Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal

Section 1. General administrative information

Bull Trout Genetics, Habitat Needs, L.H. Etc. In Central And N.E. Oregon

Bonneville project number, if an ongoing project 9405400

Business name of agency, institution or organization requesting funding
Oregon Department of Fish and Wildlife

Business acronym (if appropriate) ODFW

Proposal contact person or principal investigator:

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Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name
Confederated Tribes of the Warm Springs Reservation	Confederated Tribes of the Warm Springs Reservation	Warm Springs, OR 97761	Terry Luther
USDA, Forest Service	Umatilla National Forest, 2517 S.W. Hailey	Pendelton, OR 97801	John Sanchez
University of Montanta	Department of Biological Science	Missoula, MT 59812	Fred Allendorf Ph.D.

NPPC Program Measure Number(s) which this project addresses.
10.5A.2

NMFS Biological Opinion Number(s) which this project addresses.

Other planning document references.
Metolius Basin Subplan-ODFW, Oregon Bull Trout Status Report - ODFW, Integrated Resources Managment Plan - Confederated Tribes of the Warm Springs Reservation

Subbasin.
Deschutes, John Day, Grande Ronde, Umatilla, Walla Walla, Powder, Malheur, Pine, Imnaha, Hood

Short description.
Provide essential scientific information for the protection, management and recovery of bull trout populations in Oregon and the Pacific Northwest..

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
	Anadromous fish		Construction		Watershed
X	Resident fish		O & M	X	Biodiversity/genetics
	Wildlife		Production	*	Population dynamics
	Oceans/estuaries	X	Research	*	Ecosystems
	Climate		Monitoring/eval.		Flow/survival
	Other		Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement		Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.
Genetics, spawning, DNA, interactions with exotic species, life history, habitat, temperature requirements, migration, timing, ecological interactions, trapping, population status and trends

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9202604	Spring Chinook Early Life History Study	They provide information on bull trout encountered in sampling and capture fish for tagging.
940400	Willamette Bull Trout Study	They aid sampling for genetics, and participate in information exchange
8810808	STREAMNET	We provide information and maps for website and database.

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine the genetic characteristics of Oregon bull trout populations.	a	Collect samples from bull trout groups within the 11 Oregon river subbasins of the Columbia Basin.
1		b	Conduct nuclear DNA analysis of those samples collected in task a
1		c	Determine spatial relationships between populations between populations, metapopulation structure and estimates of genetic variation within and among those populations.
2	Determine distribution of juvenile and adult bull trout and habitats associated with that distribution in portions of the Grande Ronde, John Day, Deschutes and Walla Walla subbasins..	a	Identify areas where bull trout spawn
2		b	Identify movement patterns of radio-tagged migratory juvenile bull trout.
2		c	Identify movement patterns and characterize habitat use of radio-tagged adult bull trout.
2		d	Map juvenile and adult distribution using the Geographic Information System (GIS).
3	Determine relationships between stream temperature and distribution of bull trout.	a	With thermographs, identify summer temperatures experienced by juvenile bull trout in selected streams.
3		b	With thermographs and telemetry, identify fall through spring temperatures experienced by migrant juvenile bull trout in selected streams of the John Day subbasin.
3		c	Primarily with thermistor telemetry identfy seasonal

			temperatures experienced by adult bull trout in the Walla Walla, John Day and Grande Ronde subbasins
4	Determine fluvial and resident life history patterns in the upper John Day subbasin.	a	Trap downstream migrant juvenile and subadult bull trout and implant them with PIT (passive integrated transponder) tags
4		b	Trap upstream migrant adult bull trout, sample for PIT tags and mark them to permit visual identification.
4		c	Collect scales and length data to determine length at age.
5	Characterize interactions between bull trout and introduced brook trout.	a	Determine the distribution of sympatric bull trout and brook trout populations
5		b	Estimate the amount of hybridization between bull trout and brook by dorsal fin pigmentation and genetic analysis.
5		c	Characterize invertebrate communities in bull trout and brook trout zonations
5		d	Identify food habits feeding behavior of bull trout alone and in sympatry with brook trout.
5		e	Determine a basis for assessing the relative risk to bull trout by brook trout.
6	Establish guidelines to monitor the abundance of bull trout using spawning surveys	a	Identify variation in spawning distribution.
6		b	Identify variation associated with life history form.
6		c	Estimate variation among spawning surveyors
6		d	Determine variation in spawning timing between years.
6		e	Determine duration of redd visibility

