporated to meet this objective:

Work Element # 165: Produce Environmental Compliance Documentation
Title: Permits and ESA Compliance for PIT tagging efforts
Description: Obtain local permits and ESA compliance associated with the spawning operations.

Work element # 158: Mark / Tag animals
Title: PIT tag juvenile wild spring Chinook
Description: At the outmigrant taps on CTWSRO reservation streams (described in Objective # 2), insert PIT tags into a portion of the captured juvenile spring Chinook salmon.

Work element # 182: PIT tags
Title: Purchase PIT tags and Readers
Description: Purchase PIT tags and PIT tag readers for spring Chinook salmon monitoring program

Work element # 159 Submit / Acquire Data
Title: PIT tag reporting
Description: Submit data on tagged and released fish and data collected at CTWSRO PIT tag arrays to PITAGIS data managers.

Objective 8) Investigate the feasibility of supplementing the production of wild spring Chinook salmon in the Warm Springs River Basin and Shitike Creek.

As discussed previously, there is evidence that the habitat in the Warm Springs River basin is capable of producing more wild spring Chinook salmon, particularly in, but not limited to, Beaver Creek and Mill Creek. As such, the feasibility of supplementing wild populations in the Warm Springs and Shitike Creek watersheds will be investigated. Some or all of these actions may take place in 2009; however, if the compliance documentation and / or tribal committee permissions cannot be obtained, work will not proceed until such time permission can be obtained. Some of these actions may also be implemented in coordination with the CTWSRO Deschutes Habitat Restoration Program (BPA MOA Project #2008-301-00)

Work Element # 165: Produce Environmental Compliance Documentation
Title: Permits and ESA Compliance for Chinook Spawning Operation
Description: Obtain local permits and ESA compliance associated with the spawning operations.

Work Element # 64: Spawn Fish
Title: Spawn BY 2009 wild spring Chinook salmon
Description: Spawn approximately 40 wild spring Chinook salmon (20 males, 20 females) at the Warm Springs National Fish Hatchery to produce approximately 50,000 eggs for supplementation efforts.

Work Element #59: Incubate Eggs
Title: Streamside hatch box incubation of spring Chinook salmon
Description: Eyed eggs will be transported from the Warm Springs National Fish hatchery to stream side hatchboxes in identified streams in the Warm Springs River Basin upstream of the Warm Springs National Fish Hatchery.

Objective 9) Assist in efforts to reestablish runs of spring Chinook salmon above the Pelton Round Butte Hydroelectric Project.

Work Element # 156 Develop R, M & E Methods and Designs.
Title: Deschutes Anadromous Reintroduction
Description: As co-managers of the fisheries resources in the Deschutes River Basin, CTWSRO and ODFW have developed a plan for reintroduction of anadromous fish, including springs Chinook salmon above the Pelton Round Butt Hydroelectric Project (ODFW and CTWSRO 2008). Although the basic outline of reintroduction efforts have been established, the specific duties and responsibilities of the CTWSRO and other partners have not.

FACILITIES AND EQUIPMENT

Facilities, personnel, equipment, and vehicles will be provided by the CTWSRO. New equipment purchases will include the cost of one new 5 foot screw trap (Objective 2), PIT tag array equipment and installation (Objective 5) and the video monitoring station (Objective 5). The costs for these items may be cost shared among several BPA projects as well as PSCRF funds. Other equipment purchases may include gear necessary for data collection, including waders, dry suits and snorkeling gear, inflatable kayaks and paddles, polarized sunglasses, nets, chemicals for fish handling, and hand and power tools.

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Key Personnel:

JENS LOVTANG, FISH PRODUCTION BIOLOGIST
PRINCIPAL INVESTIGATOR / PROJECT MANAGER

Education

Oregon State University, M.S. Fisheries Biology, 2005
Humboldt State University, B.S Natural Resources Planning, 1995

Work Experience

Confederated Tribes of Warm Springs
Fish Production Biologist, November 2005 – Present
Current Duties: Oversee data collection, analysis, and reporting of the CTWSRO Fish Production Program, which includes monitoring of natural production of steelhead and spring Chinook salmon in reservation streams, and kokanee salmon in the Metolius River Basin. Participate in the cooperative management of the Warm Springs National Fish Hatchery.

Oregon Department of Fish and Wildlife, Corvallis, Oregon
Experimental Biology Aide, Gearhart Mountain Bull Trout Project, July – August 2005
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Recent Publications

Lovtang, J.C. 2008. Confederated Tribes of Warm Springs, Fish Production Program, 2007 Annual Report. Confederated Tribes of Warm Springs, Warm Springs, OR

Lovtang, J.C., M. Hill, R. Stocking, and B. Hodgson. 2008. Lake Billy Chinook / Metolius River 2007 Kokanee Spawning Population Studies. Tab 17 *in* Portland General Electric Pelton Round Butte Project, 2008 Annual Fisheries Workshop. Portland General Electric, Portland, Oregon.

Lovtang, J.C., 2008. Chinook Reintroduction / Fry Releases in the Metolius River Basin, 2008. Tab 12a *in* Portland General Electric Pelton Round Butte Project, 2008 Annual Fisheries Workshop. Portland General Electric, Portland, Oregon.

Confederated Tribes of the Warm Springs Reservation of Oregon and The United States Fish and Wildlife Service. 2007. Warm Springs National Fish Hatchery, 2007- 2011 Operational Plan and Implementation Plan. USFWS, Columbia River Fisheries Program Office, Vancouver, WA.

Lovtang, J.C., P. Galbreath, and S. Hyun. 2007. Using a Dual-Frequency Identification Sonar (DIDSON) to enumerate the spawning migration of Kokanee salmon into the Metolius River. Tab 19 *in* Portland General Electric Pelton Round Butte Project, 2007 Annual Fisheries Workshops. Portland General Electric, Portland, Oregon.

Lovtang J.C. 2005. Distribution, Habitat Use, and Growth of Juvenile Chinook Salmon in the Metolius River Basin, Oregon. FERC Number 2030. Portland General Electric, Portland, Oregon.

LISA HEWLETT-DUBISAR, FISHERIES BIOLOGIST

Education:

Portland State University, B.S Environmental Science, 2000

Work Experience

The Confederated Tribes of Warm Springs
Fisheries Biologist**,** November 2005 - Present
Make recommendations and mitigations to conserve, protect, and enhance fisheries resources. Apply the Tribal Integrated Resource Management Plan to timber sales and other land use practices. Write biological assessments on ESA listed fish species. Review proposed projects and write biological evaluations. Frequently communicate with various state and federal agencies. Conduct spring Chinook, steelhead, and bull trout redd counts. Use GPS and GIS to geographically present field data. Construct a fish weir to collect summer steelhead kelts and to monitor underwater video to enumerate upstream migrating adult salmonids. Manage project budgets. Present project results in technical reports, maps, and professional presentations.

