PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Evaluate Juvenile Salmonid Outmigration And Survival In The Lower Umatilla

BPA project number: 8902401
Contract renewal date (mm/yyyy): 10/1999 ☐ **Multiple actions?**

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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NPPC Program Measure Number(s) which this project addresses
7.0C.4, 7.1C, 7.2D, 7.2D.1, 7.4I, 7.4I.1, 7.4L, 7.4L.1, 7.10, 7.10A.2

FWS/NMFS Biological Opinion Number(s) which this project addresses
No biological opionions have addressed the Umatilla River Outmigration Study

Other planning document references
A Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin (ODFW 1986); Umatilla Hatchery Master Plan (ODFW and CTUIR 1990); Umatilla River Subbasin Salmon and Steelhead Plan (ODFW and CTUIR 1989); Umatilla Basin Project-Initial Project Workplan (USBR and BPA 1989).

Short description
Determine migration patterns, migrant abundance, and survival of hatchery and natural juvenile salmonids in the Umatilla basin using PIT tag and radio telemetry technology and investigate effects of environmental variables on fish migration.

Target species
Spring and fall chinook salmon, coho salmon, summer steelhead, and Pacific lamprey.

Section 2. Sorting and evaluation

Subbasin
Lower Mid-Columbia / Umatilla River subbasin

Evaluation Process Sort

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

Section 3. Relationships to other Bonneville projects

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

Project #	Project title/description
20516	Umatilla River Subbasin Umbrella
8902401	Evaluate Juvenile Salmonid Outmigration and Survival
9000501	Umatilla Natural Production M&E
9000500	Umatilla Hatchery M&E
9402600	Pacific Lamprey Research and Restoration

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
8903500	Umatilla Hatchery O&M	Use of facilities, fish for tests
8343600	Umatilla Fish Passage Facility O&M	Assistance, information exchange
8802200	Umatilla Fish Passage Operations	Assistance, coordination, information exchange
8343500	Umatilla Satellite Facilities O&M	Coordination, information exchange
8710001	Enhance Anadromous Fish Habitat	Information exchange

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1997	Video monitored fish behavior / passage	Identified passsage problems / routes
1997	Evaluated tranport of juvenile fish	Determined mortality/condition effects on fish
1997	Completed Final Report for Passage Evaluation Study	Met contract obligations
1997	Measured velocities at key locations at the fish ladder and canal facility	Identified poor hydraulics for juvenile fish passage
1997	Determined diel patterns of fish movement	Identified differences in river and canal facility diel movement
1997	Determined condition of juvenile migrants	Identified health /condition problems
1997	Identified fish predators	Predation problems exist
1998	Evaluated new color marking techniques	Identified constraints/benefits to use of photonic /VI-jet marks on fish

1998	Estimated lower river natural production	Identified natural production success from adult outplants
1998	Estimated survival of hatchery migrants	Identified survival problems for specific rearing strategies and species
1998	Determined trap efficiencies	Identified trap efficiencies by species
1998	Investigated feasibility of PIT tag use	Clarified logistics for PIT tag use and conducted a pilot study
1998	Determined relationship between flow and fish migration	Identified flow and temperature effects on fish movement / survival
1998	Determine migration patterns of migrants	Identified similarities/differences between hatchery/natural migrations

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Use PIT tag technology to monitor tagged juvenile salmonids emigrating from the basin.	a	Coordinate installation of remote tag detection systems (134 kHz) at two lower river canal facilities.
1		b	Initiate PIT-tagging and monitoring activities.
1		c	Determine tag detection efficiency
1		d	Conduct trap efficiency tests with PIT-tagged fish
1		e	Edit, send, and retreive PIT tag data
2	Determine migration performance and pattern, migrant abundance, and survival of PIT-tagged hatchery fish	a	Remotely interrogate PIT-tagged hatchery fish from different rearing and release strategies and release locations.
2		b	Estimate migrant abundance and survival of specific tag groups
2		c	Tag and release fish for reach-specific survival studies from March - July..
3	Determine migration parameters, life history characteristics, migrant abundance, and survival of PIT-tagged natural fish.	a	Remotely and actively interrogate PIT-tagged natural fish and weigh and measure sampled fish.
3		b	PIT tag natural fish sampled in trap
3		c	Sample natural subyearling chinook and estimate abundance
3		d	Estimate migrant abundance and survival of tag groups from tag data.
4	Determine species composition, condition, and total weight/count of collected fish at Westland Canal	a	Sample, count, and examine fish and save mortalities for disease analysis
4		b	Obtain PIT tag data from collected fish
4		c	Weigh net-loads of fish and compute total number transported
5	Investigate relationships between river flow / temperature / turbidity and canal diversions with migration parameters of hatchery and natural fish	a	Obtain environmental data and canal flow data from other agencies
5		b	Measure Secchi depth and temperature at trap sites
6	Participate in a radio telemetry study to	a	Assist with tagging of summer steelhead

	validate survival estimates for steelhead		release groups
6		b	Assist with receiver installation and monitoring of tagged fish.
7	Assist with Pacific lamprey research	a	Collect and count juvenile lamprey
7		b	Conduct trap efficiency tests
8	Participate in planning and coordination activities in the basin	a	Attend basin coordination meetings
8		b	Present findings to basin research and management groups
9	Prepare annual progress report	a	Summarize and analyze findings
9		b	Interpret and discuss findings

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	10/1999	9/2000			10.00%
2	3/2000	8/2000	Abundance, survival		25.00%
3	10/1999	8/2000	Abundance, survival		20.00%
4	7/2000	8/2000	Species comp, abundanc		5.00%
5	10/1999	9/2000			5.00%
6	4/2000	6/2000	Survival, movement		10.00%
7	10/1999	2/2000	Abundance, migration		5.00%
8	10/1999	9/2000			5.00%
9	6/2000	3/2001			15.00%
				Total	100.00%

Schedule constraints
Time required to complete annual progress report for FY2000 will extend into FY2001. Remote detection at Westland Canal may not be completed in FY2000.

Completion date
2003

Section 5. Budget

FY99 project budget (BPA obligated): $250,785

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel		%41	123,390
Fringe benefits		%15	47,041
Supplies, materials, non-expendable property		%1	3,360
Operations & maintenance		%3	11,550
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Remote + hand-held 134 kHz detectors	%3	11,000
NEPA costs	NA		0
Construction-related support	NA		0

PIT tags	# of tags: 10,000	%9	29,000
Travel		%2	6,909
Indirect costs	35.5%	%22	68,249
Subcontractor	NA		0
Other			
		TOTAL BPA FY2000 BUDGET REQUEST	$300,499

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
			0
			0
			0
			0
		Total project cost (including BPA portion)	$300,499