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	5/1995	9/2000	16.60%
2	5/1995	9/2001	26.00%
3	5/1996	9/2001	14.70%
4	3/1997	9/2001	18.10%
5	5/1996	9/2001	12.80%
6	5/1996	9/2001	11.80%
			TOTAL 100.00%

Schedule constraints.
None known

Completion date.
2001

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel		$118,300
Fringe benefits	at 36%	$42,587
Supplies, materials, non-expendable property		$11,840
Operations & maintenance		$3,950
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		$ 0
PIT tags	# of tags:	$ 0
Travel		$25,208
Indirect costs	at 22.9%	$46,232
Subcontracts	$80,000 to CTWSR; $11,400 to USFS	$91,400
Other		
TOTAL		$339,517

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$330,000	$280,000		
O&M as % of total	1.50%	1.50%		

Section 6. Abstract

The goal of the project is to provide scientific information that will help develop a protection and recovery plan for weak stocks of native bull trout in Oregon's proportion of the Columbia Basin. The factors addressed in the study; status, habitat needs, genetics, life history characteristics, interactions with exotic species and other limiting factors have been identified by many authors as key factors in the survival and recovery of bull trout populations (Howell and Buchanan, 1992; Rieman and McIntyre, 1993; Kostow, 1995; Buchanan et al. 1997). From these considerations we have derived specific objectives and tasks

1. Determine genetic characteristics of bull trout populations.
2. Determine distribution of juvenile and adult bull trout and associated habitats.
3. Determine relationships between stream temperature and bull trout distribution.
4. Determine fluvial and resident life history patterns in the upper John Day subbasin.
5. Characterize interactions between bull trout and introduced brook trout.
6. Establish guidelines to monitor abundance of bull trout populations using spawning surveys.

Each of these objectives are addressed using established techniques including DNA analysis, systematic sampling of streams, habitat surveys, spawning surveys, radio tagging, and trapping. Data are summarized and statistical analysis performed to test specific hypothesis. The project is planned through 2001. We will have addressed all objectives by this time and provide guidance to fisheries managers on these subjects. The results of our research will be presented in the form of annual reports; presentations at professional meetings and publications in peer-reviewed journals.

Section 7. Project description

a. Technical and/or scientific background.

Bull trout are a native species listed as "sensitive" by the state of Oregon and USDA Forest Service and have been proposed for listing by the U.S. Fish and Wildlife under the Endangered Species Act. It is estimated that bull trout occupy only 36% of their former range south of the Canadian border. Over 78 percent of the historic bull trout populations in the proposed study subbasins are classified as having a moderate, high risk of extinction or probably extinct (Howell and Buchanan, 1992; Buchanan et al. 1997). Bull trout numbers have been severely impacted by harvest pressure, habitat degradation, passage barriers and interactions with exotic species. Past and current efforts to assess, protect and restore existing bull trout populations have been limited by the lack of basic information about bull trout ecology, life history and genetics (Howell & Buchanan, 1992; Rieman and McIntyre, 1993; Kostow, 1995; Rieman and McIntyre, 1995; Buchanan et al. 1997; Spruell and Allendorf, 1997). The overall objective of our study is to provide scientific information in these areas. This will allow threats to existing bull trout populations to be correctly evaluated and management decisions pertaining to bull

trout conservation and recovery to be effectively implemented and monitored.

b. Proposal objectives.

All findings from our research will be published in the form of annual reports, special reports or articles in peer reviewed journals.

Objective 1. Determine the genetic characteristics of Oregon bull trout populations. The null hypothesis associated with this objective is " H_o: There is no significant genetic difference among Oregon bull trout populations". This objective will result in a description and inventory of the genetic structure of Oregon bull trout populations (Spruell and Allendorf, 1997). Knowledge of the limits of interbreeding populations is one of the cornerstones of scientific fisheries management. These data are also necessary to assess and maintain genetic diversity and integrity of bull trout populations (Spruell and Allendorf, 1997).

