PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

ASSESS FISH HABITAT AND SALMONIDS IN THE WALLA WALLA WATERSHED IN WASHINGTON

BPA project number	**9901100**
Contract renewal date (mm/yyyy)	03/1999
Multiple actions? (indicate Yes or No)	NO

Business name of agency, institution or organization requesting funding

WASHINGTON DEPT. OF FISH AND WILDLIFE

Business acronym (if appropriate)	WDFW

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses

7.C.1, 7.1C.3, 7.2, 7.3, 7.3B.1, 7.4A, 7.4B, 7.4L, 7.6, 7.6C, 7.8G, 10.5A

FWS/NMFS Biological Opinion Number(s) which this project addresses

NOT AVAILABLE FOR THE WALLA WALLA WATERSHED

Other planning document references

A) WY KAN USH ME WA KISH WIT, related particularly to page 54, items 1b, 1c, 2, 3, 5, 8
B) Associated with NE Oregon Hatchery Project, Umatilla H. supplemental Master Plan, and the Walla Walla Investigative Report No.1- Dec 1993.
C) This proposal would update the Watershed Assessment portion of the Walla Walla Subbasin Plan, 1989 and revised 1993.
D) Pages 16 & 17 of the Columbia River Basin Fish and Wildlife Program, FY 1998 - ANNUAL IMPLEMENTATION WORK PLAN (Oct 1997). Also, on Page 63 of the WALLA WALLA SUBBASIN SECTION of this same Work Plan and Page 107 of the 1999 Work Plan (Vol 1, May 1998).
E) Section III. B.11 recommendation for watershed assessment to precede implementation of restoration projects - in REPORT OF THE INDEPENDENT SCIENTIFIC REVIEW PANEL (ISRP REPORT 97-1, JULY 1997)
F) WA State HB 2496 - calls for limiting factor analysis
G) WA State HB 2514 - calls for liming factor analysis and quantifying and setting stream flows .

H) WA State Wild Salmonid Policy - management emphasis on wild salmonids
I) WA State draft Salmon Recovery Plan ("Extinction is not an option").

Short description

Determine fish passage, rearing, spawning conditions, and identify limiting factors for steelhead and for potential reintroduction of chinook salmon, and assess steelhead and bulltrout distribution, densities, and genetic composition in the Walla Walla Watershed**.**

Target species

Steelhead/rainbow trout, Bull Trout, and Chinook Salmon

Section 2. Sorting and evaluation

Subbasin

Lower Mid-Columbia Sub-region - WALLA WALLA SUB-BASIN (includes Mill Creek, and Touchet River and their tributaries)

Evaluation Process Sort

CBFWA caucus		CBFWA eval. process		ISRP project type	
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories	
X	Anadromous fish	X	Multi-year (milestone-based evaluation)		Watershed councils/model watersheds
	Resident Fish	X	Watershed project eval.		Information dissemination
	Wildlife				Operation & maintenance
					New construction
				X	Research & monitoring
				X	Implementation & mgmt
					Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
8802200	Trap and Haul in the Umatilla and Walla Walla Basins	WDFW project will provide information about habitat and passage conditions that may be critical to project 8802200

9000501	Umatilla and Walla Walla Basin Natural Production M&E Project	WDFW project should provide baseline habitat, fish distribution and density information needed for project 9000501
9601200	Adult Fish Passage Improvement - Walla Walla River	WDFW project updates the habitat assessment and would help identify low flow locations and potential thermal or passage problems for adult salmon (if reintroduced) and existing passage problems for steelhead or bull trout.
9604601	Walla Walla Basin Fish Habitat Enhancement	WDFW project will provide baseline data on habitat limiting factors, fish distribution and abundance needed to guide what habitat enhancement is needed and where.
8805302	Plan, Site, Design & Construct NEOH Hatchery - Umatilla/ Walla Component - Walla Walla Master Plan as part of NEOH planning	WDFW project will provide current data that are needed concerning 1) low flows, desired flows, and spring/summer temperature and passage problems, 2) potential rearing and spawning habitat available for reintroduction of spring chinook and other salmon, and for supplementation of steelhead, 3) genetic characterization of the steelhead and bull trout stocks present, 4) the distribution and abundance of steelhead and bull trout. These data are necessary for adequate master planning and implementation of the Master Plan. The project will collect genetic information on steelhead to guide hatchery broodstock development and will provide habitat assessment that may affect the location and use of satellite facilities.
9601100	Screens and Traps on the Walla Walla and Touchet	WDFW project will provide information for possible additional screening needs, or that may affect trapping needs or effectiveness

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1998	collected and summarized data to quantify summer temperatures and flows in the mainstem Walla Walla and Touchet rivers	Yes - Assess habitat conditions for anadromous and resident salmonids...
1998	obtained data regarding salmonid distribution and densities in the Touchet and Walla Walla river mainstems	Yes - Determine salmonid distribution, habitat use, and relative abundance...
1998	collected genetic samples from steelhead and bull trout in Mill Creek and the Walla Walla River in	Yes - Identify, and genetically characterize stocks of naturally produced steelhead and

	Oregon	bull trout...

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Assess habitat conditions for anadromous and resident salmonids in the Washington portion of the Walla Walla Watershed	a	Establish 4-5 constant recording stream discharge monitors in the lower Walla Walla River, Touchet River and possibly lower Mill Creek to identify available water for salmonid passage and rearing during April or May through mid November.
		b	Conduct periodic stream discharge measurements to calibrate constant recording discharge monitors and at other sites to provide information on water discharge available for salmonid passage and rearing.
		c	Conduct periodic flights of the lower Walla Walla and Touchet rivers to determine continuity of stream flows for adequate passage and rearing.
		d	Deploy constant recording water temperature monitors at various sites in the Walla Walla, Touchet, Mill Creek, and tributaries to determine temperature limitations for salmonid passage, rearing and spawning (April - Nov).
1		e	Establish fixed water quality monitors and periodically collect water quality data (eg. dissolved oxygen, turbidity, pH, total phosphorous, etc.) to determine suitability and limitations for salmonids (Apr- Oct).
		f	Conduct general habitat surveys in portions of the stream with potential for salmonid use to quantify habitat conditions and limiting factors (use a combination of modified Habitat Suitability Index Models for rainbow/steelhead trout and spring chinook, and a Hankin and Reeves survey).
2	Determine salmonid distribution, habitat use and relative abundance in the Washington portion of the Walla Walla Watershed	a	Conduct steelhead and bull trout spawning surveys. Conduct extensive surveys and then establish index areas throughout the basin.
		b	Conduct electrofishing or snorkel surveys during summer to determine salmonid rearing distribution. In index areas determine fish density, abundance and habitat use.
3	Identify, and genetically characterize stocks of naturally produced steelhead and bull trout in the Walla Walla Watershed.	a	At existing adult trap sites in Oregon (Nursery Dam on the Walla Walla and Mill Creek Intake Dam) and Washington (Yellowhawk Creek and Touchet River), or at new trap sites in Mill Creek or the Touchet River, collect up to 100 tissue samples (eg. fin clips) each from adult natural steelhead and bull trout for DNA analysis. If possible, supplement these