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$299,215	$308,191	$180,600	

Section 6. References

Watershed?	Reference
☐	Burnham, K.P., D.R. Anderson, G.C.White, C. Brownie, and K.H. Pollock. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph 5:1-437.
☐	Cameron, W.A. and S.M. Knapp. 1993. Pages 5-48 in S.M. Knapp, editor. Evaluation of juvenile fish bypass and adult fish passage facilities at water diversions in the Umatilla River. Annual Report 1992. DOE/BP01385-3, BPA, Portland, OR
☐	Cameron, W.A., S.M. Knapp, and B.P. Schrank. 1994. Pages 1-76 in S.M. Knapp, editor. Evaluation of juvenile fish bypass and adult fish passage facilities at water diversions on the Umatilla River. Annual Report 1993. DOE/BP-01385-4, BPA, Portland, OR
☐	Cameron, W.A., S.M. Knapp, and B.P. Schrank. 1995. Pages 1-98 in S.M. Knapp, editor. Evaluation of juvenile fish bypass and adult fish passage facilities at water diversions on the Umatilla River. Annual Report 1994. DOE/BP-01385-5, BPA, Portland, O
☐	Cameron, W.A., S.M. Knapp, and R.W. Carmichael. 1997. Evaluation of juvenile salmonid bypass facilities and passage at water diversions on the lower Umatilla River. Final report to Bonneville Power Administration, Portland, OR
☐	Contor, C.R., E. Hoverson, and P. Kissner. 1995. Umatilla basin natural production monitoring and evaluation. Annual progress report 1993-1994 to Bonneville Power Administration, Portland, Oregon
☐	Contor, C.R., E. Hoverson, P. Kissner, and J. Volkman. 1996. Umatilla basin natural production monitoring and evaluation. Annual progress report 1994-1995 to Bonneville Power Administration, Portland, Oregon.
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☐	CTUIR (Confederated Tribes of the Umatilla Indian Reservation) and ODFW (Oregon Department of Fish and Wildlife). 1989. Umatilla River subbasin - salmon and steelhead plan. Prepared for the Northwest Power Planning Council for Columbia basin system pla
☐	CTUIR (Confederated Tribes of the Umatilla Indian Reservation) and ODFW (Oregon Department of Fish and Wildlife). 1990. Umatilla hatchery master plan. Prepared for the Northwest Power Planning Council, Portland, Oregon
☐	CTUIR and ODFW. 1997. Trapping and transportation of adult and juvenile salmon in the lower Umatilla River in northeast Oregon, 1996-1997. Umatilla River basin trap and haul program. Annual progress report to BPA, Portland, OR
☐	Dauble, D.D., J. Skalski, A. Hoffman, and A.E. Giorgi. 1993. Evaluation and application of statistical methods for estimating smolt survival. Report to Bonneville Power Administration, Portland, Oregon.
☐	Ephron, B., and R. Tibshirani. 1986. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. Statistical Science 1(1): 54-77.
☐	Focher, S.M., R.W. Carmichael, M.C. Hayes, and R.W. Stonecypher, Jr. 1998. Umatilla hatchery monitoring and evaluation. 1996 annual progress report to Bonneville Power Administration, Portland, Oregon.
☐	Hayes, M.C., S.M. Knapp, and A.A. Nigro. 1992. Pages 53-103 in S.M. Knapp, editor. Evaluation of juvenile fish bypass and adult fish passage facilities at water diversions in the Umatilla River. Annual and interim progress reports. DOE/BP-10385-2, Bo
☐	Hayes, M.C., R.W. Carmichael, S.M. Focher, N.L. Hurtado, M.L. Keefe, G.W. Love, W.J. Groberg, Jr., S.T. Onjukka, and K. Waln. 1996a. Umatilla Hatchery Monitoring and Evaluation. 1994 Annual progress report to BPA, Portland, Oregon.
☐	Hayes, M.C., R.W. Carmichael, S.M. Focher, W.J. Groberg, Jr., S.T. Onjukka, R.W. Stonecypher, Jr., and K. Waln. 1996b. Umatilla Hatchery Monitoring and Evaluation. 1995 Annual progress report to Bonneville Power Administration, Portland, Oregon.
☐	Keefe, M.L., R.W. Carmichael, R.A. French, W.J. Groberg, and M.C. Hayes. 1993. Umatilla hatchery monitoring and evaluation. Annual progress report to Bonneville Power Administration, Portland, Oregon.
☐	Keefe, M.L., R.W. Carmichael, S.M. Focher, W.J. Groberg, and M.C. Hayes. 1994. Umatilla hatchery monitoring and evaluation. Annual progress report to Bonneville Power Administration, Portland, Oregon.
☐	Knapp, S.M. and D.L. Ward. 1990. Pages 1-32 in A.A. Nigro, editor. Evaluation of juvenile fish bypass and adult fish passage facilities at Three Mile Falls Dam, Umatilla River. Annual Report 1990. DOE/BP-01385-1, Bonneville Power Administration, Port
☐	Knapp, S.M., J.C. Kern, W.A. Cameron, S.L. Shapleigh, and R.W. Carmichael. 1996. Evaluation of juvenile salmonid outmigration and survival in the lower Umatilla River basin. 1994-1995 annual progress report to the Bonneville Power Administraion, Portla
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☐	ODFW (Oregon Department of Fish and Wildlife) 1986. A comprehensive plan for rehabilitation of anadromous fish stocks in the Umatilla River basin. Report DOE/BP-18008-

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☐	USBR (U.S. Bureau of Reclamation) and BPA (Bonneville Power Administration). 1989. Umatilla basin project. Initial project workplan presented to the Northwest Power Planning Council, May 1989.
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PART II - NARRATIVE

Section 7. Abstract

Projects to enhance and reestablish salmonid populations in the Umatilla River are addressed in the FWP as contributors to the Council's goal of increasing Columbia River basin salmon returns. This project's goal is to determine the overall effectiveness of the fisheries rehabilitation plan by evaluating the outmigration success of hatchery and natural juvenile salmonids in the lower Umatilla River using PIT tag technology and radio telemetry. It provides knowledge for adaptive management of hatchery, river, and canal operations and supplements upriver natural production monitoring. Specific project objectives include 1) using PIT tag technology to remotely monitor fish migrants, 2) determining migrant abundance, migration patterns, and survival of tagged fish representing different hatchery rearing and release strategies, release locations, and natural fish production groups; 2) investigating relationships between environmental variables and fish migration; 3) conducting radio telemetry studies to validate steelhead survival; and, 4) sampling salmonids during summer transport operations and Pacific lamprey year-round. Results provide estimates of abundance and survival for specific groups of fish, descriptions of daily and seasonal migration patterns, and the relationships between fish movement and river variables.

Section 8. Project description

a. Technical and/or scientific background

Rehabilitation of anadromous fish stocks in the Umatilla River basin in northeastern Oregon requires the restoration of coho salmon *Oncorhynchus kisutch* and spring and fall races of chinook salmon *O. tshawytscha*, and enhancement of summer steelhead *O. mykiss* (ODFW 1986). Recent research toward Pacific lamprey restoration are part of the overall restorative process. Increases in diverse populations of Umatilla River salmon and steelhead have resulted from artificial and natural production (CTUIR and ODFW 1990). These efforts were intended to provide offsite mitigation for Columbia River basin salmon losses, as specified in the initial Fish and Wildlife Program (NPPC 1987). Since its inception in the mid-1980's, the Fisheries Restoration Program in the Umatilla River basin has resulted in increasing numbers of juvenile salmonid migrants as artificial production is increased through the new Umatilla Hatchery program (Keefe et al. 1993, 1994; Hayes et al. 1996a, 1996b; Focher et al. 1998) and natural production is enhanced from supplementation and adult outplants (CTUIR 1994; Contor et al. 1995, 1996, 1997, 1998; CTUIR and ODFW 1997). Monitoring and evaluation efforts to fine-tune specific restoration projects are ongoing. However, these efforts did not include an evaluation of the overall migration success and survival of hatchery-released and naturally-produced juvenile salmonids to the lower Umatilla River. Without such an evaluation, true success of the rehabilitation program could not be measured. In addition, current smolt-to-adult survival rates are low for all species (Focher et al. 1998). In-basin survival needs to be addressed to answer critical uncertainties related to overall survival.