Objective 2.0 Determine distribution of juvenile and adult bull trout and habitats associated with that distribution. genetic data could also be useful in providing an empirical basis for validation and application of the metapopulation theory to the conservation of the species (Rieman and McIntyre, 1993). This will allow assessment and tracking of bull trout populations and guide efforts towards habitat protection, enhancement, and restoration. Such habitat information is necessary for the protection of existing critical habitat and any restoration efforts that my be undertaken. Bull trout distribution within a basin may vary widely depending on life history, life stage and season. The overall null hypothesis to be tested is "$H_{o:}$ There is no significant difference between observed bull trout distribution and a random distribution". Distribution maps from this objective have been made available to management biologists and posted on the Streamnet world wide web site (Buchanan et al., 1997).

Objective 3.0 Determine relationships between stream temperature and distribution of bull trout. This objective addresses one of the most critical habitat factors associated with bull trout in Oregon (Buchanan and Gregory, 1997; Houslet and Riehle, 1997). This will help to identify the role that temperature plays in shaping bull trout distribution. This information also relates to efforts to restore populations by habitat enhancement to lower instream temperatures. The null hypothesis associated with this project is: "H_o: Stream temperature has no significant correlation with the distribution of bull trout".

Objective 4.0 Determine fluvial and resident life history patterns in the upper John Day subbasin. This objective regards the gathering of basic life history data to allow tracking and management of migratory and resident bull trout populations. One of the major components of this goal examines the role of non-migrant fish in otherwise migrant bull trout populations. Knowledge of life history characteristics, such as spawning and migration behavior, is the basis of scientific fisheries management. The null hypothesis

associated with this project is: “Ho: Fluvial and resident life history forms do not co-exist within a stream”.

Objective 5.0 Characterize interactions between bull trout and introduced brook trout. Over 50% of Oregon bull trout populations are sympatric with introduced brook trout (Buchanan et al., 1997). Brook trout may directly compete with bull trout for habitat and food and have also been observed to hybridize with bull trout (Markle, 1992). The hypothesis to be tested examine the role of habitat and temperature in bull trout/brook trout interactions. Additionally , experiments will be performed to detect if competition actually occurs between bull trout and brook trout. Hypothesis to be tested include :

“H_o: the distribution of bull trout and brook trout in streams where they both occur is not significantly different than would be expected from a random distribution”.

“H_o: There is no significant difference in habitat between areas inhabited by bull trout and areas inhabited by brook trout within the same stream” and :

“ H_o: There is no significant difference in water temperature between areas inhabited by bull trout and areas inhabited by brook trout within the same stream”

“H_o: The presence of brook trout has no significant effect on the feeding behavior or growth of bull trout.”

“H_o: The diet of bull trout does not change in the presence of brook trout”.

Objective 6.0 Establish guidelines to monitor the abundance of Oregon bull trout using spawning surveys. Little information is available on bull trout abundance and population trends (Rieman and Mcintye, 1993). Bull trout are a rare and cryptic species so enumerating them is very difficult. Spawning surveys have been used with a number of salmonid species to monitor populations. This objective examines variability associated with using spawning surveys, provides baseline data for designing surveys and evaluates their effectiveness as a monitoring tool. Without effective monitoring of populations it is not possible to protect and restore Oregon bull trout populations. Hypothesis to be tested include:

“H_o: There is no significant difference between years in the distribution of redds within a stream”.

“ H_o: There is no significant difference between redd counts by different surveyors”.

“ H_o: There is no significant difference between years in spawning timing”.

“H_o: There is no significant difference in the variation of distribution of redds within a stream between resident and fluvial forms”.

“ H_o: There is no significant difference in variation redd counts by different surveyors between resident and fluvial forms”.

“ H_o: There is no significant difference in variation in spawning timing between fluvial and resident forms”.

c. Rationale and significance to Regional Programs.

These studies will further the goals of FWP by providing scientific information that will help protect and restore weak stocks of native bull trout. These stocks have been threatened or changed by migration barriers which limit spawning and rearing habitats and which may limit the prey base along with other important limiting factors such as genetic and random risks, over harvest, non-native species introductions and habitat loss. Like salmon and steelhead, bull trout have been impacted by hydroelectric development in the mainstem Columbia River, the mainstem Snake River, and the various subbasins. Hydroelectric dams may also have isolated small bull trout populations and prevented genetic exchange. The work of Spruell and Allendorf (1997) suggest that maintaining the genetic diversity of bull trout will require the continued existence of many populations throughout the Columbia Basin. Recent restrictive angling regulations prohibit harvest of bull trout in all of Oregon except for limited populations in the Deschutes Basin (Buchanan et al, 1997). Fishery managers need an increased understanding of movement patterns, habitat needs, and the effects of exotic brook trout to protect and restore Oregon's bull trout.

