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## PART I - ADMINISTRATIVE

### Section 1. General administrative information

#### Title of project

Annual Stock Assessment- Coded Wire Tag Program (Wdfw)

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**BPA project number:** 8906600  
**Contract renewal date (mm/yyyy):** 10/1999  **Multiple actions?**

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

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**Business acronym (if appropriate)** WDFW

#### Proposal contact person or principal investigator:

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**NPPC Program Measure Number(s) which this project addresses**  
Sections 7.1C, 7.2A.2, 7.2B, 7.2D, 8.4C, 8.4C.2,8.4C.3, 8.4C.4, 8.4D

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**FWS/NMFS Biological Opinion Number(s) which this project addresses**  
ND-NMFS-BO-Basic Monitoring; NMFS Hydrosystem Operations Biological Opinion-VIII.A.13(Reasonable & Prudent Alternative to the Proposed Action #13); Biological Opinion -Impacts on listed Snake River salmon by fisheries conducted pursuant to the 1996-1998 m

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#### Other planning document references

Snake River Recovery Plan 2.1.d.5; Snake River Salmon Recovery Team: Final Recommendations: Chapter III.K:Importance of stock identification in managing salmon; Chapter IV.7 Evaluation and monitoring of population status and trends (also subsections 7.c and 7.d). Wy Kan Ush Me Wa Kush Wit: Review Draft, volume 1: Section 5A- Recommendations:Research, Monitoring and Evaluation and a Coordinated Information System; Section 5B-technical Recommendations: #9) Selective Fisheries Habitat: Ocean and Mainstem; #10 Chinook Harvest Ceilings Habitat: Ocean (CWTs essential for estimating survival rates); #13 Stock-specific concerns Habitat: Mainstem, Tributaries

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**Short description**

Apply coded-wire tags to production groups of chinook and coho salmon at WDFW Columbia River Hatcheries and monitor hatchery salmon survival trends, evaluate hatchery techniques and provide information to Basin wide stock assessment.

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**Target species**

Fall and spring chinook, and coho salmon

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**Section 2. Sorting and evaluation****Subbasin**

System wide (Grays, Elochoman, Toutle, Lewis, Kalama, Washougal, Klickitat, Upper Columbia Mainstem)

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**Evaluation Process Sort**

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

**Section 3. Relationships to other Bonneville projects**

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

<b>Project #</b>	<b>Project title/description</b>
20543	Coded Wire Tag Program (Programmatic Umbrella)
8906600	Annual Stock Assessment -Coded Wire Tag Program (WDFW)
8900690	Annual Stock Assessment_Coded Wire Tag Program (ODFW)
8906500	Annual Stock Assessment- Coded Wire Tag Program (USFWS)
8201300	Coded Wire Tag Recovery Program (PSMFC)
8816300	Effects of Coded Wire Tag on the Survival of Spring Chinook (WDFW)

**Other dependent or critically-related projects**

<b>Project #</b>	<b>Project title/description</b>	<b>Nature of relationship</b>
9600800	PATH-Participation by State & Tribal Agencies	Data from 8906600,8900690, and 8906500 used in analysis
9000500	Umatilla Hatchery Monitoring and Evaluation	Tag coho for release in Umatilla Basin. Identification of hatchery fish from all projects in Umatilla Basin
9306000	Select Area Fisheries Evaluation	Identification of project hatchery fish in Youngs Bay fishery
9506300	Yakima/Klickitat Monitoring & Evaluation Program.	Tag coho for release in Yakima Basin and identify hatchery fish in Yakima Basin
9603301	Yakima River Fall chinook suppl.	Identification of hatchery fish in Yakima Basin
9603302	Evaluate the feasibility and potential risks of restoring Yakima River coho	Tag coho for release in Yakima Basin and identify hatchery fish in Yakima Basin
9604000	Evaluate the feasibility and risks of coho reintroduction in Mid-Columbia	Identification of hatchery fish in Wenatchee and Methow Basins
8805304	Monitor actions implemented under the Hood River Production Program	Identification of hatchery fish in Hood River Basin
9144	Monitor natural escapement and productivity of John Day Basin spring chinoo	Identification of project hatchery fish in John Day Basin
	Mainstem Umbrella Proposal	Tags from all projects can be evaluated