The primary goal of this project is to determine the survival of juvenile migrants leaving the Umatilla basin. The project was initially focused (1989-1994) on evaluating screening and bypass facilities for

juvenile fish at irrigation diversions on the Umatilla River (Knapp and Ward 1990, Hayes et al. 1992, Cameron and Knapp 1993, Cameron et al. 1994, 1995). The evaluations were called for to ensure that fish were adequately protected at newly reconstructed passage facilities (ODFW 1986; NPPC 1987). Current project research initiated in 1995 developed out of the need to enlarge the scope of evaluating the success of juvenile salmonid passage within the whole basin to ensure an effective fisheries program evaluation. The project supplements and complements other ongoing monitoring and evaluation projects and continues to examine specific passage-related problems. The project has provided information on the success of specific hatchery rearing and release strategies and on natural production enhancement strategies, on the health of natural and hatchery populations in-river, on life history patterns of natural fish, and on specific passage problems and fish behaviors at Three Mile Falls Dam (Knapp et al. 1996, 1998a, 1998b). Information on juvenile migration parameters has influenced decisions regarding canal and ladder operations and flow enhancement strategies, particularly normative flow needs for fish. Information on migration of hatchery rearing strategies has helped to tweak the hatchery program for the Umatilla basin.

In the fourth year of monitoring (FY98), hatchery production fish were PIT tagged (400 kHz) and manually interrogated at migrant traps with hand-held detectors as a pilot study to the use of PIT tags. In the current, fifth year (FY99), the project proposal was amended to incorporate the use of remote PIT-tag detection for passive tag interrogation at lower canal facilities and to use radio telemetry for tracking juvenile summer steelhead movement; these techniques will allow researchers to better answer the critical question of survival. Monitoring of PIT-tagged fish is continuing the information gathering process beyond the 1996 flood regarding migrational and life history characteristics, growth, and survival for hatchey and natural fish. Lower river natural production is also being assessed through trap captures.

b. Rationale and significance to Regional Programs

The Fisheries Rehabilitation Comprehensive Plan (ODFW 1986) identified the need for an overall fisheries evaluation, including outmigration monitoring of hatchery and natural smolts thoughout the entire river basin. In addition, the FWP (NPPC 1994) specified that biological monitoring is needed to provide information for updating subbasin plans, for improving management and conservation of natural populations, for assessing the effectiveness of hatchery rearing and release strategies (including acclimation), and for supplementation research. The Umatilla River Subbasin Plan (CTUIR and ODFW 1989) specifies that information gaps on species production, juvenile migration, smolt-to-adult survival, and competition need to be filled for proper management of the fisheries resource. For most species, information has been non-existent.

This project is an integral part of achieving the Umatilla River basin management goal of restoring extirpated populations of spring and fall chinook salmon and coho salmon, and enhancing a remnant population of natural summer steelhead. It also supplements research on status of lamprey populations. The consequences in not funding this project would be the loss of information that is essential for making informed decisions regarding salmonid restoration and river operations in the Umatilla basin. The ability to effectively manage natural and hatchery fish species would be affected by the loss of information on production potential and life history of natural fish, in-basin migration parameters, and survival for all species and stocks. Objectives toward meeting the restoration goals were developed as part of the NPPC's Fish and Wildlife Program, the Comprehensive Plan for Rehabilitation of Anadromous Fish Stocks in the Umatilla River Basin (ODFW 1986), the Umatilla Hatchery Master Plan (ODFW and CTUIR 1990), the Umatilla River Subbasin Salmon and Steelhead Plan ODFW and CTUIR 1989), the Umatilla Basin Project Workplan (USBR and BPA 1989), and th Wy Kan Ush Me Wa Kush Wit Plan (Volume II, pg 45). In all these plans, outmigration monitoring was identified as critical to assessing the status and success of salmon rehabilitation efforts. Products of this project will contribute to: evaluating critical uncertainties about survival potential, migration, and production success of hatchery and natural stocks leading to greater returns of salmon and steelhead to the Umatilla River; providing species-specific life history information; improving management and conservation of natural populations; assessing effectiveness of hatchery rearing and release strategies; improving assessment of supplementation in the basin; reestablishing sport and Tribal fisheries in the Umatilla River; acquiring knowldge on lamprey migrations and population status, on

juvenile salmonid health, and of environmental effects on salmonid migration and survival. This project will benefit salmonids and lamprey by improving passage conditions, providing essential information for managment of the resource, and ultimately increasing survival.

One of the primary objectives in the Umatilla basin is to restore natural production of fall and spring chinook salmon as well as coho salmon for off-site mitigation of Columbia River salmon stocks. However, there remains substantial uncertainty about the original natural production goals and production capacity of the basin. For natural populations of salmon, steelhead, and lamprey, lower river monitoring provides additional information on life history characteristics and production that supplements information obtained in the upper river by the Umatilla Tribes. The proposed use of PIT tag monitoring will allow a more fine-tuned analysis of migration patterns and migration timing of individual juvenile salmon from distinct cohorts in upriver rearing areas in the mainstem Umatilla and its tributaries. Abundance and survival estimates for natural fish sheds light on problems within the early life history stages and helps to establish realistic estimates of production capacity, given current and historic flow regimes, water quality, and river uses. Information on needs of natural fish for passage, rearing, and survial is vital to further refine the Umatilla Basin Project. Monitoring activities for natural salmonids meet measures 7.0C.4, 7.1C, and 7.4L.1 of the FWP.

Target flows for natural and hatchery fish are currently being debated in regard to flow enhancement projects within the basin (Umatilla Basin Project). The greatest limiting factor in the Umatilla basin is poor water quality and quantity. A comprehensive database of information on flow needs for fish is required to justify increases in target flows, particularly during summer months. Our understanding of flow needs for and flow affects on fish at specific times of the year is developed from migration monitoring information. Extension of flow augmentation into summer months requires continued monitoring to ascertain the benefit to late migrants. For both hatchery and natural species, the information obtained by this project affects river and passage facility operations, diversion strategies, flow enhancement strategies, target flows, and water quality enhancement efforts. Information obtained and shared on facility passage problems meets measure 7.10A.2 of the FWP and required elements within the Umatilla Basin Project workplan.

The Umatilla Hatchery Master Plan (CTUIR and ODFW 1990) advocates adaptive management in its goal toward increasing Umatilla River production. The artificial production program relies, in part, on information obtained from outmigration monitoring to assist in making decisions regarding hatchery practices. Hatchery practices can be immediately evaluated as to their potential success or failure in the short-term. This information is used by hatchery managers and researchers to further fine-tune or adjust hatchery practices to optimize production and produce a better product which will ultimately affect adult returns, harvest opportunities, and affect decisions on which species is best suited for Umatilla Hatchery and the Umatilla River. Monitoring activities for artificially-produced fish meet measures 7.2D.1, 7.4I, and 7.4I.1 of the FWP.