d. Project history

The Project was initiated in late 1994. Beginning phases of the project included several cooperative meetings with local subbasin bull trout working groups comprising tribes, utilities, landowners, USFS, U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and ODFW. Major cost-share funding from permanent positions and capital have been provided by ODFW, USFS and the Confederated Tribes of the Warm Springs Reservation. A Steering Committee with representatives of BPA, ODFW, Tribes, BLM, USFS, USFWS., Portland General Electric, Pacificorp and Native Fish Society meets annually to technically review the project. Fieldwork and data collection began in spring 1995.

Publications:
Several monthly and quarterly reports
1995 Annual Report (Hemmingsen et al., 1996),
1996 Annual Report (Bellerud et al., 1997)
1997 Annual Report (in progress),
Oregon Bull Trout Status Report (Buchanan et al., 1997),
Nuclear DNA analysis of Oregon Bull Trout (Spruell and Allendorf, 1997)

This study has collected data towards completion of all 23 of tasks listed in our work plan for the study.
1. We non-lethally sampled 46 bull trout populations for nuclear DNA analysis. These samples have been analyzed and the results are included in the 1996 annual report and in a special genetics report (Spruell and Allendorf, 1997).
2. Bull trout historical and current distribution data and status were compiled for Oregon’s portion of the Columbia River system. A statewide status report on Oregon’s bull trout was published in 1997 and distribution data were entered into ODFW

Geographical Information System (GIS) bull trout database (Buchanan et al., 1997).
3. Conducted distribution and habitat surveys and sampled for the incidence of bull trout/brook trout hybrids in 16 streams with sympatric populations of brook trout and bull trout (1996 and continuing). Data summary and analysis will be reported in the 1996 and 1997 annual report and the 1998 meeting of the Oregon chapter, American Fisheries Society.
4. Collected two years of summer temperature data from streams with sympatric bull trout and brook trout populations (1996 and continuing).
5. Collected two years of bull trout spawning data. This included intensive and extensive surveys of three selected watersheds to examine some of the assumptions inherent in spawning surveys. Single exploratory surveys were also made to identify previously undocumented spawning areas. (Bellerud et al., 1997)
6. We radio - tagged and monitored movement of 33 adult and 48 juvenile bull trout in the Grande Ronde, Walla Walla and John Day subbasins in 1997 (continuing).
7. We determined a relationship between observed injuries and fish size in bull trout captured by electrofishing (Hemmingsen et al. 1996). These data were incidental to efforts for collection of samples for DNA analysis.
8. We collected data during 2 years to describe the species composition of macroinvertebrates available to both sympatric and allopatric bull trout and non-native brook trout in 2 streams within different subbasins. Results indicate a consistent use of the same food resources by both species rather than partitioning among them.
9. We conducted an experiment to determine the effect of brook trout on the foraging behavior of bull trout. We detected interactions between species that indicate direct competition for existing resources, although samples sizes were low and additional replication will be necessary. Growth results are best described by antagonistic interactions that caused energy depletion in bull trout.

e. Methods.

Methods for project work undertaken during 1995-97 is described in annual reports for the project for those years (see section d. Project history). The following discussion focuses on methods for tasks to be undertaken in FY 98-01. It should be noted that the previous work represents a substantial investment in time, effort, and funding. Funding in FY 99-01 is needed to complete the field work, analyze the data, and report the findings so that the results can be applied and the benefits of those investments realized. For example, adult bull trout tagged in 1998 will potentially require tracking through 2000.

The tasks in this study frequently integrate multiple objectives. For example, fish captured for radio-tagging and subsequent tracking provide data on length at age, life history, migration patterns, habitat and water temperature association, maturity, spawning locations, and growth when recaptured.

Objective 1.0
1.1 Genetic samples were collected from 46 bull trout populations in 11 subbasins in Oregon. Sampling sites were chosen to represent the range of bull trout in central and eastern Oregon. Several subbasins were selected to more intensively sample subpopulations.
Collection methods are described in Hemmingsen et al. 1996. Additional samples will be collected in FY98 in Warms Springs River and Shitike Creek since results from previous samples were anomalous.
1.2 Tissue samples were sent to the University of Montana for analysis by polymerase chain reaction and DNA sequencing techniques (Spruell and Allendorf 1997)
1.3 The results of this analysis were presented in a project report (Spruell and Allendorf 1997).