**Section 4. Objectives, tasks and schedules**

**Past accomplishments**

<b>Year</b>	<b>Accomplishment</b>	<b>Met biological objectives?</b>
1990	Tagged 1,434,101 chinook and coho	Yes, but not all production groups included
1991	Tagged 1,377,166 chinook and coho	Yes, but not all production groups included
1992	Tagged 1,299,245 chinook and coho	Yes, but not all production groups included
1993	Tagged 2,473,946 chinook and coho and collected 3,148 tags from returning adults	All production groups included. Objective of 30 observed recoveries were met for 7 of 7 chinook groups and for 5 of 11 coho tag groups.
1994	Tagged 2,473,946 chinook and coho and	Yes, all production groups included.

	collected 3,794 tags from returning adults	Objective of 30 observed recoveries were met for 7 of 7 chinook groups and 3 of 11 coho groups.
1995	Tagged 1,855,939 chinook and coho and collected 2,673 tags from returning adults	Yes, all production groups included. Objective of 30 observed recoveries were met for 7 of 10 chinook groups and 2 of 11 coho groups.
1996	Tagged 1,798,528 chinook and coho and collected 1,266 tags from returning adults	Yes, all production groups included. Objective of 30 observed recoveries met for 9 of 11 chinook groups and 4 of 11 coho groups.
1997	Tagged 2,180,255 chinook and coho and collected 3,618 tags from returning adults	Yes, all production groups included. Objective of 30 observed recoveries met for 8 of 11 chinook groups and 1 of 11 coho groups.
1998	Number of tagged fish not yet available.	Yes, all production groups included. Objective of 30 observed recoveries not yet determined for chinook or coho.

**Objectives and tasks**

<b>Obj 1,2,3</b>	<b>Objective</b>	<b>Task a,b,c</b>	<b>Task</b>
1	Tag and release at least one group of smolts from each hatchery	a	Coordinate tagging with all appropriate entities
		b	Apply coded-wire tags into snouts and remove adipose fin of 2 million salmon at 8 hatcheries
2	Recover snouts, decoded tags, and use information to estimate survival of tagged groups	a	Collect snouts from adult salmon returning to hatcheries
		b	Decode tags, check and verify data and report to PSMFC data base
		c	Access central data base and estimate survival and distribution
		d	Analyze results and recommend improvements
3	Develop preliminary catch, escapement and distribution data for all Columbia River Hatcheries	a	Retrieve coded-wire tag data from PSMFC data base
		b	Analyze catch, distribution and escapement data and provided written narrative

		c	Report results at Technical or Project Review conferences
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**Objective schedules and costs**

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	10/1999	7/2000	Coordinate with hatcheries and tag 2,205,000 salmon. Prepare annual budget and project review.	x	79.00%
2	10/1999	9/2000	Recover snouts from escapement, retrieve tags and enter data. Complete all paper work associated with tag releases.	x	11.00%
3	6/1999	9/2000	Estimate survival and distribution of salmon by accessing PSMFC data base, report results.	x	10.00%
				<b>Total</b>	100.00%

**Schedule constraints**

Production and release of hatchery salmonids in the Columbia Basin is regulated by NMFS under the Endangered Species Act. Specific groups to be tagged depend on funding for the production and tagging of hatchery salmon in Washington.

**Completion date**

On- going

**Section 5. Budget**

**FY99 project budget (BPA obligated):** \$317,581

**FY2000 budget by line item**

Item	Note	% of total	FY2000
Personnel	Project leader and coordination, routine data entry, tag recovery and administration staff.	% 14	52,388

Fringe benefits		%3	14,603
Supplies, materials, non-expendable property	2,205,000 coded-wire tags, of which \$232,848 includes 20% OH (\$38,808)	%78	292,383
Operations & maintenance			
Capital acquisitions or improvements (e.g. land, buildings, major equip.)			
NEPA costs			
Construction-related support			
PIT tags	# of tags:		
Travel	Mileage and per diem	%0	900
Indirect costs	Agency overhead rate is 20%. (OH of salaries and travel when added to OH of CWT's: Total is \$52,386)	%3	13,578
Subcontractor			
Other			
<b>TOTAL BPA FY2000 BUDGET REQUEST</b>			<b>\$373,852</b>