Much of the work accomplished in this research project provides additional information for fisheries management, including effectiveness of new marking techniques, videography, and use of remote PIT-tag detection at canal bypass facilities. Work proposed in FY2000 would be to fine-tune PIT-tag detection capabilities in the basin. The installation of 134kHz PIT tag detectors at downstream mainstem dams provides the impetus to use this improved technology in the Umatilla Basin for answering critical uncertainties related to natural production success and hatchery effectiveness. Use of PIT-tag monitoring in-basin will augment the PIT-tag database from Columbia mainstem detections. A second year of effort at PIT tag monitoring in the Umatilla basin would allow a repeat of reach-specific survival studies to determine if survival is affected by release location. PIT tagging of natural fish by the Umatilla Tribes was delayed in FY98, precluding evaluation of their outmigration until FY99. In-basin monitoring in FY2000 would provide additional information on natural fish tagged with 134 kHz PIT tags.

c. Relationships to other projects

Study scope and approach of this project was developed in conjunction with CTUIR's Umatilla Basin Natural Production Monitoring and Evaluation Project (9000501) and ODFW's Umatilla Hatchery Monitoring and Evaluation Project (9000500). This project supplements monitoring efforts of the Natural Production M&E by monitoring and collecting biological information on natural migrants in the lower river and providing information on the natural production success of spawning fall chinook salmon from adult outplants. Biological information obtained includes outmigration timing, health, size, and scales for age analysis. Fish samples are collected for disease analysis by the ODFW Pathology Lab. The project supplements PIT-tagging of natural fish in the lower river to augment the PIT-tag database and interrogates fish tagged with PIT tags in the upper river. This project supplements monitoring efforts of the Umatilla Hatchery M&E by determining migration parameters and in-basin survival of fish production groups from different hatchery rearing and release strategies. Information on in-basin migration success of specific rearing, acclimation, and release strategies for hatchery-reared fish can lead to adjustment of hatchery practices that ultimately will increase the survival potential of the best-suited species. The proposal addresses migration success related to release location and release time effects, oxygen-supplemented rearing, rearing density, and rearing at different hatcheries. Survival information obtained in the short-term through in-basin monitoring can be compared with long-term smolt-to-adult survival. Such information is used in adaptive management decisions to improve new and existing hatchery effectiveness.

Information obtained on lamprey migration patterns is shared with the Pacific Lamprey Research and Restoration Project (9402600). Project staff will assist with studies to determine migrant lamprey abundance. Information on flow and fish relatioships is shared with river flow managers involved with the Umatilla Basin Project, including US Bureau of Reclamation, CTUIR, and Oregon Water Resources Department. Information on fish passage problems at screening and ladder facilities and recommendations is shared with the USBR (Umatilla Passage O&M) and local irrigation districts which are responsible for passage facility operations and maintenance in the Umatilla basin, the National Marine Fisheries Service which is responsible for developing operational criteria, and the Umatilla Basin Trap and Haul project (8802200). This project complements the Habitat Improvement Projects in the Umatilla basin (8710001 and 8710002) by monitoring any changes in fish abundance possibly due to habitat improvement or degradation. Monitoring coho salmon migrants in the lower river and sampling at Westland Canal during summer transport operations supplements activities and provides information to the Umatilla Satellite Facility Project (8343500) and the Umatilla River Trap and Haul Program.

Cooperation and collaboration amongst all parties and agencies involved in the Umatilla basin allows sharing of information to fill database gaps among projects and sharing of equipment, provides staff assistance during field sampling, and opportunities for participation in joint studies. Transfer of project information occurs to improve river operations, to fine-tune operating criteria for specific facilities, and to improve management decisions in the adaptive management process.

Project staff also involve local schools, organizations, other agencies, and other scientists in their activities, either through field opportunities, classroom lectures, sharing of expertise, equipment, or information, or obtaining permission for specific work. Approval for access and work at the in-river trap site is required of the Oregon Department of Transportation and approval for access to property for release of test fish is required of the Hermiston Wastewater Treament Plant and private landowners. We work with scientists with the National Marine Fisheries Service in sharing information and developing recommendations at passage facilities. We contact other agencies conducting similar work (Idaho Dept. Fish and Game, Yakima Indian Nation, WA Dept. Fish and Wildlife, Battelle, Pacific Northwest Labs) to improve our research and study designs. We work with Pacific States Marine Fisheries Commission to acquire tag detectors and interact with the PIT tag database. An arrangement has been established with the U.S. Fish and Wildlife Service to use their field trailer as an on-site office. We obtain specific database information necessary for project data analysis from the Oregon Water Resources Department, the National Weather Service, and the U.S. Geological Survey. We assist the Umatilla Basin Watershed Council in their understanding of basin issues through tours of passage facilities and trap sites. We require assistance from the Oregon State Police and the local county sheriff's department when hunting or fishing violations are

observed during the course of our work. We provide answers to questions on fish and wildlife issues from the public who visit our office and assist in promoting public awareness.

d. Project history (for ongoing projects)

This project succeeds the project to Evaluate Juvenile Fish Bypass and Adult Fish Passage Facilities at Water Diversions on the Umatilla River (Knapp and Ward 1990; Hayes et al. 1992; Cameron and Knapp 1993; Cameron et al. 1994, 1995, 1997). Passage facility research was conducted from 1990 to 1995 and provided information on injury and travel time for juvenile fish, screening efficiency, and screen velocities. Work was augmented to include studies on juvenile fish passage through adult fish ladders and the use of videography to monitor passage. Current research to Evaluate Juvenile Salmonid Outmigration and Survival in the Lower Umatilla River Basin developed out of the need to enlarge the scope of evaluating juvenile salmonid passage success (migration and survival) and to supplement and complement other ongoing monitoring and evaluation projects. Within the current project, objectives were met to complete the passage evaluation study (Cameron et al. 1997).

Monitoring and evaluating the outmigration of juvenile salmonids has been conducted for four years from 1995 - 1998 and is currently in its fifth year. During the first year evaluation (1994-1995; $256,971), we obtained preliminary data on juvenile salmonid migration, abundance, and survival by sampling at numerous sites with various traps (Knapp et al. 1996). Through these experiences, we refined study methods, identified survival problems, and identified logistical and operational constraints. During the second year (1995-1996; $283,140), we monitored the salmonid outmigration year-round at the West Extension Canal sampling facility and at a lower river rotary-screw trap. We initiated an evaluation of juvenile fish transport, tested the use of VI-jet tags, and augmented our data collection at Three Mile Falls Dam, including video monitoring at the east-bank ladder (Knapp et al. 1998a). During the third year (1996-1997; $292,399), we monitored at the rotary-screw trap only in an effort to obtain more reliable trap efficiency and fish abundance estimates. We continued the evaluation of juvenile fish transport, video monitored juvenile fish passage at Three Mile Falls Dam, and tested the use of Photonic tags in outmigration monitoring (Knapp et al. 1998b). Fourth year monitoring at the two trap sites (1997-1998; $259,842) was recently completed and included reach-specific survival studies, manual interrogation of fish for PIT tags, photonic marking of fish, and video monitoring at Three Mile Falls Dam. Current work in 1998-1999 ($249,000) will encompass the use of remote PIT tag detection for outmigration monitoring and survival estimation, additional studies on reach-specific survival, biological monitoring, and a pilot radio telemetry study to validate survival estimates for summer steelhead.