Objective 2.0.
2.1 Juvenile bull trout were captured on their downstream migration using screw and weir traps and PIT (passive integrated transponder) tagged (Bellerud et al. 1997). A subsample (n=48) was radio- tagged and tracked. Downstream trapping, tagging, and tracking will continue during FY98-01. An additional screw trap will be operated in Mill Cr. (Walla Walla subbasin) beginning in FY 98. Approximately 50 downstream migrants will be radio-tagged in FY 98 and in FY 99.
2.2 Large (>900 gr.), upstream migrating bull trout assumed to be adults were captured in 1997 by angling and traps (Bellerud et al. 1997). Radio tags were surgically implanted in 33 fish. These fish are currently being tracked. In FY 98 approximately 45 additional fish will be radio-tagged; 15 in Mill Cr. (Walla Walla subbasin), 20 in the Wenaha River (GrandeRonde subbasin), 10 in the upper John Day River. These fish will be tracked through FY01.
2.3 Data on bull trout movement patterns and habitat associations will be compiled and entered into a computer database. Adult and juvenile bull trout distribution will then mapped using ArcInfo geographic information system (GIS) software.

Objective 3.0
3.1 Electronic temperature loggers were placed within surveyed streams in areas identified as bull trout zones, brook trout zones and where bull trout and brook trout distribution overlapped. At the end of the sampling season the temperature loggers were recovered and the data they contained downloaded to a PC for summary and analysis (Bellerud et al. 1997).
3.2 We implanted thermistor (i.e., temperature-reporting) radio tags in 5 fish in the Walla Walla subbasin and in 10 fish in the WenahaRiver (Grande Ronde subbasin). Most of the radio tags used in FY98 and FY99 will be thermistor type.
3.3 Water temperature and fish locations from radio tracking data will be entered into a computer database. This data will be used to create fish distribution and temperature map layers in ArcInfo.

Objective 4.0
4.1 Juvenile bull trout were captured on their downstream migration using screw and

weir traps and PIT tagged (Bellerud et al. 1997). A subsample (n=48) was radio- tagged and tracked. Large (>900 gr.), upstream migrating bull trout assumed to be adults were captured in 1997 by angling and traps (Bellerud et al. 1997). Trapping, tagging, and tracking will continue during FY98-01 to establish fluvial migratory or resident life history patterns.
4.2 Scales and lengths of fish collected in traps will be taken and analyzed to determine age/length relationships (Bellerud et al. 1997).

Objective 5.0.
5.1 We surveyed streams identified as containing both bull trout and brook trout by one-pass electrofishing (Bellerud et al. 1997). Physical habitat surveys were conducted for comparison of bull trout and brook trout zones (Bellerud et al. 1997).
5.2 Fish collected during task 5.1 were examined to identify the presence of brook trout/bull trout hybrids. Hybrids were identified using the characters in Markle (1992): dark spots on the dorsal fin, vermiculation and tri-color ventral fins. Fin clips were also gathered from fish identified as hybrids for verification by genetic analysis.
5.3 Aquatic invertebrate samples were collected from the bull trout, sympatric and brook trout zones of streams. Benthic samples were collected from six pools in each zone and drift samples were collected from three pools in each zone. Macroinvertebrates samples were identified to family and enumerated (Merrit and Cummins, 1996). From these samples relative abundance was estimated for the benthic and drift communities. Non-lethal stomach samples (Meehan and Miller, 1978) were also collected from 10-20 bull trout and brook trout from each zone. Samples were identified and enumerated to identify macroinveribrate family and size composition consumed by each species in each reach.
5.4 Bull trout and brook trout were placed in enclosures in stream reaches where they are sympatric (Fausch, 1988). Treatments included enclosures with only bull trout and bull trout with brook trout. Fish were marked to allow identification of individuals and observations of feeding behavior were conducted weekly (Fausch and White, 1981). After six weeks the fish were removed from the enclosure weighed and measured to estimate comparative growth and released. Results will be presented in a master's thesis, which will be published by Oregon State University in FY99.