Obj 1,2,3	Objective	Task a,b,c	Task
			samples from steelhead carcasses for electrophoretic analysis to compare with existing genetic data for nearby populations.
3		b	Collect fin clips or other tissue samples from juvenile steelhead/rainbow trout and bull trout during electrofishing for salmonid distribution, density and abundance surveys for genetic (DNA or electrophoretic) analyses to supplement adult collections and compare DNA and electrophoretic genetic characterization of populations.
		c	Conduct DNA or electrophoretic analyses at the WDFW genetics laboratory and compare with other genetic analyses for nearby populations to identify and characterize steelhead and bull trout stocks.
		d	Use the genetic stock identification information to plan for development of local steelhead broodstocks for hatchery production in the Walla Walla Watershed.
4	Coordinate data collection and resource planning with others, compile and disseminate results and conclusions for watershed restoration planning in WA and OR.	a	Coordinate our activities and share our results with other parties working in, or with interest in, the Walla Walla Basin in both the WA and OR. Ensure that our activities and results are coordinated and used in salmonid recovery, watershed planning and restoration efforts throughout the basin.
		b	Report activities and results orally to various organizations and groups.
		c	Quarterly and annually distribute written data summaries and complete a final written report for distribution to other agencies, the CTUIR, the Conservation District, and the public .

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	03/2000	12/2001	Assess habitat conditions for anadromous and resident salmonids in the Washington portion of the Walla Walla Watershed	X	45
2	03/2000	12/2001	Determine salmonid distribution, habitat use and relative abundance in the Washington portion of the Walla Walla Watershed	X	34
3	03/2000	12/2001	Identify, and genetically		

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
			characterize stocks of naturally produced steelhead and bull trout in the Walla Walla Watershed	X	11
4	03/2000	07/2002	Coordinate data collection and resource planning with others, compile and disseminate results and conclusions for watershed restoration planning.	X	10
				Total	100

Schedule constraints

Securing ESA permits for all activities, or modifying proposed actions to comply with ESA requirements may delay or affect completion of all proposed actions. High flows in area streams may require delay of deployment of monitoring devices, or their withdrawal, and it may hinder or preclude spawning surveys.

Completion date

Final report completion is expected in July 2002, unless delays or problems occur that prolong the study.

Section 5. Budget

FY99 project budget (BPA obligated):	$183,792 - recommended by the NPPC

FY2000 budget by line item

Item	Note	% of total	FY2000 ($)
Personnel	Biol (1 FTE), Proj. leader (.25 FTE) 2 Techs. (1.2 FTE)	44.98	82,099
Fringe benefits	at 28.5%	12.82	23,398
Supplies, materials, non-expendable property	replacement nets, boots, dry suits, temp. monitors and discharge monitors, flights, fuel, DNA analyses, water analyses, software, vehicle lease and fuel.	18.77	34,260
Operations & maintenance	equipment repair	0.55	1,000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	None	0	0
NEPA costs	None	0	0
Construction-related support	None	0	0
PIT tags	# of tags: None	0	0
Travel	per diem for meetings and planning	0.35	640
Indirect costs	at 22.5% (excluding $6,000 for equipment)	16.78	32,826
Subcontractor	DOE - water quality DOE - flow monitoring	3.56 2.19	6,500 4,000
Other	None	0	0
	TOTAL BPA REQUESTED BUDGET		184,723

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
WA Dept. of Ecology	installation, operation and summary of data for flow monitors and water		

	quality data collection and summary	1.54	3,000
USFS and ODFW	collection of genetic samples from adult steelhead and bull trout at existing dams	1.02	2,000
WDFW/LSRCP	collection of genetic samples from adult steelhead and bull trout at a trap on the Touchet River, or during electrofishing activities in the Touchet River tributaries under the LSRCP funding.	0.51	1,000
WDFW	office space and utilities	3.38	6,600
	Total project cost (including BPA portion)		197,323

Outyear costs

	FY2001	**FY02**	**FY03**	**FY04**
Total budget	207,190	35,000	0	0

Section 6. References

Watershed?	**Reference**
X	Bureau of Reclamation. 1997. Watershed assessment - Upper Walla Walla River subbasin, Umatilla County, Oregon. Prepared for the Walla Walla Basin Watershed Council, Milton-Freewater, Oregon. 34p. plus appendices.
	Busack, C. and J.B. Shaklee. 1995. Genetic Diversity Units and Major Ancestral Lineages of Salmonid Fishes in Washington. Washington Department of Fish and Wildlife Technical Rept. RAD 95-02.
X	Confederated Tribes of the Umatilla Indian Reservation (CTUIR). 1989. Walla Walla Subbasin Salmon and Steelhead Plan. Prepared for the Nortwest Power Planning Council. Portland, Oregon.
	Confederated Tribes of the Umatilla Indian Reservation (CTUIR). 1993. & 1998. Walla Walla Master Plan (draft). Prepared for the Nortwest Power Planning Council. Portland, Oregon.
X	Corps of Engineers (COE). 1992. Walla Walla River Basin Reconnaissance Report, Oregon and Washington. U. S. Army Corps of Engineers, Walla Walla District. Walla Walla, Washington.
X	Corps of Engineers (COE), 1997. Walla Walla River Watershed, Oregon and Washington Reconnaissance Report. U. S. Army Corps of Engineers, Walla Walla District. Walla Walla, Washington.
X	Covert, J. J., J. M. Lyerla, and M. D. Ader. 1994. Initial Watershed Assessment - Tucannon River Watershed: Washington State Department of Ecology Open File Technical Report 95-04, 44p.
	CRITFC. 1995. Wy-Kan-Ush-Mi Wa-Kish-Wit. Spirit of the Salmon - Tribal Recovery Plan. Volume I and II.
	Germond, Jon. 1998. Personal communication. ODFW, La Grande, OR.
	Hankin, D.G. and G.H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Can. J. Fish. Aquatic Sci. 45: 834-844.
	Independent Scientific Review Panel (ISRP). 1997. Review of the Columbia River Basin Fish and Wildlife Program as directed by the 1996 amendment to the Power Act. ISRP Report 97-1 for the Northwest Power Planning Council. Portland, Oregon.
	Martin, S. et. al. 1992. Investigations of bull trout, steelhead trout, and spring chinook salmon interactions in southeast Washington streams. 1991 Annual Report. BPA Proj. 90-53.
	Michaelis, K. A. 1972. Ecology and distribution of the fishes of the Touchet River. MS Thesis. Walla Walla College.