Major results thus far show survival estimates for most species to be variable year to year. Spring chinook salmon survival is between 30 - 60% and summer steelhead survival has been > 90%. Fall chinook salmon subyearlings suffer from high mortality in June and July due to elevated water temperatures and disease; survival is low (< 35%). Survival of yearling fish reared at Umatilla Hatchery is significantly less than survival of fish from Bonneville or Little White Salmon hatcheries and released in the Umatilla River. At times, transported fish incure significantly greater mortality and scale loss than non-transported fish. Flow augmentation in June facilitates the outmigration of hatchery and natural subyearlings. Hatchery fish condition deteriorates with time, especially hatchery summer steelhead; bird attacks on fish are worse immediately following fish releases. Natural fish are in better condition than hatchery fish and their size is significantly smaller. Smolt level is correlated with fish size and appears related to when fish movement peaks. Yearling spring chinook and subyearling fall chinook salmon migrate out quickly; coho salmon, yearling fall chinook salmon, and summer steelhead have protracted outmigrations. Migration patterns for hatchery and natural summer steelhead are similar but are longer in duration for natural salmon than hatchery conspecifics. Natural fall chinook salmon are being produced in the lower river, mostly from adult outplants. Fish movement increases with increasing river flow and is affected by changes in daylight; diel patterns of movement are different between fish in-river and at canal facilities. Juvenile fish behavior, injury, and passage at the adult fish ladder is affected by hydraulic patterns and velocity.

Findings on migration paremeters, bypass efficiencies, fish condition, ladder passage, and the presence of natural salmonids in the lower river can be applied toward management of river, canal, and passage facility operations and water release and flow enhancement strategies to improve outmigration, passage, survival, and rearing conditions for juvenile salmonids. Survival results may necessitate a change in approach to fisheries restoration efforts to increase effectiveness. Alteration of hatchery practices for specific rearing, acclimation, and release strategies is partly based on outmigration and survival results; these changes may result in improved products and greater adult returns. Information on lower river natural production assists managers in determining natural production potential and limitations. Successful natural production enhancement efforts for summer steelhead are contingent on understanding full life history characteristics of natural and hatchery stocks. Information on predators and predation facilitates control measures to increase salmonid survival. Results from disease analysis of migrant mortalities contributes to understanding in-river disease dynamics for specific species and stocks of fish. Observations of juvenile fish behavior at ladder structures affects ladder operations and design. Effectiveness of pilot studies on PIT tag and photonic mark use could alter marking /tagging strategies and provide additional migration information.

e. Proposal objectives

1. Use PIT tag technology to monitor tagged hatchery and natural juvenile salmonids emigrating from the Umatilla basin.
Assumptions: Ability to successfully tag representative groups of hatchery and natural juvenile salmonids; ability to effectively develop, install, and use remote detection systems (134 kHz) at West Extension Canal and Westland Canal; ability to successfully conduct trap collection efficiency tests using PIT tags, and tag detection efficiency tests.
Products: An in-line, 134 kHz PIT tag interrogation system at West Extension Canal for remote detection of tagged fish using the bypass; a PIT tag interrogation system at Westland Canal for fish entering the holding pond; databases of PIT-tagged fish released and detected in the Umatilla River and at mainstem dams; estimates of tag detection efficiency; estimates of trap collection efficiency at West Extension Canal by species and hatchery and natural fish during all flow regimes and canal operations.

2. Determine migration performance and pattern, migrant abundance, and survival of PIT-tagged hatchery-released spring and fall chinook salmon and summer steelhead in the lower Umatilla River; determine for specific rearing and release strategies of Umatilla production groups and for fish released within different river reaches.
Null hypothesis: There is no significant difference in survival or migration rate of different rearing and release strategies of tagged Umatilla production groups.
Null hypothesis: There is no significant difference in relative detection and migration rate among fish groups released in different river locations.
Assumptions: Ability to effectively detect PIT-tagged hatchery fish at trapping facilities with > 95% detection efficiency; ability to obtain valid trap efficiency estimates for computation of migrant abundance and survival estimates; ability to effectively conduct reach-specific survival tests.
Products: Detections of PIT-tagged hatchery fish in the lower river; information on migration timing, rate, and duration, and migration magnitude; estimates of survival from release point to detection point in the lower river for tagged spring and fall chinook salmon and summer steelhead; relative detection among and between different rearing and release strategies and release locations for each species or race of juvenile salmonid.

3. Determine migration parameters, life history characteristics, migrant abundance, and survival of PIT-tagged naturally-produced juvenile salmonids migrating within the lower Umatilla River; obtain biological data on sampled fish.
Null hypothesis: There is no significant difference in survival or migration characteristics among natural fish within a species tagged in different river locations.

Assumptions: Same as #2. Ability to effectively identify untagged natural fall chinook salmon from untagged hatchery subyearling salmon.
Products: Estimates of lower river abundance for tagged natural summer steelhead and spring chinook salmon and untagged fall chinook salmon; determination of migration performance and pattern for naturally-produced species; differences in migration parameters between hatchery and naturally produced species of fish; individual length and weight measurements on PIT-tagged natural fish; estimates of survival for tagged natural spring chinook salmon and summer steelhead.

4. Determine species composition, condition, and total weight/count of collected fish at Westland Canal during trap and transport operations.
Null hypothesis: None
Assumptions: Ability to obtain a representative sample for biological information.
Products: Counts and relative proportions of hatchery and natural fish per net load, mean lengths of fish, individual lengths and weights of PIT-tagged fish, assessment of fish condition, and net-load weights for salmonid and non-salmonid species; findings of pathological analysis.

5. Investigate relationships between river flow/temperature/turbidity and migration parameters of hatchery and natural fish; investigate relationship between canal flow and diversion rate on tag detections.
Null hypothesis: There is no significant correlation between environmental variables and migration patterns.
Null hypothesis: There is no significant correlation between canal flow or diversion rate and relative detections of PIT tags at West Extension Canal.
Assumptions: Ability to obtain valid environmental and hydraulic data.
Products: Relationship between environmental variables and migration parameters; association between water temperature and fish mortality; relationship between canal operations and tag detections.

6. Participate in a radio telemetry study to validate survival estimates for hatchery summer steelhead from different release strategies.
Null hypothesis: There is no significant difference in detection rate (survival) between early-released and late-released summer steelhead.
Assumptions: Ability to effectively tag, monitor, and detect radio-tagged steelhead in the Umatilla River.
Products: Tracking data of summer steelhead from acclimation/release site to RM 3, obtained from fixed site and mobile receivers; relative survival estimates between release groups.

7. Participate in a study to determine migrant abundance of Pacific lamprey emigrating from the Umatilla River.
Null hypothesis: None
Assumptions: Ability to effectively capture juvenile lamprey and conduct trap efficiency tests following standard mark/recapture methods and assumptions.
Products: Counts of juvenile lamprey in the rotary-screw trap; trap collection efficiency estimates for juvenile lamprey.

8. Participate in planning and coordination activities associated with anadromous fish passage in the Umatilla basin.
Products: Effective and coordinated conduct of research projects and dissimination of information necessary for adaptive fisheries management and optimal river operations in the basin.

9. Prepare an annual progress report for the Outmigration and Survival Study.
Products: Written annual progress report including tabular and graphic presentations of products obtained and interpretations of findings.

f. Methods

During the FY2000 contract period, we will monitor the outmigration of PIT-tagged (134 kHz) hatchery and natural juvenile salmonids and estimate abundance and survival of these fish. We will coordinate the installation of new 134 kHz tag detectors at two lower river canals and determine trap and detection efficiencies. Using PIT tags, we will conduct reach-specific survival studies and continue to investigate flow and temperature effects on smolt migration and survival, particularly during flow enhancement operations. We will participate in a radio-telemetry study to monitor the movement of steelhead from separate release groups and assist with lamprey abundance estimations.