### **Cost sharing**

<b>Organization</b>	<b>Item or service provided</b>	<b>% total project cost (incl. BPA)</b>	<b>Amount (\$)</b>
N/A			0
<b>Total project cost (including BPA portion)</b>			<b>\$373,852</b>

### **Outyear costs**

	<b>FY2001</b>	<b>FY02</b>	<b>FY03</b>	<b>FY04</b>
<b>Total budget</b>	\$385,067	\$396,620	\$408,518	\$420,773

## **Section 6. References**

<b>Watershed?</b>	<b>Reference</b>
<input type="checkbox"/>	Byrne, J., H.J. Fuss and C. Ashbrook. 1998. Annual Coded-Wire Tag Program, Washington Missing Production Groups. Annual Report 1997. DOE/BP01873, Bonneville Pwer Adminsitration, Portland, Oregon
<input type="checkbox"/>	Byrne, J., H.J. Fuss and C. Ashbrook. 1997. Annual Coded-Wire Tag

	Program, Washington Missing Production Groups. Annual Report 1996. DOE/BP01873, Bonneville Pwer Adminsitration, Portland, Oregon
<input type="checkbox"/>	Fuss, H.J. 1996. Annual Coded-Wire Tag Program, Washington Missing Production Groups. Annual Report 1995. DOE/BP01873, Bonneville Pwer Adminsitration, Portland, Oregon
<input type="checkbox"/>	Fuss, H.J. 1995. Annual Coded-Wire Tag Program, Washington Missing Production Groups. Annual Report 1994. DOE/BP01873, Bonneville Pwer Adminsitration, Portland, Oregon
<input type="checkbox"/>	Fuss, H.J., R. Fuller 1994. Annual Coded-Wire Tag Program, Washington Missing Production Groups. Annual Report 1993. DOE/BP01873, Bonneville Pwer Adminsitration, Portland, Oregon
<input type="checkbox"/>	Hoffman, A., C. Busack and C. Knudsen. 1994. Experimental designs for testing differences in survival among salmonid populations. U.S. Dept. Energy, BPA Technical Report. DOE/BP-0029-3. Pp. 71
<input type="checkbox"/>	DeLibero, F.E. 1986. A statistical assessment of the use of the coded-wire tag for chinook and coho studies. PhD dissertation, University of Washington, Seattle, WA
<input type="checkbox"/>	Coronado, C. and R. Hillborn. 1998. Spatial and temporal factors affecting survival in coho salmon ( <i>Oncorhynchus kisutch</i> ) in the Pacific Northwest. Can. J. Fish. Aquat. Sci. 55: 2067-2077.

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## PART II - NARRATIVE

### Section 7. Abstract

The goal of the program is to tag a statistically valid number of coho and chinook salmon from each hatchery such that accurate estimates of survival and distribution in the ocean and spawning grounds can be made. These data will allow for valid comparisons to be made among these groups and allow assessment of long term survival trends. For among group comparisons, release numbers of coded-wire tagged fish have been calculated to have sufficient power such that the probability of detecting a 50% difference in survival among groups is  $p=1-0.95/2$ . Survivals of fish released in this project can be used for comparison with coded-wire tag groups originating from other projects throughout the region. Each coded wire tag group (30,000-200,000 fish) represents a portion of the total hatchery production for the species. Thus, the roughly 1 million tagged chinook released each year represent about 15 million untagged fish and the 0.5 million tagged coho represent approximately 6.5 million untagged coho. Multiple tag groups at each hatchery represent different production scenarios, such as one portion of the production released at a different time or size than another portion. Also, several coho tag groups represent production that is transported off-station and released into other river systems, such as the Klickitat, Yakima, Wenatchee, or Methow rivers. This production is specified to meeting obligation under U.S. v. Oregon.