	Mendel, G., et al. 1993. Tucannon River Spring Chinook Salmon Hatchery Evaluation Program Report - 1992 Annual Report. AFF 1/LSR-93-06. Washington Department of Fisheries report to the U.S. Fish and Wildlife Service, Lower Snake River Compensation Plan Office, Boise, Idaho.
	Nielson, R.S. 1950. Survey of the Columbia River and its Tributaries, Part 5. U.S. Fish and Wildlife Service, Scientific Report: Fisheries, No. 38, 41 p.
	Northwest Power Planning Council (NPPC). 1995. 1994 Columbia River Basin Fish and Wildlife Program (as amended in 1995). Portland, Oregon.
	Northwest Power Planning Council (NPPC). 1997. Columbia River Basin Fish and Wildlife Program - Fiscal Year 1998. Annual Implementation Work Plan. Portland, Oregon.
	Pearman, J. R. E. 1977. Ecology and distribution of fishes in yellowhawk , Cottonwood and lower Walla Walla River. MS Thesis, Walla Walla College.
	Raleigh, R., T. Hickman, R. C. Soloman, and P.C. Nelson. 1984. Habitat Suitability Information: Rainbow Trout. U.S. Fish and Wildlife Service FWS/OBS-82-10.60. U.S. Department of Interior, Washington, D.C.
	Raleigh, R., W. J. Miller, and P.C. Nelson. 1986. Habitat Suitability Models and instream flow suitability curves: Spring Chinook. U.S. Fish and Wildlife Service Biological Report 82(10.122). U.S. Department of Interior, Washington, D.C.
	Schuck, M., A. Viola, and J. Dedloff. 1997. Lyons Ferry Trout Evaluations Annual Report. Rept. # H97-08. WDFW
	Spruell, P. and F. W. Allendorf. 1997. Nuclear DNA Analysis of Oregon Bull Trout. Final Report to ODFW. Report 97/5. Division of Biological Sciences, University of Montana, Missoula, MT.
	Underwood, K. et al. 1995. Investigations of bull trout, steelhead trout, and spring chinook salmon interactions in southeast Washington streams. 1992 Annual Report. BPA Proj. 90-53.
	Washington Dept. of Fish and Wildlife. 1997a. Salmonid Stock Inventory - Bull Trout and Dolly Varden.
	Washington Department of Fish and Wildlife. 1997. Wild Salmonid Policy - Final Environmental Impact Statement.
	Washington State Natural Resources Cabinet. 1998. Extinction is not an option. A statewide strategy to recover salmon. Working draft.
	Washington State House Bill 2496.
	Washington State House Bill 2415.
	Zimmerman, B. 1993. Northeast Oregon Hatchery Project (NEOH)- Walla Walla Investigative Report No. 1. Confederated Tribes of the Umatilla Indian Reservation report to Bonneville Power Administration. 6p.

PART II - NARRATIVE

Section 7. Abstract

Fish habitat in streams within the Walla Walla watershed of southeast Washington and northeast Oregon has been severely degraded by urban and domestic development, farming, grazing, irrigation, logging, recreational activities, floods and flood control efforts. Historically, the Walla Walla basin produced substantial runs of both spring chinook salmon and steelhead. Salmon have been extirpated from the basin since approximately the 1920's and native steelhead runs and bull trout have declined.

The Northwest Power Planning Council Fish and Wildlife Program (FWP-NPPC 1995) calls for regular updating of subbasin plans and collecting information on population life history and status, etc. It also recommends evaluation of supplementation plans and risk assessments along with a hatchery production Master Plan that includes identification of limiting factors. A watershed assessment and coordination of habitat planning efforts is recommended by the FWP.

The NPPC has funded several projects in the Walla Walla basin with the CTUIR and the Walla Walla Conservation District. Additional aquatic resource planning or restoration efforts have been undertaken recently, or are currently underway by the Corps of Engineers, a citizen watershed council in Oregon, and the Conservation Districts with funding from the State of Washington (eg. HB 2496) or the federal government (eg. Whip, CREP. etc.).

The WDFW is proposing to continue a watershed habitat and salmonid stock assessment in the Walla Walla basin. The project would assess salmonid stocks and habitat for steelhead and bull trout, as well as the potential for chinook salmon reintroduction. The objectives are as follows: 1). Assess habitat conditions for salmonids, 2). Determine salmonid distribution and abundance, 3). Identify, and genetically characterize naturally produced steelhead and bull trout stocks, 4). Coordinate data collection activities with others, compile and disseminate results. The proposed project will be completed in 2002.

Methods include habitat and fish components. Fixed monitoring sites will measure stream temperatures, and flows, and water quality. Habitat surveys such as Hankin and Reeves (1988) and Habitat Suitability Index models will be used to determine habitat limiting factors. Spawning ground surveys, electrofishing and snorkel surveys will be used to determine distribution and abundance of salmonids. Genetic characterization will be completed for naturally produced steelhead and bull trout by use of DNA or electrophoretic analyses.

The information proposed for collection is critical for planning and implementing watershed restoration, resource management for sensitive and depressed salmonid populations, as well as planning hatchery supplementation or continuing hatchery mitigation for steelhead, or for reintroduction of salmon in the Walla Walla basin.

Section 8. Project description

a. Technical and/or scientific background

The Walla Walla watershed is located in southeast Washington and northeast Oregon. The total area of the watershed is 1,758 square miles, of which 1,275 square miles (73%) are in Washington (COE 1992, 1997). The primary physiographic features of the basin are the steep, lightly timbered Blue Mountains in the southeast, the rolling foothills and Palouse Prairie throughout much of the landscape, and the Walla Walla and Touchet river valleys. The main streams in the Basin include Mill Creek, the Touchet and Walla Walla rivers, plus several smaller tributaries. Approximately 15% of the basin is forest lands and 82% is used for cropland and grazing. Over 90% of the basin in Washington is privately owned.

Fish habitat in basin streams has been severely degraded by urban and domestic development and related water withdrawals, farming, irrigation, grazing, logging, recreational activities, floods and flood control efforts, as well as road construction and maintenance activities. Sixty percent of current water usage in the basin is for irrigating crops (COE 1997) and irrigation has severely impacted stream flows in the Walla Walla River since the 1880's (Nielson 1950). Portions of the lower Walla Walla River and lower Mill Creek are partially or completely dewatered during summer and fall months. Summer water temperatures and sedimentation are high and numerous passage problems exist because of low flows or irrigation diversions. Lower Mill Creek has two dams for water diversions and several stream reaches that contain weirs and dikes or concrete channels as part of the flood control project through the town of Walla Walla. The lower Touchet River has low stream flows, high summer water temperatures (>85^{o}F), and the

substrate is covered with sediment. Although the lower reaches of all these streams are seriously degraded, much of the upper portions of Mill Creek and the Walla Walla River are in nearly pristine conditions. The upper reaches of the Touchet River and tributaries above Dayton contain both marginal and good quality salmonid spawning and rearing habitat. Several other tributaries such as Coppei Creek and Blue Creek have suitable habitat for steelhead.

Historically, the basin produced substantial runs of both spring chinook salmon and summer steelhead. Chum and coho salmon also were likely present. Salmon have been absent from the basin since approximately the 1920's due to irrigation dams, extensive water withdrawals and habitat degradation (CTUIR 1989). Native steelhead runs have also declined. Steelhead are proposed for listing and bull trout are listed as threatened in the Walla Walla watershed under the Endangered Species Act (ESA).

Limited information exists that adequately documents current salmonid habitat conditions or salmonid distribution and population abundance. The information available regarding fish habitat conditions is incomplete. For example, detailed documentation of the location and timing of low stream flows (or dry sections) and high stream temperatures is generally lacking. Some information regarding fish distribution was collected sporatically from 1930-1977 (eg. Nielson 1950, Michaelis 1972, Pearman 1977) but current data regarding salmonid spawning and rearing distribution and abundance or habitat limiting factors are very limited, or are non-existent for sub-watersheds.