Oregon Department of Fish and Wildlife
Experimental Biology Aid,
February 2005 – October 2005; June 2004 – October 2004; June 2001 – October 2001;
Performed various sampling techniques to determine escapement and productivity of spring Chinook and summer steelhead in the John Day subbasin. PIT tagged emigrating smolts using rotary screw traps and 100ft beach seine. Performed Chinook , steelhead, and bull trout spawning ground surveys. Identified fin marks, sex, origin, collect scale, kidney, genetic, and ovary samples from salmonid carcasses. Operated and navigated drift boat and jet sled down the Mainstem John Day River.

Department of Environmental Quality
Natural Resource Specialist 1, June 2004 – October 2004

Oregon State University
Research Assistant, February 2001 – June 2001

JOB-RELATED PUBLICATIONS:

Hewlett, L.M. 2007. The Confederated Tribes of the Warm Springs Reservation of Oregon. Shitike Creek Summer Steelhead (Oncorhynchus mykiss) Kelt Reconditioning: Reproductive Success, Monitoring, and Assessment.

Lovtang, **L. M. Hewlett**, and A. Mitchell. 2006. The Confederated Tribes of the Warm Springs Reservation of Oregon Fish Production Program. Annual Progress Report 2006.

Lovtang, J., D. Best, **L. M. Hewlett**, and A. Mitchell. 2005. The Confederated Tribes of the Warm Springs Reservation of Oregon Fish Production Program. Annual Progress Report 2005.

ARTHUR MITCHELL, LEAD IMPLEMENTATION TECHNICIAN

Art has worked for the CTWSRO Department of Natural Resources since 2002. His experience with the CTWSRO Fish Production program includes serving as crew leader for spring and fall migrant trapping, redd surveys, snorkeling efforts, and the Shitike Creek steelhead kelt reconditioning program. Art coordinates field activities for the program, including snorkeling and redd counts, and oversees data entry for all field data collection.

Education

Graduated from Molalla Union High School
Molalla, Oregon 1986

Professional Experience

Confederated Tribes of Warm Springs, 2002 - present
Lead Technician, Fish Production Program
Duties: Coordinate and implement tribal fisheries research projects including operation and maintenance of field gear (e.g., picket weirs, migrant traps); maintain equipment; lead daily field crew activities; effectively communicate, orally and written; enter, verify, and assist with summarizing of field data; assist in report preparation; and coordinate field sampling activities with a variety of entities.

Ironworkers Union Local #27, Portland, Oregon
Apprentice Ironworker 2000-2002

Yakama Nation, Land Enterprises, Wapato, Washington
Irrigation Field Crew Boss, 1994-2000

FY 2008-2009 F&W Program Accords (MOA) Proposal Review

Narrative

Table 1. Proposal Metadata (You may provide a link to this information in Pisces, if available, rather than filling out this table.)

Project Number	2008-311-00
Proposer	The Confederated Tribes of the Warm Springs Reservation of Oregon
Short Description	This project's goal is to monitor steelhead production on the Warm Springs Reservation. We will also attempt to increase steelhead production through the use of hatch boxes.
Province(s)	Columbia Plateau
Subbasin(s)	Lower Deschutes
Contact Name	Jennifer Graham
Contact email	jgraham@wstribes.org

Information transfer:

A. Abstract

Steelhead *(Oncorhynchus mykiss)* in the Deschutes River basin are a part of the Middle Columbia River (MCR) steelhead "distinct population segments" (DPS). The National Marine Fisheries Service (NMFS) listed steelhead as threatened under the Endangered Species Act of 1973 (ESA) on March 25, 1999 (64 FR 14517) and NMFS reaffirmed threatened status on January 5, 2006 (71 FR 834). High stray rates of steelhead within the Deschutes River "evolutionarily significant unit" (ESU) have contributed to a decision by National Marine Fisheries Service (NMFS) to list Middle Columbia River steelhead as threatened. Steelhead are culturally significant to the people of the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) but also of high economic and recreational value to non-Indians. This project addresses objectives of the Middle Columbia River Steelhead Recovery Plan, The Deschutes River Subbasin Plan, and the 2000 Northwest Power and Conservation Council's Fish and Wildlife Program.

The proposed project will focus on wild steelhead within the Lower Westside Deschutes Assessment Unit. Project activities will take place in Shitike Creek, the Warm Springs River basin, and other Westside tributaries that enter lower 100 miles of the Deschutes River.

Key objectives will focus on monitoring the distribution and abundance of juvenile and adult steelhead, investigating methods of increasing steelhead production, and determining genetic characteristics composition. Methods that will be used to meet these objectives include the use of rotary screw traps, snorkeling, spawning surveys, use of hatch boxes, Passive Integrated Transponder (PIT) tagging systems and by collection of tissue samples for genetics analysis. Feasibility studies will also be conducted to determine whether PIT tag systems within the Warm Springs basin and Shitike Creek could produce reliable results.

B. Technical and/or scientific background

Steelhead (*Oncorhynchus mykiss)* in the Deschutes River basin are a part of the Middle Columbia River steelhead (MCR) "distinct population segments" (DPS). MCR steelhead are listed as threatened under the Endangered Species Act of 1973 (ESA) on March 25, 1999 (64 FR 14517) and the National Marine Fisheries Service (NMFS) reaffirmed status on January 5, 2006 (71 FR 834). Originally NMFS classified MCR steelhead as an "evolutionarily significant unit" (ESU) of salmonids including both the anadromous and resident forms. However NMFS revised its species designation for West Coast steelhead delineating an anadromous, steelhead-only DPS. High stray rates of steelhead into the Deschutes River have contributed to a decision by NMFS to list Middle Columbia River (ESU) as threatened. This project addresses Middle Columbia River steelhead recovery plan needs in conjunction with the Deschutes subbasin plan.

Middle Columbia steelhead are distributed over approximately 35,000 square miles in the Columbia plateau of eastern Washington and eastern Oregon (Figure 1). Including all naturally spawned populations of steelhead in the DPS above Wind River, Washington, and Hood River, Oregon, to, and including the Yakima, lower Deschutes, and the John Day River basins (64 FR 14517; 71 FR 849).

Objectives of the Lower Westside unit of the Deschutes River Subbasin Plan are consistent with the visions and strategies of the Columbia River Basin (CRB) as written into the 2000 Northwest Power and Conservation Council Program. Key areas of the unit are the lower 100 miles of the Deschutes River and its tributaries. This plan addresses biological and habitat strategies for multiple species, including summer steelhead.

Life History of Summer Steelhead

Oncorhynchus mykiss exhibit complex life history traits of any Pacific salmonid. Steelhead represent the anadromous form of *O. mykiss,* whereas rainbow trout are the resident form. Steelhead runs-types are characterized by the season in which they enter freshwater; winter runs which predominate in coastal stream systems, and summer runs which are predominant in large inland river systems such as the Deschutes. Winter and summer steelhead display two different reproductive ecotypes based on the state of sexual maturity at the time of river entry and duration of spawning migration; summer steelhead enter freshwater sexually immature between May and October while winter steelhead enter freshwater sexually mature from November to April (ODFW 2005). Steelhead are iteroparous, whereas all other *Oncorhynchus,* except cutthroat trout (*O. clarki*), are semelparous. Gunsolus (1970) reported that steelhead iteroparity rates in the Deschutes basin at 3 - 7%, compared to a reported 58% for winter steelhead in the Clackamas River.