Objective 6.0
6.1 Spawning surveys have been conducted in Mill Creek (Walla Walla subbasin), the Little Minam River (Grande Ronde subbasin) and Silver Creek (Powder River subbasin) (Bellerud et al. 1997) to evaluate spawning survey methodology. Mill Creek has a population of large, migratory spawners. The Little Minam has a relatively large population of resident fish. Silver Creek has a very depressed population of resident fish. These streams will allow us to evaluate potential variation in life histories and spawning substrate relative to spawning surveys. Each creek will be surveyed 3-4 times between the end of August and the end of October during FY 98-00. By sampling the reaches multiple times during the spawning season we will be able to identify variation in spawning timing. Additionally, redds are evaluated for visibility to develop an estimate of the amount of time the redds remain visible (Bellerud et al. 1997), which

can be used to help determine survey frequency.
6.2 All tributaries upstream of the lowest reach surveyed will be surveyed (Bellerud et al. 1997). From this data we will determine variation in spawning distribution within the drainage.
6.3 Selected reaches will be surveyed by experienced and inexperienced surveyors to estimate observer variation (Bellerud et al. 1997).

f. Facilities and equipment.

The main facilities used in this study are the ODFW laboratory at Corvallis, Oregon, the ODFW research office and the Pacific Northwest Research Station (USFS) at La Grande, Oregon and the Confederated Tribes of Warm Springs Reservation offices at Warm Springs, OR. We also receive support from other ODFW and U.S. Forest Service facilities.

The ODFW laboratory at Corvallis, Oregon includes office facilities, a computer network, library, and a scale reading laboratory. Many facilities at nearby Oregon State University are also available to ODFW personnel.

The research office at LaGrande, Oregon provides office space, computers, and limited lab space. There is also a site for equipment storage and other support available from the ODFW regional office. The facilities of Eastern Oregon University where the office is located are also available.

g. References.

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Meehan, W., and R. Miller. 1978. Stomach flushing: Effectiveness and influence on survival and condition of juvenile salmonids. Journal of the Fisheries Research Board of Canada 35:1359-1363.

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Theisfeld, S.L., A.M. Stuart, D.E. Ratliff and B.D. Lampman. 1996. Migration patterns of adult bull trout in the Metolius River and Lake Billy Chinook, Oregon. Oregon Department of Fish and Wildlife Report 96/1. Portland, Oregon.

Williams, R.N., R.P. Evans and D.K. Shiozawa. 1997 Mitochondrial DNA diversity in bull trout form the Columbia Basin. Proceedings of the friends of the bull trout conference. Calgary, Alberta.

Section 8. Relationships to other projects

We have developed working relationships with a number of other projects and agencies during the course of our research. We received data and fish have been captured for us by the Lookingglass re-introduction project (Confederated Tribes of the Umatilla Indian Reservation, Lower Snake Restoration) and spring chinook early life history project (ODFW, BPA) in the Grande Ronde subbasin. Data has been exchanged

with the ODFW Willamette bull trout project and a USFS/ Idaho Department of Fish and Game bull trout study in the Rapid River, ID. The program has also supported a graduate research program in conjunction with the Department of Fisheries and Wildlife at Oregon State University. We have cooperated with the Walla Walla Ranger District of the U.S. Forest Service (USFS) in conducting spawning surveys of the Mill Creek drainage. We are co-operating with the Confederated Tribes of The Warm Springs Reservation, as subcontractors they are updating distribution and relative abundance, spawning distribution and movement patterns of bull trout on and bordering Warm Springs Reservation lands. We have also exchanged data with many of the fishery management biologists from ODFW and USFS located in areas of Oregon where bull trout occur. Since we have been conducting our radio tracking study we have provided technical assistance to the Burns Piaute Tribe for a study in the Malheur subbasin, a cooperative study funded by the USFS and Idaho Public Power in the Pine Creek subbasin and an EPA funded study being conducted by ODFW in the Umatilla subbasin. We have also served as scientific advocates for bull trout by encouraging interest by fisheries managers and biologists and providing a source of information with documents such as our annual reports and the Oregon Bull Trout Status Report.

Section 9. Key personnel

Dave Buchanan, Principle Investigator, 0.5 FTE- no charge to BPA
Blane Bellerud, Project Manager, 1.0 FTE
Alan Hemmingsen, Project Manager, 0.5 FTE
Phil Howell, Project Manager, 0.25 FTE - no charge to BPA
Terry Luther, Project Manager, 0.1 FTE - no charge to BPA

David V. Buchanan
Project Leader, Oregon Department of Fish and Wildlife Bull Trout Project

Education:
B.S. in Fisheries Science, Oregon State University, 1967
M.S. in Fisheries Science, Oregon State University, 1970

Professional Experience:
1987-Present: ODFW, Research Project Leader, Native Trout Project, Corvallis , OR. Wrote proposal and conducted original research on several projects studying bull trout, rainbow trout and redband trout.