Steelhead population data are limited in the basin within Washington. Estimated wild steelhead escapements of 350 to about 800 fish per year have been reported for the last six years in the upper Walla Walla River in Oregon (Jon Germond, pers. com.). Minimum escapement estimates based on spawning index surveys have ranged from about 175-900 fish per year in the upper Touchet River above Dayton during the 1990s. The majority of these fish are likely of wild stock. Additionally, upper Mill Creek, Coppei Creek and other tributaries also have populations of wild steelhead. The WDFW annually releases a total of 250,000-300,000 Lyons Ferry stock steelhead smolts into the lower Walla Walla, lower Mill Creek and the Touchet River at Dayton as part of the Lower Snake River Compensation Program (Schuck et al. 1997). A substantial sport fishery and harvest of 800-2,000 hatchery steelhead occurs annually in the lower portions of basin streams within Washington. Limited data suggests that returning hatchery steelhead have only mimimal entry into the upper portions of the Walla Walla River and its major tributaries. Therefore, wild and hatchery steelhead spawning and rearing may be relatively separate within the basin.

Bull trout populations are classified as depressed within the Washington portion of the basin (WDFW 1997a). However, viable bull trout still remain within the basin. Spawning surveys from 1994-1997 have documented 27-86 redds per year in tributaries of the upper Touchet River, 188-191 in upper Mill Creek and tributaries, and 114-180 in upper South Fork of the Walla Walla River in Oregon. It is unknown if these populations are isolated, or whether they maintain some connectivity. All bull trout fishing is closed in the Walla Walla basin. Detailed studies of bull trout in Mill Creek and the upper Wolf Fork were recently completed (Martin et al. 1992, Underwood et al. 1995) and a bull trout radio telemetry study is currently underway by the Oregon Deparment of Fish and Wildlife (ODFW) and the US Forest Service (USFS) in Mill Creek.

Fish management efforts in the Washington portion of the Walla Walla watershed are primarily focused on protection and restoration of dwindling naturally produced steelhead and bull trout, and implementation of a large mitigation program for steelhead and resident trout under the Lower Snake River Compensation Plan (LSRCP) by providing recreational fishing opportunities. Primary threats to salmonid resources include hydroelectric dams and associated reservoirs in the Columbia River, out-of-basin harvest, loss of riparian habitat, loss of instream water, fish passage problems within the basin, and detrimental changes in hydrology, sediment transport, stream channel stability and summer water temperatures caused by local land use activities.

The Walla Walla Subbasin Plan, written nearly ten years ago (CTUIR 1989), and the draft Walla Walla Master Plan (CTUIR 1993 & 1998) which was based on the Subbasin Plan, recommend using hatcheries for supplementing steelhead and reintroducing spring chinook salmon in the Walla Walla watershed. The Northwest Power Planning Council Fish and Wildlife Program (NPPC 1995) calls for regular updating of subbasin plans (7.0C) and collection of population status, life history and other data on naturally spawning (wild) populations (7.1C and 7.1C.3), which includes bull trout (10.5A). It also calls for improved hatchery production, or developing new hatchery supplementation programs, while proceeding with extreme caution to avoid damaging remaining naturally spawning

populations (7.2). The Fish and Wildlife Program (FWP) recommends developing, implementing and evaluating supplementation plans and risk assessments (7.3, 7.3B.1, 7.4A). It also requires writing a hatchery production Master Plan (7.4B, 7.4L) that includes identification of factors limiting production and setting project goals and objectives.

The NPPC has approved and funded several projects in recent years in the Walla Walla basin (8802200, 9601100, 9000501, 9601100, 9601200, 9604601, 8805302) with the Confederated Tribes of the Umatilla Reservation (CTUIR), and the Walla Walla Conservation District (9606401). Additional aquatic resource efforts are underway in the basin by the COE for resource planning and environmental restoration (COE 1992, COE 1997) and by a citizen watershed council in Oregon (BOR 1997). The Walla Walla and Columbia County Conservation Districts received large sums of money from Washington State for watershed planning and restoration efforts in the basin in 1998-1999 (eg. HB 2496). Washington State is expected to continue contributing several hundred thousand dollars per year for watershed restoration activities for the next several years. A Subbasin Plan (CTUIR 1989) and a draft hatchery production Master Plan (CTUIR 1993) have also been completed for the watershed. The U.S. Forest Service (USFS) and the Oregon Department of Fish and Wildlife (ODFW) are conducting spawning surveys, trapping adult and juvenile bull trout in Mill Creek, and a radio telemetry study of bull trout in the basin. All these efforts in the Walla Walla watershed are for planning or implementing watershed and fish stock restoration programs, or for protecting wild salmonids.

The existing resource planning efforts for the Walla Walla basin each provide new information and complement one another, but they all tend to use much of the same limited data for fish habitat conditions and salmonid distribution and abundance. For example, it is common knowledge that portions of the Walla Walla and Touchet Rivers are dry or very warm in late spring and summer because of irrigation withdrawals. These low flows and high stream temperatures likely affect salmonid passage, use, or survival in the lower rivers, but the extent and duration of the problems have not been quantified. Also, current information on salmonid distribution, habitat use, abundance and stock indentification are generally lacking. Additional field data are necessary to adequately plan for habitat and salmonid stock restoration. These data should include detailed field measurements of water availability and water quality for fish passage, rearing and spawning, as well as other measures of habitat condition and determination of habitat limiting factors. They should also include field verification concerning salmonid distribution, abundance, and genetic stock identification. These data needs are key elements necessary for watershed and fish stock restoration planning and implementation in the basin.

The Washington Department of Fish and Wildlife (WDFW) has been actively involved for many years with fish habitat and salmonid stock assessment activities in the nearby Tucannon River and Asotin Creek as part of model watershed programs (Asotin Conservation District 1994, Columbia Conservation District 1997), LSRCP hatchery monitoring and evaluation, and stream flow studies of the Tucannon River. The WDFW initiated this project in late spring 1998 and has coordinated with the CTUIR, COE, USFS, Washington Department of Ecology (WDOE), the ODFW, and the Columbia County and Walla Walla County Conservation Districts regarding this proposal. All entities have indicated general support and are intending to cooperate with this proposed project. This WDFW project would supplement efforts by all other organizations by providing detailed, quantifiable salmonid habitat and population data that are necessary for adequate resource planning and restoration efforts within the Walla Walla Basin. The WDFW has the expertise for the proposed data collection and summarization for fish habitat and fish stocks in the basin. Genetic stock identification and characterization will be obtained from portions of the Walla Walla Basin in Oregon and Washington to supplement current WDFW efforts (Busack and Shaklee 1995) to identify salmonid stocks for local and State management, as well as for more regional ESA considerations (Spruell and Allendorf 1997). Genetics samples, data and analyses (Dr. Shaklee as lead) would be available to ODFW, CTUIR, the National Marine Fisheries Service (NMFS), the U. S. Fish and Wildlife Service (FWS) and other interested parties. Stream discharge, temperature and water quality data proposed to be collected for the lower portions of the Walla Walla and Touchet rivers would be of substantial importance to several other resource planning efforts and organizations (eg. DOE, COE, CTUIR, ODFW, Walla Walla Watershed Council in Oregon, etc.). John Covert (WDOE) has much experience with stream flow monitoring as does Dr. Hal Beecher (WDWF) with use of the Instream Flow Incremental Methodology to determine fish habitat needs and recommend flows for salmonids. Similar flow studies were conducted by these individuals in the Tucannon River in the past three years (eg. Covert et al. 1994). Dr. Bill Ehinger and Dave Hallock (WDOE) have many years of experience collecting and analyzing water quality data. The proposed temperature monitoring and habitat and fish stock assessment are similar to activities conducted by WDFW in the Tucannon River (Mendel et al. 1993).

b. Rationale and significance to Regional Programs

The proposed project would address the goals of the FWP and other efforts as indicated below for each numbered objective.