Steelhead rear in the Deschutes River from one to three years before migrating to the ocean (Zimmerman et al. 1999). Juveniles emerge from spawning grounds, in tributaries, and migrate to the mainstem Deschutes River to rear (ODFW 1997). Entrance occurs between age-0 + and age-3+ (ODFW 1997; CTWS unpublished data). Rotary screw trap data from Shitike Creek and Warm Springs River suggest peak outmigration during fall and spring (CTWS unpublished data). Relationships have been observed between timing, temperature, and flow. From March through June, smolts migrate to mature in saltwater (ODFW 1997). Wild Deschutes steelhead average one to two years in the ocean (Cramer et al. 2006). Cramer et al. (2006) noted a minor percentage of fish remaining in saltwater for three years.

Deschutes River fish enter the Columbia River during summer and then the Deschutes River from August through September (Cramer et. al 2006). Fry (1942) described the lower Deschutes basin as having a spring and fall return of summer steelhead (as cited in Cramer et al. 2006). The fall run begin migration into the Deschutes in August and September to over-winter in the

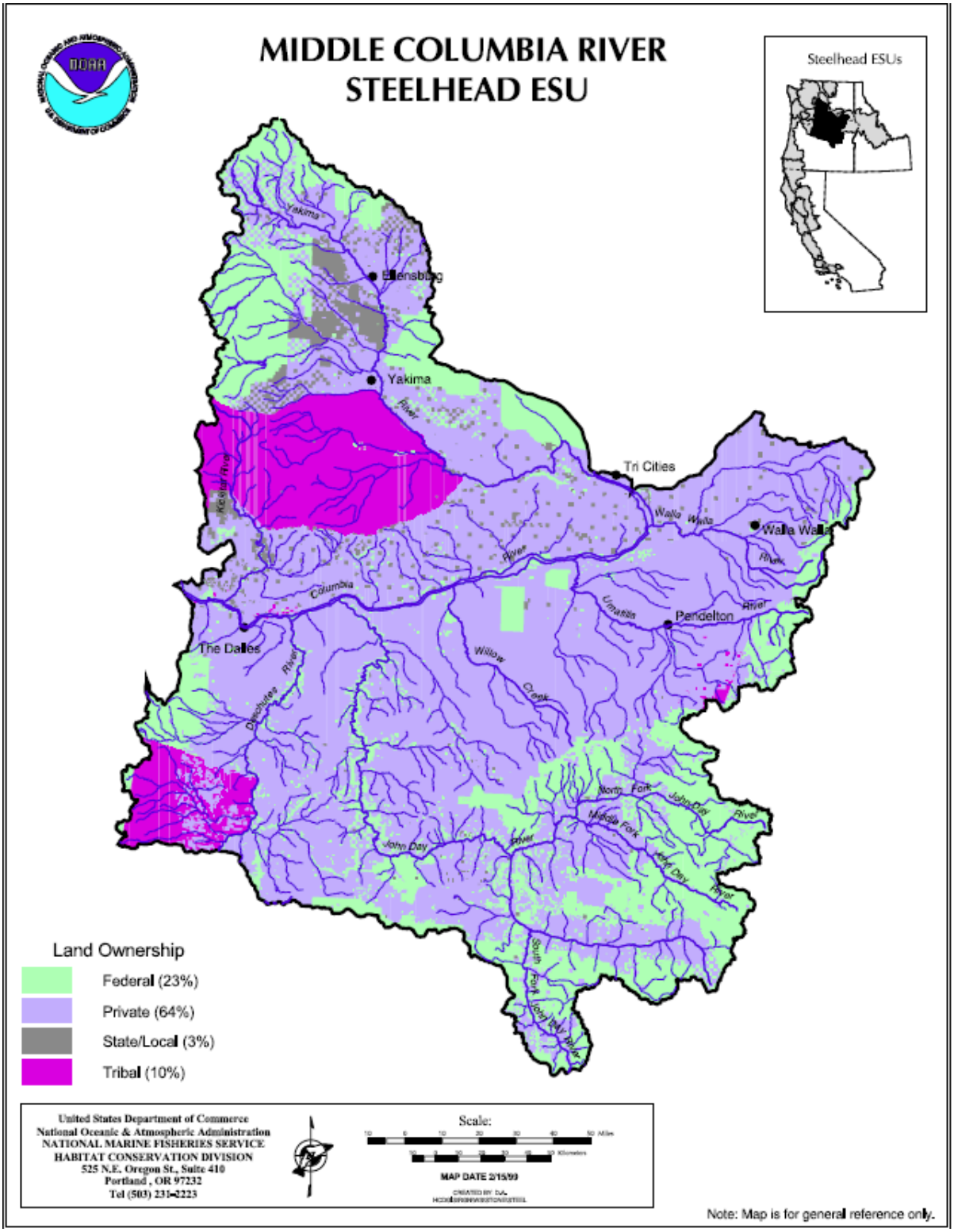

Figure 1. Middle Columbia River steelhead ESU that extends from Oregon to Washington (http://www.nmfs.noaa.gov/).

mainstem Deschutes. Spring fish over-wintered in the Columbia until entrance in April and May. Spring and fall immigrants are the same population differing by over-winter location.

Spawning occurs in tributaries and mainstem Deschutes River from March to May. Adults will hold in pools and migrate to suitable spawning habitat depending on temperature and location (Cramer et al. 2006; CTWS unpublished data). Typical spawning temperatures are between 50 and 60 ºF (Cramer et al.2006). Zimmerman (1999) showed reproductive isolation exists in spawning habitat and timing between resident and anadromous forms of *O. mykiss* with minimal overlap in the lower Deschutes River. The period was shorter for the resident form and occurred from March to the end of August.

Zimmerman (1999) analyzed redd characteristics of Deschutes steelhead and found average gravel size to be 32.5 mm, redd length of 2 m, redd width of 1.2 m, depth adjacent to pit 54 cm, and mean velocity adjacent to pit of 71.4 $cm \cdot s^{-1}$. Once spawning occurs embryos incubate in gravel 20 to 80 days. Eggs depend on oxygen and cool water temperatures for growth and metabolism. Dissolved oxygen (DO) concentrations below 5 ppm will extend incubation times (Fulton 2004). Water temperature greatly influences egg incubation. At 15.4 ^{o}C (60 F) steelhead eggs hatch within 20 days (cite). Colder temperatures will increase incubation (Fulton 2004). Embryos hatch into alevins and remain in the interstices of gravel from 15 to 20 days. Fry will emerge between May and the end of June highly dependent on temperature.