1986-1987: ODFW, Assisted in developing Oregon's statewide trout plan.

1979-1988: ODFW, Research Project Leader, Restoration of the Native Winter Steelhead Run on the South Santiam River above Foster Dam, Corvallis, OR.

1974-1979: ODFW, Assistant Project Leader, Willamette River Steelhead, Development and assessment in the Willamette River Basin, Corvallis, OR.

1972-1974: Oregon State University: Research Assistant, Toxicity of 13 pesticides to Dungeness crab, OSU Marine Science Center, Corvallis, OR.

1970-1972: Alaska Department of Fish and Game, Regional shellfish biologist, studied king crab, Dungeness crab, pink shrimp, pink salmon and steelhead, Petersburg, AK.

Relevant Publications:
Howell, P.J. and D.V. Buchanan, editors. 1992. Proceeding of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

Buchanan, D.V., M.G. Wade and D.L. Higley. 1993. Restoration of the native winter steelhead run on the South Santiam River above Foster Dam, Completion Report, Oregon Department of Fish and Wildlife, Portland, Oregon.

Buchanan, D.V., A.R. Hemmingsen and K.P. Currens. 1994. Native trout project. Oregon Department of Fish and Wildlife Fish Research Project F-136-R-07, Annual Progress Report, Oregon Department of Fish and Wildlife, Portland, Oregon.

Buchanan, D.V. and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Proceedings of the friends of the bull trout conference. Calgary, Alberta.

Buchanan, D.V., M.L. Hanson and R.M. Hooton. 1997. Status of Oregon's bull trout. Oregon Department of Fish and Wildlife. Portland, Oregon.

Blane L. Bellerud Ph.D.
Fisheries Research Biologist, Oregon Department of Fish and Wildlife

Education:
B. S. in Marine Biology , Western Washington University, 1983
M.S. in Aquatic Biology, Central Washington University, 1989
Ph.D. in Aquatic Parasitology, Mississippi State University, 1994

Professional Experience:
Assistant Project Leader, ODFW Bull Trout Project, 6/96 to present.
Develop experimental strategies, protocols and plans, supervise seasonal employees, conduct sampling, summarize and analyze data, write reports.

Assistant Project Leader, ODFW Elk Creek Dam Project, 8/95-6/96
Develop experimental strategies, protocols and plans, supervise seasonal employees, conduct sampling, move spawning salmon by truck, summarize and analyze data, write reports.

Research Biologist, National Biological Service, 1/94 - 8/95
Develop experimental strategies, protocols and plans, supervise seasonal employees, conduct sampling, summarize and analyze data, write reports.

Relevant Publications:

Bellerud, B.L., S.Gunkel, A.R. Hemmingsen, D.V. Buchanan and P.J. Howell. 1997. Bull trout life history, genetics habitat needs, and limiting factors in central and northeast Oregon. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon.

Alan R. Hemmingsen
Fisheries Research Biologist, Oregon Department of Fish and Wildlife.

Education:
BS Fisheries and Wildlife Biology, Iowa State University, 1971,

Professional Experience:

1988 - Present:
Oregon Department of Fish and Wildlife, Assistant Project Leader, Native Trout Investigations.

Qualifications:
Since 1988 I have conducted or assisted various investigations on native trout in Oregon. Those investigations were designed to describe the diversity among native trout, determine threats to their sustainability, and foster awareness of their value. Specific projects involved genetic characterization of populations, description of life history traits, definition of migration patterns, and identification of critical habitat needs. Through these investigations I have obtained biological knowledge and field skills that can be directly applied to research efforts on Oregon bull trout.

Relevant Publications:

Currens, K.P., A.R. Hemmingsen, R.A. French, D.V. Buchanan, C.B. Schreck, and H.W. Li. In press. Introgression and susceptibility to disease in a wild population of rainbow trout. North American Journal of Fisheries Management.

Hemmingsen, A.R., R.A. Holt, and R.D. Ewing. 1986. Susceptibility of progeny from crosses among three stocks of coho salmon to infection by *Ceratomyxa shasta*. Transactions of the American Fisheries Society 115:492-495.