Objective 1: Assess habitat conditions.
Limited stream flow (discharge), water quality, and temperature data have been compiled in recent reports for the Walla Walla River (Zimmerman 1993, COE 1992, COE 1997). Zimmerman (1993) collected some new stream temperature data from one site near the mouth of the river. He concentrated on the likely effects of temperatures and flows on potential reintroduction of spring chinook salmon but he did not evaluate their effects on existing natural steelhead and bull trout populations in the watershed that are, or may become, listed under the ESA. These documents do not assess the amount or condition of salmonid fish habitat in the watershed for rearing and spawning, or the factors limiting salmonid use and production. The draft Walla Walla Master Plan (CTUIR 1993) listed estimates of suitable salmonid habitat in the basin as documented in the Walla Walla Subbasin Plan (CTUIR 1989). These estimates were best guesses in 1988 by Mark Schuck and Glen Mendel (WDFW), and Gary James (CTUIR), and were based on general familiarity with the area streams. They have not been verified by field habitat measurements. The proposed WDFW project would obtain the necessary field data to evaluate those estimates and develop the final Master Plan for hatchery production (7.4B, 7.4L). This is consistent with the FWP (NPPC 1995) which calls for regularly updating the Subbasin Plan (7.0C). The Independent Scientific Review Panel (ISRP 1997) recently recommended that watershed assessments precede implementation of restoration projects (III.B.11). The NPPC (NPPC 1997) later concurred with the ISRP's recommendation that watershed assessments precede implementation of restoration activities. A watershed assessment and coordination of habitat planning efforts is recommended in the FWP (7.6C). The FWP also states that instream flow needs should be established and protected (7.8G). The proposed project would determine instream flow needs with an IFIM study in the lower Walla Walla River in 1999.

Objective 2: Determine salmonid distribution and relative abundance.
Little is known about current salmonid distribution and abundance for many areas of the watershed. Steelhead spawning ground surveys and juvenile salmonid sampling are currently conducted in the upper Touchet River basin, but much of the remaining watershed has not been sampled in recent years, if at all. The proposed activities would greatly increase our knowledge for planning and management and they are specially called for in the FWP for regularly updating the Subbasin Plans (7.0C), development of the hatchery production Master Plan (7.4B, 7.4L), and collection of population status, life history and other data on naturally spawning populations (7.1C and 7.1C.3, 10.5A). It enables the fishery managers to adequately plan for hatchery enhancement while protecting naturally produced salmonids (7.2, 7.3, 7.3B, 7.4A) and remain consistent with potential ESA requirements and the WDFW Wild Salmonid Policy (1997b).

Detailed bull trout studies have been conducted in Mill Creek and the Wolf Fork of the Touchet River (Martin et al. 1992, Underwood et al. 1995). Bull trout spawning surveys are annually conducted in several streams within the basin, but additional areas should be sampled to determine spawning and rearing use. A radio telemetry study of adult bull trout is underway by the USFS and ODFW that may provide useful information on adult habitat use and movements.

Objective 3. Identify, and genetically characterize stocks of naturally produced steelhead and bull trout. Currently, the WDFW/LSRCP hatchery program is using Lyons Ferry stock steelhead for mitigation in the Walla Walla River basin. This stock may be inconsistent with the WDFW Wild Salmonid Policy, and potential ESA requirements if steelhead are listed within this watershed. This stock is also inconsistent with the draft hatchery Master Plan (CTUIR 1993) and ODFW's wild fish management plan for the Walla Walla River. The number of separate natural steelhead and bull trout stocks in the Walla Walla basin are currently unknown, so we can not effectively determine the best approach to develop one (or multiple) local hatchery broodstock(s) for steelhead mitigation or supplementation and for protection of natural stocks. Collection of genetics data as proposed by WDFW is consistent with the FWP for updating Subbasin Plans (7.0C), collecting information about population status of wild populations (7.1C, &.1C3, 10.5A), and developing hatchery Master Plans and hatchery programs (7.2, 7.3, 7.3B, 7.4A, 7.4B, 7.4L). It also assists with management decisions associated with wild fish policies and potential listing under ESA.

Objective 4: Coordinate data collection and resource planning with others, compile and disseminate results and conclusions for watershed restoration planning. Summaries of results and conclusions will greatly benefit salmonid habitat and fish stock restoration planning and implementation and management decisions as indicated for the first three objectives. Although WDFW can only work within Washington State, all efforts and resource planning or management will be coordinated and integrated with efforts within the Oregon portion of the basin.

c. Relationships to other projects

The work proposed by the WDFW would continue providing detailed habitat and fish stock information in the Walla Walla basin that should help guide all FWP approved projects for improving fish passage or habitat (9606401, 9601100, 9601200, 8802200, 9000501) and hatchery production master planning (8805302) as well as resource planning efforts by the COE (COE 1992, 1997) other organizations (Walla Walla Watershed Council in Oregon and the Walla Walla and Columbia County Conservation Districts, Washington State salmon recovery and watershed restoration efforts, etc.). Although the CTUIR project for riparian and fish habitat analysis, protection and enhancement...(#9604601) appears from its title to conflict, or duplicate actions proposed by the WDFW project, there is no duplication or conflict. Their fish habitat analysis is specific to sites that receive riparian and fish habitat enhancement activities as part of their project, or involves compilation of available information, while our proposed fish habitat assessment consists of collecting field data to evaluate habitat conditions and limiting factors throughout the basin for overall watershed planning. The WDFW has discussed coordination and cooperation with the CTUIR and their subcontractor (Washington State University). Both WDFW and CTUIR see opportunities for mutual assistance and benefits to resource planning in the basin (Jed Volkman, CTUIR, personal communication).

The WDFW has arranged for assistance from WDOE for stream discharge and water quality monitoring. WDOE has indicated they will contribute the costs of establishing and compiling the water quality data. WDFW has also communicated the intent of our proposed activities with the CTUIR, ODFW, the USFS, COE and the Columbia and Walla Walla Conservation Districts, and the Walla Walla Watershed Council in Oregon, for future cooperation and coordination. Ample opportunity exists for assisting each other in data collection, watershed planning and implementation of restoration activities. Coordination and cooperation will be a high priority.

The proposed project will provide detailed data concerning salmonid habitat conditions and limiting factors, salmonid abundance, distribution and genetic data that can assist with limiting factors analysis and provide guidance for watershed planning, restoration and salmon recovery efforts by the local Conservation Districts and the State of Washington, and the Walla Walla Watershed Council in Oregon, as well as with the Corps of Engineers Walla Walla Watershed Reconnaissance Plan and any subsequent feasibility studies.

d. Project history (for ongoing projects)

This project was established and initiated in May 1998 for $100,000. This delayed the start of the project from the proposed start of April 1. Equipment purchasing and hiring further delayed field activities until mid June. Landowners then were contacted to acquire stream access along private lands. Because of the delayed start to this project we were unable to conduct steelhead spawning surveys, or document critical stream temperatures and flows for adult and juvenile salmonid migration through the lower main stem rivers during the months of April, May and June. Data collection was concentrated along the mainstem Walla Walla and Touchet rivers this year. Stream temperatures and flows were recorded from mid-June through early November, as well as determination of fish distribution and relative densities in the mainstem rivers. Temperatures as high as 91^{o}F were recorded in the lower Touchet River and salmonid summer distribution was restricted to above Coppei Creek at Waitsburg. Salmonids also were found to rear in low densities in the Walla Walla River in a clustered distribution, which may reflect groundwater inflow sites. Bull trout spawning surveys were expanded in the upper Wolf Fork in the fall. The first annual report should be completed by January 1999 and the project will restart in March of 1999.