History

The Deschutes River basin provides vast amounts of production potential for summer steelhead. Since Pelton Hydroelectric Project completion in 1957, abundance and distribution of wild fish has declined (Anadromous fish migration is blocked at Pelton Reregulating dam (RM 100)). Therefore, habitat once available in the middle and upper portions of the Deschutes River basin became inaccessible. Prior to construction, steelhead had access to the Crooked River, Whychus Creek, and possibly the Metolius River (Middle Deschutes Basin) (Nehlsen 1995). Counts of adults in Whychus Creek ranged from 62 to 619 in the 1950's, and dwindled in the 1960's (Cramer et al. 2006). At Pelton Dam, counts of wild steelhead from 1957 to 1961 ranged from 354 to 1,619, but by 1967 runs were failing to reproduce the parent runs (Nehlsen 1995).

Dwindling returns of adults and juvenile outmigration past the hydroelectric project initiated a hatchery by Oregon Department of Fish and Wildlife (ODFW) to supplement the declining steelhead population. Annually ODFW and the Round Butte Hatchery (RBH) release up to 162,000 yearling smolts to the Deschutes (Palmer 2008). Hatchery reared steelhead return to Pelton Trap for RBH broodstock collection; however, some tributary straying occurs. Currently, hatchery fish that stray into the Warm Springs River, Trout and Shitike Creeks are removed from the system.

Not only has Pelton Hydroelectric project affected anadromous fish migration, human activities since the 1800's in the Deschutes River basin have damaged spawning, rearing, and migration habitat for fish, resulting in substantial depletion of the native salmon and steelhead runs (Nehlsen 1995). Upland grazing caused native grasses to disappear, increase soil erosion, and reduce water storage capacity in watersheds (Nehlsen 1995; Platts 1991). The demand for irrigation reduced available quantities of water for spawning fish which decreased flows and increased summer temperatures (Stuart et al. 1996).

Present day spawning and rearing distribution is restricted to the lower 100 miles of the Deschutes River basin. Spawning and rearing occurs in the mainstem Deschutes River and most tributaries. Focal steelhead spawning areas in the lower Deschutes include Shitike Creek, Warm Springs River watershed, Trout Creek, Wapinitia Creek, White River, Eagle Creek, Nena Creek, Buck Hollow watershed, and Bakeoven Creek watershed (Cramer et al. 2006). Spawning habitat in Eagle and Nena Creek is limited due to natural barriers.

Steelhead returning to the Warm Springs National Fish Hatchery (WSNFH) (RM 9) have been enumerated since 1977. Wild counts have ranged from 79 to 880 (WSNFH unpublished data). Stray hatchery steelhead have ranged from 42 to 988 (WSNFH unpublished data). To preserve the genetic integrity of wild steelhead, all hatchery strays are removed at WSNFH. The spawning and rearing distribution of wild fish throughout the Warm Springs River tributaries is highly variable. Based on redd count data majority of spawning occurs in the upper, mainstem, Warm Springs River followed by Beaver and Mill Creeks (CTWS unpublished data). Beaver and Mill Creeks have available spawning habitat but appears to be underutilized.

Since 1977, wild, Round Butte origin and hatchery stray steelhead have been enumerated at Sherars Falls on the Deschutes River (RM 44.1). Wild fish numbers have fluctuated from a low of 482 in 1994 to a high of 9,624 in 1985 (ODFW unpublished data). Stray hatchery steelhead composed on average 13.6% from 1982 to 1986 (Hand et al. 2003) (Figure 3). Since 1987, the mean has increased to 50.9% (Hand et al. 2003).

C. Rationale and significance to regional programs

Study objectives are consistent with Columbia River Basin Accords (Accord). Specifically, the general principles listed in the Habitat and other Non-Hatchery Actions (Section III). This project will identify and address the actions for steelhead recovery. Based on distribution and better definition of limiting factors, we'll be able to make recommendations to the Deschutes River Restoration Project for habitat improvements which will benefit steelhead production. Furthermore, project objectives are consistent with the Accord because they address subbasin planning objectives and recovery goals for Middle Columbia Steelhead. This project will also meet general provisions for all funded projects.

The Accord and 2000 Northwest Power and Conservation Council (NPCC) Fish and Wildlife Program (FWP), rely heavily on guidance from subbasin planning efforts. Steelhead is a focal species in the Deschutes River Subbasin Plan. Our efforts focus on meeting objectives listed in the Lower Westside Unit (LWU) of the Deschutes Subbasin Plan. The LWU outlines management goals within westside tributaries to the Deschutes downstream of RM 100, excluding the White River. The goals include maintaining or increasing genetic diversity, production, life history diversity, and distribution of steelhead. The project objectives address each of the goals of the LWU including: collecting genetic samples, monitoring population levels, removing hatchery fish at weirs in the Warm Springs River, attempting to increase production though the use of hatch boxes, and monitoring distribution.

The NPCC adopted the 1982 FWP to recover, rebuild, and mitigate impacts on fish and wildlife. The framework of general scientific and policy principles of the 2000 FWP include the vision, biological objectives, and the implementation strategies to restore fish and wildlife populations throughout the entire Columbia River Basin (NPCC 2000). In the NWP vision acknowledges and