The expected outcome of this project is to provide a long and consistent time series of survival and distribution data that can be used to measure trends in abundance of hatchery fish as well be used as surrogate data for critical stocks. The Fish and Wildlife Program has goals for monitoring and evaluation (Section 3) restoration of wild stocks (Sections 4 & 7), increased hatchery effectiveness (Section 7), improved passage around dams (Sections 5 & 6) and improved stock assessment and harvest management (Section 8). This project is expected to contribute to these goals by providing annual monitoring, as well as a long-term, consistent data base that contributes to modeling efforts such as used in the PATH project. These data will ultimately be used to address critical uncertainties identified in the Fish and Wildlife Program as well as for managing the Columbia River.

## **Section 8. Project description**

### **a. Technical and/or scientific background**

The coded-wire tag is a stock assessment tool that allows fishery managers to identify the origin of salmon and steelhead when these fish are captured or recovered in fisheries, on spawning grounds, at hatcheries, or in juvenile and adult migrant traps. The coded-wire tag is a relatively inexpensive tool that allows the fishery manager to gain more information about groups of fish over a broader geographic area than the more expensive PIT tag. For example, coded wire tag recoveries have identified the greater distance of ocean migration of mid and upper Columbia River chinook stocks relative to lower river chinook stocks. The coded-wire tag provides accurate estimates of survival, and when applied in sufficient numbers, coded-wire tags have been used to statistically measure differences in performance between experimental groups. Such uses include measuring performance of fish subjected to different hydroelectric passage regimes (barging v. direct release), differences in response to rearing and growth regimes in hatcheries, and basic survival differences between hatchery and wild produced smolts.

This project addresses many of the critical uncertainties associated with releases of hatchery reared fish. By providing a stable, representative and consistent data base, rates of production of upriver and lower river hatchery and wild fish can be determined and accounted for. Further, it meets objectives in the Fish and Wildlife Program and in the Biological Opinion for Recovery of Snake River (and soon for Columbia River) for basic monitoring and evaluation. Tagged fish from this project also measure differences in performance of production groups released at different times or sizes from the hatchery as well as measure survival of groups of coho released into other watersheds.

Prior to this project, groups of coded-wire tagged fish were released from Columbia Basin Hatcheries in an inconsistent and random pattern, with some hatcheries included for several years in succession and production from other hatcheries not tagged at all. This pattern of inconsistent tagging resulted in critical uncertainties in the proportion of fish from specific stock groups (wild and hatchery) in escapement and fisheries, where fish of Columbia River origin (both wild and hatchery) mingle with fish from other locations. It further made determination of hatchery effectiveness very difficult because it assumed that both production capabilities from each hatchery and stray rates were the same, which was found to be untrue based on other tagging exercises.

## **b. Rationale and significance to Regional Programs**

The rationale for this project is to provide comprehensive stock assessment and hatchery salmon production monitoring data to regional management entities. The data generated from the long-term coded-wire tag program will be useful, if not essential, in meeting many of the goals and objectives of the 1994 Fish and Wildlife Program. These include: (1) Monitoring and evaluation (Section 3), (2) restoration of wild stocks (Sections 4 & 7), (3) increased hatchery effectiveness (Section 7), (4) improved passage around dams (Sections 5 & 6) and (5) improved stock assessment and harvest management (Section 8).

Furthermore, the data generated by this project has provided the ability to prioritize hatchery production programs that lead to better cost effectiveness because release groups that perform poorly can be eliminated and hatchery programs that are successful are identified. One such example, is the Select Area Fisheries Project (9306000) that provides for terminal area fisheries in the Columbia River with minimal by-catch of critical stocks and minimal straying into adjacent rivers. The data generated by the Annual Stock Assessment project is also used in the Artificial Production Review for the Columbia Basin, and in the now defunct IHOT project. This project provides tag groups that can be used to model wild populations that are too sensitive to capture and tag as well as provides a useful tool to compare wild populations that can be similarly tagged with similar hatchery populations. It also provides a tool to assess productivity differences between upriver and lower river populations.