Continuation of this project is necessary, or similar data would have to be collected if other funding could be secured, to provide adequate baseline information concerning fish abundance, distribution, genetic characteristics, and habitat conditions for proper fish management and to guide enhancement activities. Otherwise salmonid management and restoration decisions would have to be based on the limited data currently available and restoration monies may not be used effectively.

e. Proposal objectives

The WDFW is proposing to conduct a watershed habitat and salmonid fish stock assessment in that portion of the Walla Walla Basin within Washington State. The project would assess the habitat conditions (particularly stream flows, water temperatures and water quality) that affect steelhead and bull trout use and passage in the lower portion of the basin, as well as the potential for adult and juvenile passage if spring chinook or other salmon species are reintroduced. Habitat and fish stock assessment in the middle and upper watershed within Washington would evaluate the amount of potential rearing and spawning habitat available for salmon, and habitat conditions and habitat limiting factors, habitat use, distribution, densities, abundance and genetic stock characterization of existing natural populations of steelhead and bull trout. The specific objectives are as follows:

1. Assess habitat conditions for anadromous and resident salmonids in the Washington portion of the Walla Walla watershed.
2. Determine salmonid distribution and relative abundance in the Washington portion of the Walla Walla watershed.
3. Identify, and genetically charaterize stocks for naturally produced steelhead and bull trout in the Walla Walla watershed (including part of Oregon).
4. Coordinate data collection and resource planning with others, compile and disseminate results and conclusions for watershed restoration planning in Washington and Oregon. This objective includes preparation and distribution of annual reports and a final project report in 2002. Additionally, data from this project will be compiled and distributed to CTUIR and WSU, and others for integration into a complete watershed assessment.

f. Methods

Methods include habitat and fish components. Fixed monitoring sites will measure stream temperatures, and flows, and water quality. Habitat surveys such as Hankin and Reeves (1988) and Habitat Suitability Index models will be used to determine habitat limiting factors. Spawning ground surveys, electrofishing and snorkel surveys will be used to determine distribution and abundance of salmonids. Genetic characterization will be completed for naturally produced steelhead and bull trout by use of DNA or electrophoretic analyses.

We will make every reasonable effort to minimize any potential undesirable social or biological side effects from this project. We will maintain open and clear communications with landowners to limit or reduce their concerns about our data collection efforts and any management decisions that may result. We will not electrofish during salmonid spawning and we use a variable pulse electrofisher specifically designed to minimize injuries to fish in areas where we expect salmonids.
We will minimize the number of sites that we electrofish and we will supplement our sampling with snorkeling methods to determine salmonid distribution and abundance. All methods that potentially adversely affect salmonids or other fish will be reviewed and coordinated with federal fish managers during ESA consultation.

Tasks 1a-c. WDOE will establish several stream discharge monitoring devices to continually record stream discharges from April or May through October. The monitors will be established at various sites in the Walla Walla and Touchet rivers to supplement the one active USGS gauge station in the lower Walla Walla River. Periodic stream flow measurements will be made at transects with a Swoffer portable velocity meter to determine discharge and calibrate the monitoring stations. Additional stream flow measurements will be periodically made at additional sites to supplement the fixed-site monitors. Approximately two flights per month will be made with a Cessna 182 fixed wing aircraft during May-October to determine continuity of water flow in the river channels in the lower Walla Walla and the Touchet rivers. A video or 35 mm camera may be used to document results of the flights.

Task 1d. WDFW will deploy up to 12 constant recording temperature monitors to record water temperatures each hour from May through October. These monitors will be distributed along several streams in the basin to aid in determination of available habitat and passage conditions for salmonids.

Task 1e. WDOE will establish several fixed-site monitoring devices to continually record water quality from April or May through October. The monitors will be established at various sites in the Walla Walla and Touchet rivers to supplement the one USGS gauge station in the lower Walla Walla River. Water quality sampling will include dissolved oxygen levels (DO) levels and percent oxygen saturation, total phosphates, turbidity and several other

factors. Periodic water quality sampling may be conducted at various sites in the Touchet and Walla Walla rivers when discharge or temperature monitors are downloaded, and at other times and locations to supplement the fixed-site samples.

Task 1f. General and intensive habitat surveys will be conducted in selected reaches of the streams to determine fish habitat conditions. Number and area of pools, pool quality, thalweg velocities, and other habitat measures will be collected. The survey methods may include modified Hankin and Reeves (1988) methods for the general habitat surveys and use of the Habitat Suitability Index Models for spring chinook and rainbow/steelhead trout (Raleigh et al. 1984 and 1986) to help identify habitat limiting factors for these salmonids. Other standard habitat variables may be included.

Task 2a. We will attempt to conduct steelhead and expand existing bull trout spawning surveys, depending on stream flows and the availability of access to private lands. Selected river segments (index areas) would be walked weekly, if possible. Marked redds would be used to determine redd life (visibility duration) for expansion of redd counts. Bull trout surveys would supplement those currently conducted by the USFS, ODFW and WDFW.

Task 2b. Randomly selected snorkel or electrofishing index sites will be established and surveyed for juvenile salmonid distribution and densities throughout the watershed within Washington. Snorkeling will usually involve two snorkelers conducting a total count of salmonids at each site. Salmonids captured during electrofishing will be identified and measured. Scale and DNA samples (small fin clips) may be collected from a portion of the sampled fish. Some juvenile salmonids may be killed for tissue samples for genetic analysis with electrophoresis. Block nets will be used to isolate the site during electrofishing and prevent ingress or egress of fish. Two or three pass electrofishing surveys and use of a depletion estimation formula will estimate the numbers of fish present and density at each selected site. Site length and width measurements will be used to calculate the area sampled. Other qualitative electrofishing or snorkeling may be conducted to determine general salmonid distribution. Juvenile sampling will generally occur between 5 July and 30 September to measure summer rearing conditions, distribution, densities and abundance.

Task 3a. WDFW will coordinate with ODFW for DNA sampling (small fin clip) of up to 100 wild steelhead and 100 bull trout crossing the Nursery Bridge trap in Milton- Freewater Oregon. Samples will be held in alcohol, and sampling will follow the WDFW genetics DNA sampling protocol. Similar sampling will occur at a cooperatively operated trap in Yellowhawk Creek, and in the upper Touchet River and with the US Forest Service and ODFW at a trap site on upper Mill Creek. Each sample will receive a unique identification code.

Task 3b. Additional fin clips or tissue samples may be collected from juvenile salmonids during electrofishing surveys to supplement the fin clip samples or to possibly use electrophoresis instead of DNA genetic analyses. The same sampling protocol will apply as with the adults for DNA sampling.

Task 3c. Genetic analyses will be conducted at the WDFW Genetics Lab. in Olympia, WA with a DNA sequencer or gel electrophoresis. Allelle frequencies will be compared with other genetic samples and data sets in the Northwest to determine fish stock relationships.