Hemmingsen, A.R., R.A. French, D.V. Buchanan, D.L. Bottom, and K.P. Currens. 1992. Native trout project. Oregon Department of Fish and Wildlife, Fish Research Project F-136-R, Portland.

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Simon, R.C., J.D. McIntyre, and A.R. Hemmingsen. 1986. Family size and effective population size in a hatchery stock of coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 43:2434-2442.

Philip J. Howell
Fisheries Biologist/Aquatic Ecologist
USDA Forest Service, Pacific Northwest Research Station

Education:

B.A. Rockhurst College, 1972
M.A. University of Missouri, 1976

Professional Experience

1992-Present, U.S. Forest Service, Interior Columbia Ecosystem Management Project-Science Team, project design and development, assistance with field work, data analysis and reporting, coordination with Forest Service.

1979-1992, Oregon Department of Fish and Wildlife, Project Leader, Corvallis, OR.

1979-1982, Oregon State University, Instructor, Corvallis, OR

Expertise:
I currently provide aquatic science oversight for the development of a management plan for federal lands in the interior Columbia Basin, which will address the habitat management needs of bull trout and other aquatic species. For that project I completed and assessment of the status, distribution and management of bull trout and other aquatic species east of the Cascades. I have also been a principal investigator of the BPA-Funded study of bull trout genetics, life history, habitat needs and limiting factors in eastern Oregon since the project began in 1995. in 1992 I completed the first assessment of bull trout distribution, status and management in Oregon.

Relevant publications:

Lee, D.C., J.R. Sedell, B.R. Rieman, R.F. Thurow, J.E. Williams, P.J. Howell and 15 co-authors. 1997. Broadscale assessment of aquatic species and habitats. pages 1057-1496 *in* Quigley, T.M., S.J. Arbelidae, editors. An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins. USDA Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Hemmingsen, A.R., D.V. Buchanan and P.J. Howell. 1996. Bull trout life history, genetics, habitat needs, and limiting factors in central and northeast Oregon. U.S. Department of Energy, Bonneville Power Administration, Portland, Oregon.

Stowell, R.P., P.J. Howell., B. Rieman and J. McIntyre. 1994. An assessment of the conservation needs for bull trout. USDA Forest Service. Missoula, Montana.

Ratliff, D.E. and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 in Howell, P.J. and D.V. Buchanan, editors. proceeding so the Gearhart Mountain bull trout workshop. American Fisheries Society, Corvallis, Oregon.

Terry A. Luther
Fish, Wildlife and Parks Manager
Confederated Tribes of the Warm Springs Reservation of Oregon

Education:
B.S. Wildlife Science, Oregon State University, 1976

Currently responsible for the management and supervision of fisheries, wildlife and parks programs on and off the reservation. This involves oversight of 18 different projects and contracts including two cede area offices in Hood River and John Day, Oregon. Other responsibilities involve; timber harvest impacts to fish and wildlife resources, development and implementation of integrated plans for fish and wildlife resources, FERC coordination, wildlife mitigation efforts, bull trout research and spotted owl project monitoring.

Section 10. Information/technology transfer

Information from this research will be distributed by publications, presentations, and other means. The primary publications of this project will be annual reports distributed to ODFW stations and available to other interested parties on request. We have also published special reports such as the Oregon Bull Trout Status Report (Buchanan et al., 1997) and Nuclear DNA Analysis of Oregon bull Trout (Spruell and Allendorf, 1997) Articles will also be published in peer-reviewed journals.
We have, and continue to make presentations at intra-agency and interagency meetings. We recently held an information meeting for ODFW management biologists with bull trout in their districts. Presentations have also been made at professional meetings such as the Oregon American Fisheries Society meeting. Dave Buchanan (Principal Investigator) gave a talk for the Blue Mountain Natural resources Council that was broadcast on television throughout northeast Oregon. Phil Howell presented the study design and preliminary results to Forest Service biologists and program managers from areas throughout Oregon and Washington. Alan Hemmingsen and other project personnel made a presentation to visiting fisheries biologists from British Columbia. We have also done outreach activities with local groups such as schools, high school teachers and the cub scouts. We have also developed a web page for the internet.

Data from our research will be used in development of management policy and programs concerning bull trout. The gathering of information to develop such policies is the key reason for undertaking this research project.