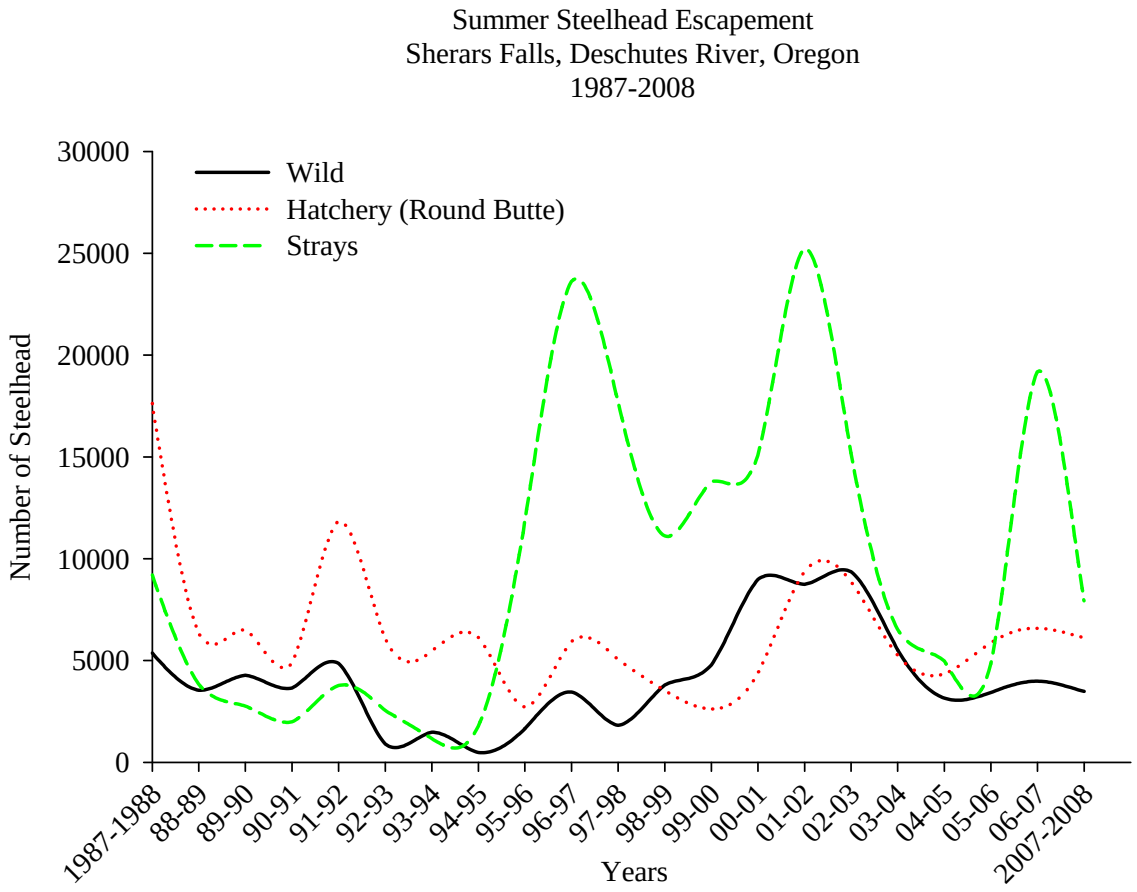

Figure 3. Steelhead escapement at Sherars Falls, Deschutes River, Oregon from 1987-2008 (from Hand et al 2003).

ever changing environment and requires an adaptive management approach complete with research and monitoring. This project is based on the principles of collecting sound scientific data to be applied in such a way that steelhead in the basin can be managed using an adaptive approach. Our intention is to also increase production and work towards the delisting of Middle Columbia Steelhead. Research and monitoring efforts will allow us to quantify changes over time and determine if recovery planning goals are being met. The scientific foundation of the FWP is based on sound scientific principles. Specifically, ecological conditions are addressed as well as the importance of diversity within the ecosystem. As an ESA threatened species, steelhead are linked with many ecological functions; therefore, the productivity and abundance of the species will have an effect on the entire ecosystem. Monitoring and increasing production in the Deschutes River will not only work towards steelhead recovery but improve ecosystem function as a whole. We will also be able to address biological objectives on the subbasin level, identifying and assisting managers in addressing habitat based limiting factors for steelhead. Identification of and improvements to factors limiting production will produce a measurable outcome.

The 2000 NWP overarching objectives identifies the need for sufficient populations for harvest directly linked to tribal treaty rights and trust responsibility. The CTWSRO's overall goal is to restore Middle Columbia steelhead to sustainable, harvestable numbers for the Tribal membership in perpetuity. Specific objectives are to: 1) restore the widest possible set of healthy naturally reproducing populations of salmon and steelhead in each relevant province by 2012 and 2) increase total adult salmon and steelhead runs above Bonneville Dam by 2025 to an average of 5 million annually in a manner that supports tribal and non-tribal harvest (NPCC 2005).

Although this project will be based in the Deschutes River, it is known that mainstem Columbia River Dams are a primary limiting factor for Middle Columbia Steelhead. We are currently unable to quantify those effects in westside Deschutes River tributaries. With the overall focus of the NPCC FWP Mainstem Amendments on improvements to mainstem Columbia River dams, improvements to areas detrimental to steelhead will be identified and/or addressed. With a smolt-to-adult ratio calculation we should be able to determine effects of the mainstem Columbia River over time including survivability. This will assist in evaluating if the biological objectives are being met including if improvements are being made that will increase lifecycle survival.

The Middle Columbia Steelhead Recovery Plan (MCSRP) identified actions needed to restore the species such that they are self sustaining within their ecosystem and no longer in need of ESA protection (NMFS 2008). Westside Deschutes River populations are of concern to the MCSRP because of their "high risk" categorization for extinction within 100 years. For the DPS to be de-listed, key actions must be taken including: 1) reduction of out-of-basin strays, 2) restoration of connectivity into historic spawning and rearing areas behind passage barriers, 3) coordination and dissemination of information, 4) improving survival, and 5) addressing habitat problems that decrease productivity. While not all of these actions are specifically addressed in this proposal, CTWSRO is actively working on all addressing these issues. An organized, cooperative approach will be taken to monitoring activities so that information collected by this project can assist in meeting all five key actions. This will include making the results available through electronic form and presenting results in regional forums which will reduce redundancy in future studies.

With the new FERC license for operation of the Pelton-Round Butte Complex (PRB), anadromous fishes will be reconnected with habitat in the Middle Deschutes, Crooked, and Metolius rivers. (ODFW and CTWSRO 2008) Recent reintroduction of steelhead fry into Whychus Creek and the Crooked River basin, upstream of the PRB addresses one of the objectives of the MCSRP. The Tribes have played an active role in cooperation with Oregon Department of Fish and Wildlife and Portland General Electric. Reintroduction of fish into Whychus Creek is likely to help us meet recovery planning goals.

Location of the problem

The Deschutes River originates at Little Lava Lake and flows 252 river miles (RM) to the Pacific Ocean (Nehlsen 1995). Drainage area consists of 10,500 square miles (including tributaries) and joins the middle Columbia River at RM 204. The Pelton Round Butte Hydroelectric Project (PRB), a series of three dams that separates the lower and middles sections of the Deschutes River, blocks all anadromous movement. The reregulation dam is the lowest of the three dams at RM 100.

The lower Deschutes sub-basin has numerous tributaries including Warm Springs River (RM 84), Shitike (RM 94), Trout (RM 88), Buck Hollow (RM 44), and Bakeoven Creeks (RM 52) which provide summer steelhead spawning and rearing habitat (Figure 4).

Shitike Creek and Warm Springs River are two major tributaries located entirely on the Warm Springs Reservation. Shitike Creek originates at Harvey Lake and has a drainage area of 104 square miles. Approximately 7.6 miles upstream from the mouth of the Deschutes River, there is a 0.8 mile gorge that may inhibit anadromous fish migration into the upper portion of the watershed at periods of low flow. Springs and small tributaries feed into Shitike. Land management activities include grazing, timber harvest, anthropogenic activities, and conditional use in the upper portion of the watershed.

The Warm Springs River is the largest on the reservation at 527 square miles. Its principle water sources are springs and tributaries. A weir located at The Warm Springs National Fish Hatchery (RM 10.6) blocks all adult migration. Only wild fish are allowed to pass upstream. There are three main tributaries to the Warm Springs River, Beaver Creek, Mill creek, and Badger Creek, which provide spawning and rearing habitat for summer steelhead.