Task 4a and b. Data will be compiled annually and disseminated orally and in written form. A final report will be completed that summarizes the entire project in 2002 . Coordination with others working in the basin will be a high priority.

g. Facilities and equipment

The WDFW Snake River Lab. has two portable Swoffer velocity meters for stream discharge measuring, and several backpack electrofishers are available from WDFW for use on this project. Office space and utilities will be provided by WDFW. Genetics (DNA and eletrophoresis) processing equipment (DNA sequencer, etc.) are available at the WDFW Genetics Lab. A vehicle will need to be leased as part of this project.

The WDOE will contribute personnel, travel and data compilation costs for the water quality sampling. Water quality analysis will be processed at about $300 per water sample.

Purchases of equipment for the project in year 2000 will include a stream discharge monitoring station (~$2,000) as a replacement for one of those purchased in 1998, and 10 water temperature monitoring units (~$150 each). We anticipate the need to replace up to two dry suits and maintain other equipment such as computer repairs or software upgrades or additions.

h. Budget

The budget for this project consists mainly of personnel costs (58%) to collect and summarize the habitat and salmonid data . Supplies, small equipment and genetic analyses constitute about 19%, while subcontracts for water discharge and water quality set up, collection, and sample analyses adds another 6 %. Indirect costs account for nearly all the remaining 17 %.

Section 9. Key personnel

GLEN W. MENDEL, (0.25 FTE as Project Manager)
District Fish Manager for SE Washington
Washington Department of Fish and Wildlife, Fish Management - 529 W. Main St., Dayton, WA 99328 - (509) 382-1005, FAX (509) 382-2427.

Project duties: Project manager to take care of administrative duties and guide the project. He is experienced in administering contracts and projects under the LSRCP and past BPA contracts in southeast Washington and experienced in conducting salmonid abundance and habitat condition assessments in the Tucannon River and Asotin Creek as part of his previous LSRCP duties.

Education: - Supplemental Aquatic biology courses (1983), University of Idaho
- M.S. degree -- Wildlife Resources (1979), University of Idaho.
- B.S. degree -- Wildlife/fisheries (1975), - B.S. degree -- Biology (1973) Univ. of Idaho.

Employment History:

Fish Biologist and Manager for the Washington Department of Fish and Wildlife (WDFW) - (half time management duties April 1997-March 1998, full time since April 1998). Assistant project leader for evaluation of Lyons Ferry Hatchery program for spring and fall chinook salmon and steelhead (Mar. 1994-April 1998).
Fishery Biologist 3 for the Washington Department of Fisheries (5/1991 to 3/1994). Field supervisor for three projects: Monitoring and evaluation of Lyon's Ferry spring and fall chinook salmon hatchery programs (as part of the Lower Snake River Compensation Plan - LSRCP), and conducting adult fall chinook salmon radio telemetry research to evaluate upstream migration and spawning in the Snake River. Planned, directed and supervised these projects with 3 permanent staff, and up to 10 seasonal support staff.
Habitat Biologist 3 for the Washington Department of Wildlife (12/1988 to 5/1991). Main duties included reviewing and responding to environmental permits to protect fish and wildlife and their habitats in 3 SW Washington counties.
Fish Biologist 2 for the Washington Department of Wildlife (7/1984 to 12/1988) for evaluation of Lyons Ferry Hatchery steelhead and resident trout program .
Wildlife Biologist 2 for the Washington Department of Game (5/1983 to 7/1984). Biologist in charge of the Instream Habitat Improvement Study for streams in SE WA.
Biologist - Fisheries (GS/7) for the US Army Corps of Engineers (Jan-Sep. 1982, Apr. - Jun. 1981). Field supervisor for radio telemetry of chinook salmon at Snake R. dams.
Wildlife Biologist 2 for the Washington Department of Game (June - Dec. 1981, Jan. - Apr. 1981). Senior biologist on a study of anadromous fisheries enhancement potential in SE WA. Evaluated salmonid habitat and predicted salmonid biomass in streams by using the Wyoming HQI model. Estimated fish populations from electrofishing samples at 46 sites in 9 streams. Assisted with data collection for the Instream Flow Incremental Methodology.
Wildlife Biologist (GS/7) for the USDA Soil Conservation Service (May - Dec. 1979).
Publications: several publications in journals and symposium proceedings, and many agency reports regarding salmonid populations and their habitats .

JOHN J. COVERT
Washington Department of Ecology, 811 w. 24TH Spokane, WA 99203
phone 509-456-6328

Project duties: John will install the constant water discharge monitors and oversee their use. He will maintain and download them, as well as summarize the data.

Current Position:

Hydrogeologist 3, Shorelands and Water Resources program, WA Department of Ecology. August 1990 - present.

Past Experience:

Computer information Consultant 2 for the WDOE Water Resources Program. May 1988-1990.

Senior Geologist, Conoco Inc. January 1983-May 1988.

Research Assistant, Department of Geology and Geophysics, Univ. of Utah. 1980-1982.

Academic Record:

M.S. Degree (1983) Univ. Of Utah, College of Mines.

B.S. Degree (1980) Unv. of Michigan, College of Engineering.

Teaching Fellowship (1981) Univ. of Utah, Geological Society of America Penrose Grant.

Publications:

Bowman, J.R., Covert, J.J., Clark, A.H., and Mathison, G.A. 1985. The CanTung E Zone Scheelite Skarn Orebody, Tungsten, N.W.T., Oxygen, Hydrogen and Carbon Isotope Studies: Econ. Geol. v. 80:1872-1985.

Olson, T.M., Covert, J.J.. 1994. Eastern Washington observation well network. Washington Department of Ecology open file technical report 94-04, 94p.

Covert, J.J., Lyerla, J.M. and Ader, M.D. 1994. Initial Watershed assessment Tucannon River watershed: Washington Department of Ecology open file technical report 95-04, 44p.

Dr. JAMES B. SHAKLEE

Washington Department of Fish & Wildlife, 600 Capitol Way N., Olympia, Washington 98501
Phone: (360) 902-2752, e-mail: shakljbs@dfw.wa.gov FAX: 360-902-2944

Project Duties: Dr. Shaklee will oversee all genetic analyses and data summarization or reporting.