PIT Tagging and Tag Detection (Obj 1): In FY2000, we will coordinate installation of remote 134 kHz-tag detectors at the West Extension Canal sampling facility and the Westland Canal holding pond. We will assist with PIT tagging of all hatchery production groups and test groups, tag untagged natural fish sampled at the lower traps, and interrogate all sampled fish for PIT tags. We will coordinate with PSMFC the acquisition of new remote tag detectors and with USBR the installation of the detectors. A computer and monitor system will be installed at each remote detection site for automatic storing of PIT tag detections. Two hand-held detectors will be used for hand sorting of fish and initial tagging. PIT tagging of hatchery and natural fish will begin in October 1999 and end in May 2000. Number of fish to be tagged for each production group or test group (reach-specific survival) will be determined from 1999 detection results, but will not be <250 per group. Fish tagged for release site tests will be held separately at the hatchery to determine tag loss and for test use later one. Hatchery and natural PIT-tagged fish will be remotely interrogated at the West Extension Canal facility (RM 3) and at Westland Canal (RM 27). During monitoring at the rotary trap from October through February, all natural fish will be interrogated for PIT tags. Untagged and sampled natural spring chinook salmon and summer steelhead will be tagged at the trap sites to augment CTUIR's tag database; tagged fish will be held for 24-48 h to determine tag loss and mortality.

Tags recorded on hand-held detectors will be downloaded onto a computer file; tags recorded remotely will be automatically transferred to a connected computer. All files of tag releases, tag recoveries, and tag mortalities will be sent to the PITAGIS database. The PIT tag database will be interrogated to retreive information on tagged Umatilla fish detected at lower mainstem dams and at the estuary. Efficiency of the remote detection systems will be tested daily by using blank tags imbedded in wooden rods.

Trapping and Outmigration Monitoring (Obj 1, 2 ,3, 4, 5, 7): To detect PIT-tagged fish, we will operate the West Extension Canal sampling facility (RM 3) during the primary outmigration period (March-July 2000) and the rotary trap (RM 1.2) most of the remaining contract period (October 1999-February 2000). At the rotary trap, fish will be sampled on a daily or intermittent basis, identified to species and origin, interrogated for PIT tags, and counted. All fish will be placed in a mild anesthetic (MS-222) prior to handling and all mortalities of natural fish will be frozen for later analysis of pathology. The canal facility at RM 3 will be operated 100% in the bypass mode beginning in early March as hatchery fish are being released. Monitoring effort will focus on ensuring the sampling facility and detection system is operating satisfactorily and will not involve massive fish sampling. We will limit sampling to periods when fish are needed for trap efficiency tests. During the outmigration of subyearling chinook salmon in June, increased subsampling will be necessary to obtain an abundance estimate for natural fall chinook salmon. These fish will not have been PIT tagged and cannot be remotely monitored. To differentiate between non-clipped hatchery and natural chinook salmon, we will interrogate all non-clipped subyearlings for blank wire tags (hatchery fish). Hatchery and natural fish will also be interrogated for PIT tags using a hand detector; natural subyearling salmon will be counted. For all tagged species, rearing and release strategies, we will ascertain migration performance (rate and timing), migration patterns (duration and magnitude by date), and migrant abundance (total outmigration of tagged group).

In July or August, we will remotely monitor PIT-tagged fish entering the holding pond at Westland Canal and subsample fish that have been collected for transport. We will weigh net-loads of fish and determine species composition to estimate total number of juvenile salmonid species transported. Resident fish will be weighed separately after net-load weighing to determine their weight contribution to the sample. Juvenile salmonids will be measured and evaluated for condition. We will not trap in late August or

September because of extremely low flow conditions in the lower river and the discontinuance of juvenile transport.

Trap Efficiencies (Obj 2, 3, 7): Trap collection efficiencies for juvenile salmon will be determined for the West Extension Canal facility, using fish that will be PIT tagged. No tests will be conducted at the rotary trap because too few fish are collected or at Westland Canal because all fish are captured. We will periodically subsample fish entering the sampling facility to obtain sufficient numbers for tagging; we will tag and release fish twice weekly. Approximately 200 fish per species will be tagged each week (*M*) during the peak migration. After tagging, fish will be held at the canal site for 24-48h prior to release to determine tag loss and mortality (percent survival). We will transport and release tagged fish about 2 miles upriver and remotely interrogate these fish (*m*)as they pass through the bypass system at the canal. Trap efficiency estimates will be determined for each species of hatchery fish (except coho salmon) and for natural summer steelhead (*TE = m/M*); trap efficiency estimates for natural spring and fall chinook salmon will be based on estimates for hatchery conspecifics.

Trap efficiencies for Pacific lamprey at the rotary trap will be determined using juvenile lamprey that are clipped on the dorsal fin and released upriver. Trap monitoring and efficiency tests will be conducted at the rotary trap in the fall and winter months.

Abundance Estimates (Obj. 2, 3, 7): Abundance will be estimated mostly for hatchery and natural fish that are PIT-tagged; fish without tags will normally not be detected or sampled and therefore their abundance cannot be estimated (the exception is for natural subyearling fall chinook salmon). Abundance estimates (*A*) for tagged hatchery and natural fish species detected at West Extension Canal will be based on the migrant abundance method (Dauble et al. 1993) using the number of tag detections (D) and the trap efficiency estimate (TE) for each fish species [*A = (D)(1/TE)*]. In this case, individually PIT-tagged fish will represent a "batch" mark for fish groups from hatchery rearing strategies, release strategies, or reach-specific release sites. When sampling is necessary, we will adjust the number of tag detections by the sample rate. Abundance estimates for untagged natural subyearling chinook salmon passing RM 3 will be based on the number of fish sampled (expanded by sample rate) and the trap efficiency estimate of the hatchery conspecific. Sample rate will be at or < 10% to minimize the number of fish sampled and handled. We will use the Bootstrap method (Ephron and Tibshirani 1993) to compute a variance for the abundance estimate.

Survival Estimates (Obj 2, 3,): Survival will be estimated for tagged hatchery and natural fish detected at the West Extension Canal facility using the single-release recapture model (Burnham et al. 1987), and will be based on the migrant abundance of specific tag groups of fish. Individually PIT-tagged fish will represent a "batch" mark for fish groups from hatchery rearing strategies, release strategies, or reach-specific sites. With the known number of tagged fish released (R_t) and a migrant abundance estimate for tagged fish at the recovery site (A_t), a survival estimate will be computed for each tag group within a fish species. This method will be dependent on good tag detection and trap collection efficiencies. Release sites for hatchery fish will be at the upriver acclimation ponds. We will assume that survival of tagged fish groups is representative of survival of the main production group. Differences in detection trends among the various tag groups will be tested for significance with the Chi^2 test of independence.

To estimate survival of tagged natural migrants, natural spring chinook salmon and summer steelhead will be captured upriver (RM 80) by CTUIR beginning in fall 1999, PIT tagged, and released, and detected by ODFW at the rotary trap or West Extension Canal. To derive a survival estimate, the abundance estimate for tagged spring chinook salmon and summer steelhead at the trap site will be compared to the number of fish that were tagged upriver.