Lastly, the monitoring and evaluation is a central theme of the 1994 Fish and Wildlife Program. Expansion of fish marking programs is specifically called for in Section 8.4D.1. The need for a hatchery monitoring and evaluation program is identified in several other Basin plans. For example, the Snake River Recovery Plan (2.1.d.5) and the Hydrosystem Operations Biological Opinion (VIII.A.13) both call for the establishment of a comprehensive monitoring, evaluation and research program. The critical uncertainties that these Plans want addressed is an accounting of the proportion of wild and hatchery fish in both fishery catches and escapement (spawning grounds and hatchery racks). Without the ability to identify the origin of these fish the ability to effectively manage recovery efforts and account for actions is non-existent.

In summary, the coded-wire tag program meets the goals of the 1994 Fish and Wildlife Program by providing a tool that: (1) better accounts for proportions of weak or critical stocks in the mixed stock fisheries from California to Alaska, and especially in the fisheries and spawning grounds of the Columbia River system; (2) better accounts for the number of fish of each stock, wild or hatchery, that is recovered in various escapement areas (dams, hatcheries, spawning grounds); (3) allows monitoring and evaluation of hatchery practices such that poorly performing production groups can be identified and changed or eliminated, as well as allows for identification of strays and determination of total hatchery adult production.

**c. Relationships to other projects**

This project (8906600) is part of an umbrella project, “The Coded-Wire Tag Program”, that consists of four components. Three of these components are the Annual Stock Assessment-Coded-Wire Tag Program projects that include WDFW project (8906600) and USFWS (8906500) and ODFW (8906900) projects. The fourth component, the “Coded- Wire Tag Recovery Program” (8201300) is critical to the success of the three tagging projects, because this project is responsible for sampling fish from fisheries and spawning grounds, and processing , collating , and managing the resultant data base. The purpose of this new umbrella grouping is to ensure that a comprehensive monitoring and evaluation program exists on the Columbia Basin that is consistent with meeting goals or the 1994 Fish and Wildlife Program. To accomplish this objective, two committees will be established. One committee will be the “CWT Oversight Committee” which will set and review overall program goals and objectives with a strong emphasis towards meeting significance of the CWT Program to regional programs. The second group is the “CWT Work Group” which has the responsibility for reviewing daily operations, methods, and determining proper tagging levels.

The Fish and Wildlife Program has a wide range of projects associated with it’s numerous measures, all of which address critical uncertainties associated with the particular area of concern (e.g.; effects of transportation). Some projects seek to improve habitat, others to improve existing artificial production, while others seek to assess the impacts on naturally produced salmon and steelhead of large releases of artificially produced salmon and steelhead, and still others seek to regulate catch in mixed-stock fisheries, and develop analytical methods to better predict and manage the basin’s activities for the benefit of naturally and artificially produced salmon and steelhead.

The activities associated with the four projects are closely related to other basin projects. For example, several projects funded by the Fish and Wildlife Program deal with restoration of natural populations of chinook and coho above Bonneville Dam. These projects include John Day Basin spring chinook (9144), Umatilla Basin coho restoration (9000500), Hood River Production Program (8805304), restoration of coho and spring chinook in the Klickitat, Yakima, Wenatchee, and Methow rivers. The umbrella coded-wire tag project is related to these other projects in several key ways: (1) they provide tagged fish for introduction into some of these systems, for example, project 8906600 provides tagged coho for introduction into the Klickitat, Wenatchee, and Methow Rivers, (2) they provide coded-wire tagged releases of hatchery fish that can be identified when recovered in their natal systems and when they stray outside their natal system, thus, providing the ability to more accurately account for total system production, (3) they allow for identification and determination of the proportion of strays in natural or restored populations, and in critical hatchery populations where they can be removed from the spawning population (this ability is particularly essential for listed populations such as with the listed fall chinook at the Lyons Ferry Hatchery, WDFW), (4) they provide a robust and dependable source of data for other projects to perform analyses on a multitude of potential variables that affect survival. For example, data generated by these projects can be used to evaluate effects of flow on survival, comparisons of survival among upriver and downriver populations and can be used as surrogates for survival and ocean distribution of

critical stocks. These data can also be used by non-project researchers such as in the recent analysis of spatial and temporal factors affecting survival in coho salmon (Coronado and Hillborn 1998)

**d. Project history** (for ongoing projects)

The project 89-66 (8906600) began in 1989 and had the title: “Annual Coded Wire Tag Program-Missing Production Groups (Washington). We are changing the title to better reflect the project purpose. The new proposed title is: Annual Stock Assessment-Coded-Wire Tag Program (WDFW).