D. Relationships to other projects

Table 2. Relationship to existing projects

Funding Source	**Project #**	**Project Title**	**Relationship (brief)**
BPA	200201600	Evaluate Status of Lamprey in the Deschutes Subbasin	Assist with limiting factor monitoring – specifically water temperature monitoring
BPA	200715700	Bull Trout Status and Abundance	Assist with limiting factor monitoring – specifically water temperature monitoring
BPA	200830400	Spring Chinook Production Monitoring	Will coordinate data collection and cost share project equipment.
BPA	200830100	Deschutes Basin Restoration Program	Will coordinate data collection, collaborate and share information for habitat restoration projects, will assist with limiting factor monitoring and data synthesis.
CRITFC	n/a	Adult steelhead kelt reconditioning	Will coordinate activities where possible and share project information
BPA	199404200	Trout Creek	Habitat improvement to increase steelhead production; Hatchery steelhead removal
OR Wildlife Heritage Fund	n/a	Bakeoven and Buckhollow Creeks Stray Hatchery Steelhead Assessment Project	Summer steelhead research that involves estimating run-size, life history, run timing, and removing hatchery steelhead from Buck Hollow and Bakeoven Creeks.

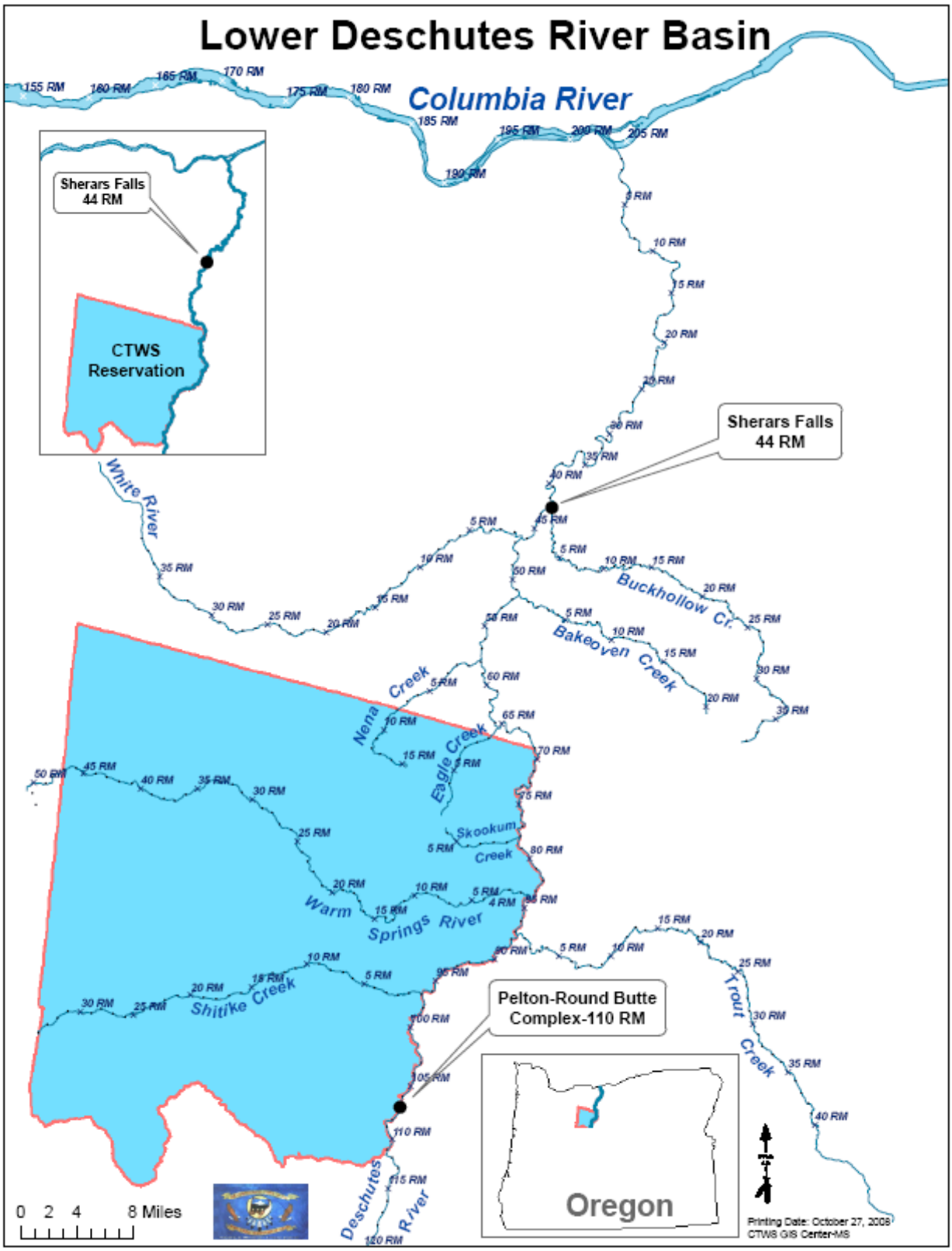

Figure 4. Lower 100 miles of the Deschutes River basin from Pelton Dam to the Columbia River.

E. Project history (for ongoing projects)
New project

F. Proposal biological/physical objectives, work elements, methods, and metrics
Key objectives of the project will focus on juvenile and adult steelhead monitoring of distribution and abundance; increasing steelhead production; improving life history knowledge; and determining genetic characteristics. Work will be conducted in the Warm Springs River watershed, Shitike watershed, and other lower Westside tributaries.

Objective 1: Provide management direction, planning, and administration of BPA projects

Work element 119: Manage and Administer Projects
The CTWSRO will be implementing several new BPA-funded programs in 2009. Three of these: Steelhead Production Monitoring, Chinook Production Monitoring, and Sockeye Development (See Table 3) will be administered under the CTWRSO Fish Production Program. As such, many of the duties, tasks, and equipment involved with data collection for these projects will be shared by CTWSRO personnel.

Objective 2: Determine out-migration timing and relative abundance of juvenile *O. mykiss* in the Warm Springs River watershed and Shitike Creek.

Work element 157: Operate Rotary Screw Traps in the Warm Springs Watershed and Shitike Creek
Rotary screw traps will be placed throughout Warm Springs River basin and in Shitike Creek (Table 3). All RST's will be operated in the spring from March through June and in the fall from October through December. The Mill Creek, 4-ft RST may be operated during varying times of the year. We will be a secondary collector on this trap; however, the CTWSRO Kelt Reconditioning project will be primary.

Traps will be run 4 or 5 days a week. All fish collected from the traps will be anesthetized using MS-222, identified to species, counted and placed in a recovery bucket. The first 20 of each species on each day will be, measured, weighed. After recovery, all fish will be returned to the river. On the first 3 days of each week, all juvenile steelhead will be marked with a fin clip (upper or lower caudal on a rotating weekly basis) and released approximately 1/2 mile upstream of the trap. Recaptured individuals will be counted (but not measured or weighed) as a method of estimating trap efficiency.