We will also conduct a test to determine reach-specific survival of hatchery fish, using information obtained from PIT tag detections at lower Umatilla River traps and at John Day and Bonneville dams. This study will follow the single release-recapture model coupled with the known capture history protocol (Burnham et al. 1987). PIT-tagged fish will be released at strategic sites in the Umatilla River, in addition

to the standard upriver sites, to determine the effects of river reaches on survival. Strategic sites will be based on their proximity to diversion canals and the standard release site(s) will serve as the control. Two to three tagged groups of fish (250-500 fish per release site) will be released at each site, several days apart, to serve as replicates. Tagged species will be interrogated on the Umatilla River and mainstem Columbia River. We will use ANOVA to determine significant differences in relative detections (relative survival) and migration rate smong release site groups (Snedecor and Cochran 1989). PIT-tagged subyearling fall chinook salmon will also be released at the Westland Canal holding pond in July during juvenile trap and haul operations. These fish will be transported to and released at the mouth of the Umatilla River and detected at mainstem dams. Recovery estimates on these fish will provide information on transport effects. All fish will be PIT tagged at the hatchery site and each release group will be held in separate circulars until testing. At test time, a subgroup of fish will be removed, interrogated for tag number, and transported upriver for a replicate release. Mortalities and tag loss will be accounted for at the hatchery. At Westland Canal, fish will be acclimated at the site to ambient conditions and river water temperature several days prior to release in July.

Environmental Monitoring (Obj 5): To evaluate environmental factors that may influence smolt migration or survival, we will measure daily the minimum and maximum water temperatures at the collection sites and obtain upper river temperature data from USBR thermograph stations. Flow data from West Extension Canal and the lower river will be obtained from the U.S. Geological Survey and the Oregon Water Resources Department. Weather data will be collected from the National Weather Service in Pendleton, Oregon. We will measure Secchi depth daily to determine changes in water clarity. We will use linear correlation to determine relationships.

Radio Tracking (Obj 6): We will assist with the tagging (25-50) and tracking of hatchery summer steelhead to validate survival estimates and investigate residualism of fish from early and late release groups. Tags will be purchased by the lead project (#9000500) and equipment will be borrowed from CTUIR. Fish will be tracked using fixed-site receivers at strategic river locations and at the acclimation ponds, and with a mobile tracking unit. Fish will be tagged in April and tracked from mid-April to late June. We will periodically download information from associated dataloggers to laptop computers.

Planning and Coordination (Obj 8): We will use coordination and information exchange processes currently established within the Umatilla Basin (Umatilla River Operations Group, Umatilla Passage Technical Work Group, Umatilla Monitoring and Evaluation Oversight Committe) to assist in project planning and coordination**.**

g. Facilities and equipment

1. *Traps*: Traps for collection of fish will include a 5-ft rotary-screw trap (E.G. Solutions, Corvallis, OR), a permanent fish collection facility built into the juvenile fish bypass at West Extension Canal, and a collection and holding facility at Westland Canal. The sampling facility at West Extension Canal has been modified to allow continuous sampling and/or bypassing of fish and the easy retrieval and processing of sampled fish. A sheltered work station has been built at the rotary trap site to process fish with the provision of a gravity flow system for water inflow. The rotary trap will be anchored to bridge support pillars.

2. *Transport*: Transport of fish for release during trap efficiency tests and for release-site tests will be provided by a 250-gal slip tank loaded into the bed of a 3/4-ton pickup truck. The tank will be supplied with an auxilliary aeration system. At times when few fish were transported, we will use 30-gal garbage cans.

3. *Offices:* Office space at the West Extension Canal site is provided through the use of a travel trailer excessed to ODFW from the U.S. Fish and Wildlife Service. Office space in Hermiston occupies a 2,600 ft^2 suite and is shared with other projects. Office is equipped with Fax machine and copier.

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4. *Computer Equipment*: Three desk-top (386, 486, + pentium) and one lap-top computer (486) are available for word processing, data summarization and analysis, graphics development, and PIT tag

downloading and uploading. MS Office is the standard software used. A 56kbps modem is connected for email exchange and internet access on two of the desktop computers.

5. *Vehicles*: One vehicle will be used for transporting project staff to meetings, field sites, and training year-round. Vehicle will be obtained from DAS. During field sampling, one year-round 3/4-ton pickup truck and one seasonal 1/2-ton truck will be used for personnel, fish, and equipment transport.

6. *Technical and PIT-tag Equipment*: Water velocities will be measured with a Marsh McBirney electromagnetic flowmeter (Model 2000). Underwater video monitoring can be done with a Sony (model HMV-352) underwater video camera (Furhman Diversified TX)and Sony (model EV-A50) 8-mm video cassette recorder. Two table top PIT tag detectors (134 kHz) and two remote detectors will be purchased and used to interrogate PIT-tagged fish. Radio tracking equipment will be loaned by Intertribe and CTUIR. Radio tags will be purchased by another project (9000500).

h. Budget

Personnel costs include full-year salaries for two project biologists, and partial-year salaries for the program manager, office support, and seasonal workers. Fringe benefits are 36% of permanent salaries and 45% of seasonal salaries. Non-expendable items include remote and hand-held PIT-tag detectors (134 kHz). Costs for Supplies cover training, field supplies, and field clothing. O&M costs are shared among other BPA-funded projects in the office and cover office and office equipment rent, office supplies, utilities, telephone + internet acces, and technical services. Travel includes vehicle rent, mileage, and per diem costs. The total estimated budget for FY2000 is approximately $49,700 more than the FY1999 budget. This additional amount reflects the purchase of new PIT tag detectors and 10,000 tags, and includes a 3% increase in salaries, a 5% increase in costs for Supplies and O&M, and an increase in overhead rate to 35.5%.

Section 9. Key personnel

Program Leader: Richard W. Carmichael; FTE = 0.08
Project Leader: Suzanne M. Knapp; FTE = 1
Ass't Project Leader: Shannon M Focher; FTE = 1
Seasonal workers: FTE = 2

Program Manager
Richard W. Carmichael

Education

1984 - M.S., Fisheries Science, Oregon State University, Corvallis, OR
1979 - B.S., Fisheries Science, Oregon State University, Corvallis, OR

Current Employment

Oregon Department of Fish and Wildlife, Fish Research and Development, La Grande, OR. July 1990 - present. Program Leader - Executive Manager for NE Oregon Fisheries Research and Development Program. Primary responsibilities are to develop and direct implementation of a complex research program to evaluate success of protecting, reestablishing, and restoring ESA listed and non-listed stocks in eastern Oregon. Oversees the work of 14 full-time fisheries biologists and up to 8 projects, and represents ODFW on regional and national scientific committees. Adjunct professor at Eastern Oregon University.

Past Employment

Fisheries Research Biologist (Project Leader), Oregon Department of Fish and Wildlife, La Grande, OR. December 1983 to July 1990.
Fisheries Research Biologist (Assistant Project Leader), Oregon Department of Fish and Wildlife, La Grande, OR. March 1983 to December 1983.
Project Assistant (Experimental Biology Aid), Oregon Department of Fish and Wildlife, La Grande, OR. October 1982 to March 1983.

Expertise

Expertise in fisheries research project development and implementation, personnel management, budget development and tracking, technical report writing, natural production and supplementation research, hatchery effectiveness, hatchery and wild fish interactions, life history, harvest assessment, stock assessment, passage evaluation, straying, captive broodstock, statistical analysis, coded-wire tag implementation and assessment, bass and trout ecology, creel censusing.

Recent publications

1998. Status review of the spring chinook salmon hatchery program in the Grande Ronde River Basin, Oregon. Lower Snake River Compensation Plan Status Review Symposium, USFWS, Boise, ID.

1998. Status review of the spring chinook salmon hatchery program in the Imnaha River Basin, Oregon. Lower Snake River Compensation Plan Status Review Symposium, USFWS, Boise, ID.

1997. Straying of Umatilla River hatchery origin fall chinook salmon into the Snake River. (R.W. Carmichael). *In* Genetic effects of straying of non-native hatchery fish into natural population (R.S. Waples, convenor). National Oceanic and Atmospheric Administration, Seattle, WA.