PRESENT POSITION
Research Scientist (Washington Department of Fish and Wildlife)

EDUCATIONAL BACKGROUND
M.S. Fishery Biology (1974) Colorado State University
Ph.D. Biology (1972) Yale University
M.Phil. Biology (1970) Yale University
B.S. Zoology (1968) Colorado State University

PROFESSIONAL EXPERIENCE
1987-present Research Scientist; Washington Department of Fisheries
1985-1987 Fishery Biologist; Washington Department of Fisheries
1981-1985 Senior Research Scientist; CSIRO Division of Fisheries Research; Cleveland, Australia
1975-1981 Assistant Professor; Department of Zoology, University of Hawaii and Hawaii Institute of Marine Biology
1974-1975 & 1972-1973 Postdoctoral Research Associate; University of Illinois

SELECTED PUBLICATIONS (since 1991)

Shaklee, J.B. and N.V. Varnavskaya. 1994. Electrophoretic characterization of odd-year pink salmon (*Oncorhynchus gorbuscha*) populations from the Pacific coast of Russia, and comparison with selected North American populations. Can. J. Fish. Aquat. Sci. 51(Suppl. 1):158-171.
Shaklee, J.B., J. Salini, and R.N. Garrett. 1993. Electrophoretic characterization of multiple genetic stocks of barramundi perch in Queensland, Australia. Trans. Amer. Fish. Soc. 122:685-701.
Shaklee, J.B., C.A. Busack, and C.W. Hopley. 1993. Conservation genetics programs for Pacific salmon at the Washington Department of Fisheries: Living with and learning from the past, looking to the future. pp.110-141. In: K.L. Main and E. Reynolds (eds.) Selective Breeding of Fishes in Asia and the United States. Proceedings of a workshop in Honolulu, HI May 3-7, 1993. The Oceanic Institute, Honolulu, HI.
Shaklee, J.B. and S.R. Phelps. 1992. Chinook salmon $NADP^+$-dependent cytosolic isocitrate dehydrogenase: Electrophoretic and genetic dissection of a complex isozyme system and geographic patterns of variation. Biochem. Genet. 30:455-489.
Shaklee, J.B., D.C. Klaybor, S. Young, and B.A. White. 1991. Genetic stock structure of odd-year pink salmon, Oncorhynchus gorbuscha, Walbaum, from Washington and British Columbia and potential mixed-stock fisheries applications. J. Fish Biol. 39(Supplement A):21-34.
White, B. and **J.B. Shaklee**. 1991. Need for replicated electrophoretic analyses in multiagency genetic stock identification programs (GSI): examples from a pink salmon (Oncorhynchus gorbuscha) GSI fisheries study. Can. J. Fish. Aquat. Sci. 48:1396-1407.
Shaklee, J.B. 1991. Simulation and other analysis of the 1991 Columbia River spring chinook GSI baseline. Technical Report 115 (40pp.), Washington Department of Fisheries, Olympia, WA.

Dr. WILLIAM JAMES EHINGER

Ambient Monitoring Section, Washington State Department of Ecology, 300 Desmond Dr., Olympia, WA 98502

Project Duties: Dr. Ehinger will be in charge of all water quality sampling at fixed sites and water quality analysis.

Educational Background

Ph.D. Ecology, University of North Carolina-Chapel Hill, 1992.

M.S. Environmental Science, Western Washington University, 1988

B.S. Forest Resources, University of Idaho, 1985

Registered Diagnostic Medical Sonographer, ARDMS, 1985

A.S. Radiologic Technology, Indiana University, 1977

Employment History

Currently working in the Ambient Monitoring Section of the Washington State Department of Ecology. My primary duties are the analysis and interpretation of long-term river and stream data. I also act as an in-house advisor on study design and statistical analysis of environmental data. I taught a 24 hour (8 weeks) linear regression class, have given several seminars on study design. Authored the Quality Assurance Project Plan for the River and Stream Ambient Monitoring Network, which included a power analysis to optimize sampling resources.

Biological Technician/self-employed (employed by the Klamath Tribe June-August 1990, on contract with the Klamath Tribe September-December, 1990 and on contract with U.S. Bureau of Reclamation January 1991 to December, 1992) Duties included: 1) collecting water samples from Upper Klamath Lake, Agency Lake, and several tributaries; 2) laboratory analyses for chlorophyll, nitrate, ammonia, total phosphorus and soluble reactive phosphorus concentrations; 3) Collect, compile, and analyze flow data from Agency Lake tributaries using Omnidata Datapod 115 continuous stream stage recorders; 4) collect temperature, pH, conductivity and dissolved oxygen data using Hydrolab submersible data sondes; 5) compile and analyze data from lake sampling and tributaries to develop a nutrient budget for the Agency Lake sub-basin for application in a lake eutrophication model; 6) design, execute and analyze several different experimental designs to assess nutrient limitation of phytoplankton and trophic interactions among nutrients, phytoplankton, zooplankton, and fish; 7) design, execute and analyze a monitoring program to estimate annual, areal phosphorus export from flood-irrigated pastures near Ft. Klamath, Oregon, for use in assessing the impacts of cattle ranching operations on lake nutrient loading. (Supervisor-Sharon Campbell, USBR-Denver, CO 303 236 6011)

Research/Teaching Assistant, University of North Carolina, Chapel Hill, NC. Worked with indoor mesocosm experiments to evaluate the effects of a gradient of total nitrogen:total phosphorus ratios and zooplankton herbivory on phytoplankton communities.

Volunteer, Klamath Indian Tribe, Chiloquin, OR. June-August, 1989. Worked with Tribal biologists (immediate supervisor-Larry Dunsmore) on *in situ* limnological experiments and water quality sampling of Upper Klamath Lake, Oregon.

Research/Teaching Assistant, Western Washington University Bellingham, WA. Sept. 1986 to August 1988. Duties included: 1) collecting water samples from Lake Whatcom and several of its tributaries, 2) determining discharge rates of the tributary streams, 3) laboratory analyses for chlorophyll, nitrate, ammonia, total phosphorus and soluble reactive phosphorus concentrations, 4) phytoplankton and zooplankton taxonomy and counts, 5) maintenance of boats and sampling equipment.

Environmental Consultant, self-employed. April 1987 to June 1988. Collected temperature, pH, dissolved oxygen and specific conductance measurements for the U.S. Army Corps of Engineers on Howard Hansen Reservoir, Green River, Wynoochee Reservoir, Wynoochee River and the Lake Washington Ship Canal (Washington state).

Hydrologic Technician, U.S. Forest Service. June 1985 to September 1985 and May 1986 to September 1986. Worked on a research crew studying water-induced forest road erosion in central Idaho and western Montana.

Publications/Presentations

Ehinger, W.J. and R.A. Matthews. 1988. Phytoplankton Population Dynamics in Lake Whatcom. Proceedings of the International Mountain Watershed Symposium, June 1988. Lake Tahoe, CA.

Ehinger W.J. and R.A. Matthews. 1988. Phytoplankton composition and temporal variation among three basins of a large, temperate, monomictic lake. Paper presented at the American Society of Limnology and Oceanography Annual Meeting, Boulder, CO.

R.A. Matthews, G.B. Matthews and W.J. Ehinger. 1991. Classification and ordination of limnological data: a comparison of analytical tools. Ecol. Model. 53: 167-187.

Ehinger, W.J. 1993. Seasonal variation in the relative importance of nutrient limitation and *Daphnia pulicaria* grazing on phytoplankton biomass and growth in a hypertrophic lake. Paper presented at the American Society of Limnology and Oceanography Annual Meeting, Edmonton, Alberta, Canada.

Ehinger, W.J., 1995 . Trend analysis in Puget Sound rivers. Proceedings of the Puget Sound Conference, January, 1995. Seattle, Washington.

Section 10. Information/technology transfer

Data will be summarized annually and distributed to BPA, CTUIR, ODFW, COE, USFS, USFWS, NMFS and the Conservation Districts and others for Walla Walla salmonid stock protection and recovery, hatchery supplementation planning and watershed restoration implementation. Annual progress will be presented orally at BPA progress review workshops and in other forums. The final report will be compiled by WDFW and printed and distributed by BPA in 2002. Oral presentations will be made to local public groups and data summaries will be made available to others for planning. Coordination of activities and efforts with others in the watershed and providing results of this project for planning and guidance of other projects will be a high priority.