Work Element 156: Investigate methods for monitoring juvenile steelhead in Mill Creek.
Although Mill Creek does support anadromous steelhead, the creek is most likely too small for deployment of a 5-ft screw trap downstream of RM 10. The CTWSRO will investigate other methods of monitoring production of juvenile salmon, which may include trapping, seining, mark - recapture efforts, or other methods.

Work Element 162: Analyze/Interpret Data
The data collected at the screw traps will be used to generate estimates of the number of juvenile *O. mykiss* outmigrating from the Warm Springs River, tributaries to the Warm Springs River, and Shitike Creek in the spring and fall. Estimates will be generated for all age classes of O.

mykiss. The proportion of steelhead and resident redband trout will be determined by genetic analysis (see objective 3).

Population estimates will be generated using three methodologies: weekly data, seasonal data, and a bootstrap program on seasonal data. For each period of trapping, estimates will be generated for each group of fish (species and age) based on the number of unmarked fish caught, the number of fish marked, and the number of marked fish recaptured. The total estimate from each week will be summed to generate a seasonal estimate. Results from all three methodologies, including 95% confidence intervals, will be reported for each season and for each brood year.

Table 3. Watershed, stream, river mile, and trap diameter for rotary screw traps used to monitoring juvenile steelhead outmigrants.

Watershed	Stream	Location (RM)	Trap Diameter
Warm Springs	Warm Springs River	1	8
Warm Springs	Warm Springs River	28	5
Warm Springs	Mill Creek	15	4
Warm Springs	Beaver Creek	8	5
Shitike Creek	Shitike Creek	1	5

Objective 3: Design and install new monitoring infrastructure in Reservation streams

Work Element 165: Produce Environmental Compliance Documentation
Obtain local permits and ESA/NEPA compliance associated with the installation of monitoring infrastructure.

Work element 70: Steelhead / Salmon monitoring weir or PIT tag detection station
Using a contractor, design and install video monitoring system near the mouth of Shitike Creek

Work element 70: Warm Springs River Steelhead / Salmon monitoring weir or PIT tag detection station
Using a contractor, design and install a full duplex PIT tag array near the mouth of the Warm Springs River

Work element 70: Shitike Creek Steelhead / Salmon monitoring weir or PIT tag detection station
Description: Using a contractor, design and install a full duplex PIT tag array near the mouth of Shitike Creek

Objective 4: Estimate adult summer steelhead smolt-to-adult returns (SAR) in Warm Springs River subbasin.

PIT tag technology has been used successfully to monitor wild populations of steelhead throughout the Columbia basin. Tagging wild juvenile steelhead salmon at outmigrant traps would allow for investigation into several areas of interest, including outmigrating timing, SAR rates for different tributaries, and SAR rates for fall and spring outmigrants.

Work Element 165: Produce Environmental Compliance Documentation
Obtain local permits and ESA compliance associated with the spawning operations.

Work element 158: PIT tag juvenile *O. mykiss*
Approximately 2,000 - 5,000 juvenile steelhead will be PIT tagged at the Warm Springs River RST or through boat seining (Wilson et al. 2007). Fish that are collected will be tagged according to PTAGIS marking procedures and anesthetized with Tricaine Methanesulfonate (MS-222) (PTAGIS 1999). Marking crews will be trained to effectively PIT tag juvenile fish to minimize negative effects and mortalities. During the sampling period a tag retention test will be conducted to ensure quality control.

Work element 161: PTAGIS reporting
Integrate information collected in the Warm Springs River into the PTAGIS database.

Work element 162: Enumerate Escapement of adult wild steelhead in Warm Spring River
Wild summer steelhead that return to the Warm Springs River will be processed at WSNFH and passed upstream. Thus enumeration of wild summer steelhead at WSNFH will provide the escapement for Warm Spring River basin.

Work element 162: Estimate Smolt-to-Adult Ratios (SAR) of summer steelhead in the Warm Springs River
Summer steelhead smolt-to-adult ratios (SAR) have never been calculated in the Warm Springs River watershed. Prior to this project, a PIT tag interrogation site has not been available to delineate between resident and anadromous forms; therefore, we have not calculated SAR's. Currently an 8-ft rotary screw trap (RST) is operated at RM 1. We may also potentially operate RST's further in the Warm Springs Basin, including the mainstem, Beaver and Mill creeks. To increase the number of smolts tagged, other sampling techniques may be incorporated.

SAR will be estimated by the ratio of smolts PIT tagged to the number of returning PIT tagged adults detected at dams as they ascend the Columbia River using DART and PTAGIS databases (DART, PTAGIS). Because of the variability in life history, summer steelhead may spend 1 - 2 years (in some instances 3) in the ocean requiring multiple years of adult data collection in order to detect a single cohort.

Objective 5: Determine adult steelhead spawning distribution in Warm Springs River watershed and lower Deschutes Westside tributaries (Skookum, Nena, and Eagle creeks).

Work element 157: Spawning ground surveys within lower Deschutes Westside tributaries
Spawning ground surveys for summer steelhead will be conducted in the following lower Deschutes Westside tributaries: Beaver, Mill, Badger, upper and lower Warm Springs, Shitike, Skookum, Nena, and Eagle creeks.

A team of two or three surveyors will begin surveys at the top of each reach and walk downstream. For each survey, the date, time, and water temperature are recorded. When a redd is identified, it will be counted, and the area of the stream channel (left bank, right bank, or mid-channel) will be recorded. Typically each reach will be surveyed two to three times over the course of a six week period.

Work element 162: Data Analysis
Redd counts are summarized by reach, stream, and basin, and provide a method of comparing production from year to year, as well as helping to refine adult-to-redd ratios.

Objective 6: Determine genetic characteristics of Warm Springs River and Shitike Creek steelhead

Work element 158: Collect fin clip for genetics analysis from juvenile
It is currently unknown what percentage of juveniles captured in the RST's are resident or anadromous. In order to determine the population structure of *O. mykiss,* we will collected fin clips from steelhead captured in the first three days of RST operations. At the time fish are processed, a tissue sample will be collected and preserved in 95% ethanol.

Work element 158: Collect fin clip for genetics analysis from adults
The overwhelming influx of stray steelhead to the Deschutes basin has caused a need to evaluate the genetic composition of native stocks. All wild summer steelhead returning to Warm Springs River pass through a weir at WSNFH. To ensure hatchery fish are removed from system, all steelhead are handled. At the time fish are processed, a tissue sample will be collected and preserved in 95% ethanol.

Work element 162: Genetic Analysis
We will subcontract this work element.

Objective 7. Determine the feasibility of increasing steelhead productivity in the Warm Spring River watershed.

Work element 70: Install hatch boxes to incubate steelhead eggs
In coordination with CRITFC, a steelhead kelt reconditioning project has been implemented in Shitike Creek for the past 4 years. In 2009 the focus of the kelt reconditioning project will be moved to Warm Springs River basin. Wild summer steelhead will be collected from the basin and will be air spawned at WSNFH. Fish will then be "reconditioned" at WSNFH. Eggs from air spawned summer steelhead will be transported to hatch boxes and reared in the upper Warm Springs River and Beaver Creek.