1995. Status of supplementing chinook salmon natural production in the Imnaha River basin. *In* Uses and effects of cultured fishes in aquatic ecosystems (H.L. Shramm, Jr., and R.G. Piper, eds.)

1994. A comparison of the performance of acclimated and direct stream released, hatchery -reared steelhead smolts in Northeast Oregon. (Whitesel, T.A., P.T. Lofy, R.W. Carmichael, R.T. Messmer, M.W. Flesher, and D.W. Rondorf) Pages 87-92 *in* High performance fish (D.D. MacKinlay, ed.); Fish Physiology Section, American Fisheries Society, Fish Physiology Association, Vancouver, British Columbia, Canada.

Project Leader
Suzanne M. Knapp

Education

1981 M.S., Biology, Eastern Washington University, Cheney, WA
1976 B.S., Environmental Health, Boise State University, Boise, ID
1974 B.S., Zoology, The College of Idaho, Caldwell, ID

1971 A.A., Liberal Arts, Long Beach City College, Long Beach, CA

Current Employment

8/91 - Present **Fisheries Research Biologist**, Oregon Department of Fish and Wildlife, 80866 Hwy 395 No., Hermiston, OR 97838

Project leader for the Umatilla River Outmigration and Survival Study. Primary responsibilities are to identify and oversee research goals and objectives, coordinate and administer project operations, develop and monitor project budget, conduct data analyses, prepare reports, presentations, and proposals, personnel management, collect scientific data, participate in interagency planning/coordination meetings, and provide technical assistance to agency staff. Also project leader on adult salmonid passage study at Snake River dams (1991-1993), using electronic tunnel and underwater video technology.

Past Employment

11/89 - 8/91 **Fisheries Research Biologist** (Assistant Project Leader), Oregon Dept. Fish and Wildlife,Hermiston, OR
2/87 - 10/89 **Fishery Biologist**, U.S. Army Corps of Engineers, Umatilla, OR
4/86 - 6/86 **Hydroacoustic Technician**, Parametrix, Bellevue, WA
9/84 - 4/85 **Fishery Biologist**, U.S. Fish & Wildlife Service, Cook, WA
7/83 - 1/84 **Fishery Biologist**, U.S. Fish & Wildlife Service, Cook, WA
3/83 - 7/83 **Biological Technician**, National Marine Fisheries Ser., Pasco, WA
3/78 - 12/78 **Aquatic Biologist**, Envirosphere Company, Satsop, WA

Expertise

Thirteen years experience in salmonid passage and migration on mainstem Columbia River and tributaries. Five years of experience in macroinvertebrate taxonomy and fish food habits. Expertise in technical report writing, personnel management, project planning and development, budget development, passage/bypass facility designs and operation at dams and canals, smolt monitoring, fish marking/tagging, aquatic entomology, computer usage.

Publications

Cameron, W.C., S.M. Knapp, and R.W. Carmichael. 1997. Evaluation of juvenile salmonid bypass facilities and passage at water diversions on the lower Umatilla River. Final report to Bonneville Power Administration, Portland, Oregon (DOE/BP-01385-7).

Knapp, S.M., J.C. Kern, W.A. Cameron, S.M. Snedaker, and R.W. Carmichael. 1998a. Evaluation of juvenile salmonid outmigration and survival in the lower Umatilla River basin. Annual progress report 1995-1996 to Bonnville Power Administration, Portland, Oregon.

Knapp, S.M., W. A. Cameron, J.C. Kern, and R. W. Carmichael. 1998b. Evaluation of juvenile salmonid outmigration and survival in the lower Umatilla River basin. Annual progress report 1996-1997 to Bonneville Power Administration, Portland, Oregon.

Knapp, S.M. and C.J. Knutsen. 1992. Evaluation of passage of adult salmon and steelhead at Lower Granite Dam and of electronic and underwater video technologies as passage evaluation methods. Report to the U.S. Army Corps of Engineers, Walla Walla District.

Assistant Project Leader
Shannon M. Focher

Education

1989 - B.S., Biology, Oregon State University.

Current Employment

1/98 - Present **Fishery Biologist** (Assistant Project Leader), Oregon Dept. Fish & Wildlife, 80866 Hwy 395, Hermiston, OR 97838

Current project objectives are to determine the timing, abundance, and survival of juvenile salmonid migrants in the Umatilla River. Duties include assisting with the development and implementation of study

plans, overseeing PIT-tagging and monitoring, managing PIT-tag database files, procuring equipment and supplies, operating juvenile fish traps in-river and at canal facilities, collecting biological and hydrological data, conducting mark-recapture studies, directing activities of seasonal employees, conducting scientific analysis of data and literature searches, writing progress reports and journal articles, presenting talks at meetings, and providing technical assistance to agency staff and managers.

Past Employment

2/93 - 12/97	**Assisstant Proj. Leader**, Oregon, Dept. Fish & Wild., Hermiston,OR
5/91 - 8/92	**Exp. Biology Aide**, Oregon Dept. Fish & Wild., Clackamas, OR
2/91 - 3/91	**Technician**, National Marine Fisheries Service, Astoria, OR
5/90 - 1/91	**Exp. Biology Aide**, Oregon Dept. Fish & Wild.,Newport, OR
3/89 - 7/89	**Research Assistant**, Oregon St. Univ., Corvallis, OR

Expertise

Ten years of work experience conducting fisheries studies. Extensive experience in marking fish and conducting and analyzing creel survey data. Additional experience in collecting and analyzing fisheries data, spawning ground surveys, age determinations of warmwater species, recording behavior of marine mammals and gillnet interactions, operation of scientific instruments in the field and laboratory, conducting statistical analyses, and writing reports.

Publications

Focher, S.M., R.W. Carmichael, M.C. Hayes, and R.W. Stonecypher, Jr. 1998. Umatilla hatchery monitoring and evaluation. 1996 annual progress report DOE/BP-23720-1 to Bonneville Power Administration, Portland, Oregon

Hayes, M.C., R.W. Carmichael, S.M. Focher, N.L. Hurtado, M.L. Keefe, G.W. Love, W.J. Groberg, Jr., S.T. Onjukka, and K. Waln. 1996a. Umatilla hatchery monitoring and evaluation. 1994 annual progress report to Bonneville Power Administration, Portland, Oregon.

Hayes, M.C., R.W. Carmichael, S.M. Focher, W.J. Groberg, Jr., S.T. Onjukka, R.W. Stonecypher, Jr., and K. Waln. 1996b. Umatilla hatchery monitoring and evaluation. 1995 annual progress report DOE/BP-23720-4 to Bonneville Power Administration, Portland, Oregon.

Section 10. Information/technology transfer

Progress reports will be written annually and distributed to those on the BPA publications distribution list or placed on the internet. Final completion reports will be written at the conclusion of the project and distributed similar to annual progress reports. Quarterly reports of accomplishments are distributed to key agencies and BPA. Journal articles are being developed on specific aspects of the project and on the passage study completion report. Results will be presented at Umatilla Passage Technical Work Group meetings, Umatilla Management, Monitoring and Evaluation Oversight Committee meetings, and Umatilla River Operations Group meetings. A Umatilla basin research review was held in January 1998, covering most research projects within the basin. Presentations are given at AFS meetings, special workshops and conferences (Smolt Workshop, Fish Culture Conference, Passage and Screening workshop) and CBFWA and BPA public reviews. PIT tag information is transferred to the PITAGIS database.

Congratulations!