Hatch box methodologies from ODFW STEP program will be used to incubate eggs.

Work element 158: Collect fin clip for genetics analysis
Eggs of air spawned steelhead will be reared in hatchboxes to an adequate release size. Before release, a small caudal fin clip will be collected from approximately 100 fry from each hatchbox. Tissue samples will be stored in vials containing 95% ethanol.

Work element 162: Genetic Analysis
We will subcontract this work element.

H. Facilities and equipment

Facilities and associated utilities will be provided by the Confederated Tribes of Warm Springs. New equipment purchases will include the cost of one new 5 foot screw trap (Objective 4), and PIT tag arrays equipment and installation (Objective 1). Other equipment purchases may include gear necessary for data collection, including waders, dry suits and snorkeling gear, inflatable kayaks and paddles, polarized sunglasses, nets, chemicals for fish handling, hand and power tools, The costs for these items may be cost shared among several BPA projects as well as PCSRF funds.

Training/Conferences
Annual attendance to American Fisheries Society to present current project results. Attend other conferences/trainings pertinent to the project.

I. References

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J. Key personnel

LISA HEWLETT-DUBISAR, PRINCIPAL INVESTIGATOR / PROJECT MANAGER
THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON

EDUCATION:
Portland State University, B.S Environmental Science, 2000

WORK EXPERIENCE:
The Confederated Tribes of Warm Springs
Fisheries Biologist, November 2005 - Present
Make recommendations and mitigations to conserve, protect, and enhance fisheries resources. Apply the Tribal Integrated Resource Management Plan to timber sales and other land use practices. Write biological assessments on ESA listed fish species. Review proposed projects and write biological evaluations. Frequently communicate with various state and federal agencies. Conduct spring Chinook, steelhead, and bull trout redd counts. Use GPS and GIS to geographically present field data. Construct a fish weir to collect summer steelhead kelts and to monitor underwater video to enumerate upstream migrating adult salmonids. Manage project budgets. Present project results in technical reports, maps, and professional presentations.

Oregon Department of Fish and Wildlife
Experimental Biology Aid*,* February 2005 – October 2005; June 2004 – October 2004; June 2001 – October 2001;
Performed various sampling techniques to determine escapement and productivity of spring Chinook and summer steelhead in the John Day subbasin. PIT tagged emigrating smolts using rotary screw traps and 100ft beach sein. Performed Chinook , steelhead, and bull trout spawning ground surveys. Identified fin marks, sex, origin, collect scale, kidney, genetic, and ovary samples from salmonid carcasses. Operated and navigated drift boat and jet sled down the Mainstem John Day River.

Department of Environmental Quality
Natural Resource Specialist 1, June 2004 – October 2004

Oregon State University
Research Assistant*,* February 2001 – June 2001

JOB-RELATED PUBLICATIONS:
Hewlett, L.M. 2007. The Confederated Tribes of the Warm Springs Reservation of Oregon. Shitike Creek Summer Steelhead (Oncorhynchus mykiss) Kelt Reconditioning:Reproductive Success, Monitoring, and Assessment.

Lovtang, **L. M. Hewlett**, and A. Mitchell. 2006. The Confederated Tribes of the Warm Springs Reservation of Oregon Fish Production Program. Annual Progress Report 2006.

Lovtang, J., D. Best, **L. M. Hewlett**, and A. Mitchell. 2005. The Confederated Tribes of the Warm Springs Reservation of Oregon Fish Production Program. Annual Progress Report 2005.

JENS LOVTANG, FISH PRODUCTION BIOLOGIST
THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON

Education
Oregon State University, M.S. Fisheries Biology, 2005
Humboldt State University, B.S Natural Resources Planning, 1995

Work Experience
Confederated Tribes of Warm Springs
Fish Production Biologist, November 2005 – Present
Current Duties: Oversee data collection, analysis, and reporting of the CTWSRO Fish Production Program, which includes monitoring of natural production of steelhead and spring Chinook salmon in reservation streams, and kokanee salmon in the Metolius River Basin. Participate in the cooperative management of the Warm Springs National Fish Hatchery.

Oregon Department of Fish and Wildlife, Corvallis, Oregon
Experimental Biology Aide, Gearhart Mountain Bull Trout project, July – August 2005
Experimental Biology Aide, Siletz River Fall Chinook Project, September - October 2005

Oregon State University, Corvallis, Oregon
Graduate Research Assistant (M.S. Candidate), January 2002 – June 2005

Portland General Electric, Madras, Oregon
Fish Technician, Pelton Round Butte Project April – November 1999

Deschutes National Forest, Sisters Ranger District, Sisters, Oregon
Seasonal Fisheries Biologist, 1996 – 1998

Recent Publications

Lovtang, J.C. 2008. Confederated Tribes of Warm Springs, Fish Production Program, 2007 Annual Report. Confederated Tribes of Warm Springs, Warm Springs, OR

Lovtang, J.C., M. Hill, R. Stocking, and B. Hodgson. 2008. Lake Billy Chinook / Metolius River 2007 Kokanee Spawning Population Studies. Tab 17 *in* Portland General Electric Pelton Round Butte Project, 2008 Annual Fisheries Workshop. Portland General Electric, Portland, Oregon.

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Confederated Tribes of the Warm Springs Reservation of Oregon and The United States Fish and Wildlife Service. 2007. Warm Springs National Fish Hatchery, 2007- 2011 Operational Plan and Implementation Plan. USFWS, Columbian River Fisheries Program Office, Vancouver, WA.

Lovtang, J.C., P. Galbreath, and S. Hyun. 2007. Using a Dual-Frequency Identification Sonar (DIDSON) to enumerate the spawning migration of Kokanee salmon into the Metolius River. Tab 19 *in* Portland General Electric Pelton Round Butte Project, 2007 Annual Fisheries Workshops. Portland General Electric, Portland, Oregon.

Arthur Mitchell, Lead Implementation Technician
THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON

Art has worked for the CTWSRO Department of Natural Resources since 2002. His experience with the CTWSRO Fish Production program includes serving as crew leader for spring and fall migrant trapping and the Shitike Creek steelhead kelt reconditioning program. Art coordinates field activities for the program, including snorkeling and redd counts, and oversees data entry for all field data collection.

Education
Graduated from Molalla Union High School
Molalla, Oregon 1986

Professional Experience
Confederated Tribes of Warm Springs, 2002 - present
Lead Technician, Fish Production Program
Duties: Coordinate and implement tribal fisheries research projects including operation and maintenance of field gear (e.g., picket weirs, migrant traps); maintain equipment; lead daily field crew activities; effectively communicate, orally and written; enter, verify, and assist with summarizing of field data; assist in report preparation; and coordinate field sampling activities with a variety of entities.

Ironworkers Union Local #27, Portland, Oregon
Apprentice Ironworker 2000-2002

Yakama Nation, Land Enterprises, Wapato, Washington
Irrigation Field Crew Boss, 1994-2000