FY-2000 will be the 11<sup>th</sup> year of the project, but in only the last 7 years have all production groups been represented by coded-wire tags. The history of tagging and recovery of snouts is listed below. Numbers of tag groups have varied annually predicated on the rearing program at individual hatcheries. Tag numbers for each group have remained relatively constant, however, because of recent low survivals in coho and spring chinook, the request for FY-2000 reflects increases in the number of tagged coho per group from 30,000 to 50,000. Also increased numbers of tags are requested for Ringold spring chinook which are within a listed ESU. Increased numbers of tags will aid in identifying stray fish along with satisfying the statistical requirements of the study design. A complete annual history follows. To date we have tagged over 16.5 million fish and recovered over 14,000 tags from hatcheries alone.

1990: Tagged 1,434,101 chinook and coho

1991: Tagged 1,377,166 chinook and coho

1992: Tagged 1,299,245 chinook and coho

1993: Tagged 2,473,946 chinook and coho and collected tags from 3,148 snouts of returning fish

1994: Tagged 1,949,381 chinook and coho and collected tags from 3,794 snouts of returning fish.

1995: Tagged 1,855,939 chinook and coho and collected tags from 2,673 snouts of returning fish.

1996: Tagged 1,798,528 chinook and coho and collected tags from 1,266 snouts of returning fish.

1997: Tagged 2,180,255 chinook and coho and collected tags from 3,618 snouts of returning fish.

1998: Proposed tagging: 2,180,000 chinook and coho, actual data not yet available. Snout collection not yet complete.

1999: Proposed tagging: 2,080,000 chinook and coho.

Annual costs of the project follows:

1990: \$142,679

1991: \$165,396

1992: \$207,972

1993: \$314,185

1994: \$306,244

1995: \$312,032  
1996: \$294,667  
1997: \$302,517  
1998: \$333,193  
1999: \$317,581 (proposed)

Costs of the project increased after 1992 because of increased tagging, increased costs of tagging and increased FTE's required to complete Objectives 2 and 3. Tagging costs and overhead have remained relatively stable since 1993, however, salaries have increased, particularly for the project leader. The FY2000 request includes a request for salaries of technicians that recover project tags from snouts taken to the WDFW Tag Recovery Lab in Olympia, WA. These costs were previously not covered by the project and due to recent budget shortfalls in WDFW, necessary personnel may not be available to retrieve the tags from the snouts.

Accomplishments include : (1) identification of fluctuating annual survivals of hatchery coho, fall chinook and spring chinook; (2) identification of differences in annual survivals among species and hatcheries; (3) identification of poorly performing hatchery groups and subsequent changes in hatchery rearing programs reflecting this information; (4) identification in differences in annual survivals among two strains of coho and two strains of chinook, particularly in relation to lowered ocean productivity; (5) identification of lower efficacy of off-station plants of coho into non-natal streams compared to on-station plants; (6) provided data on survival and distribution of hatchery reared salmon for use in IHOT Project audits; (7) provided tag groups for plants of coho salmon into Methow, Wenatchee, Klickitat, and Yakima Rivers; (8) provided data on hatchery stray rates into non-natal systems; (9) provided data to allow for run-reconstruction of total Columbia Basin production; (10) provided data for management of in-river fisheries (both Zone 6 and lower river); (11) provided hatchery efficiency data for coho and chinook (12) annual reports providing most recent survival and distribution data distributed widely throughout basin; (13) determined that low survivals of coho require increased number of tagged fish released at each facility.

#### **e. Proposal objectives**

Objective 1: Tag at least one production group of chinook and coho at each Columbia Basin Hatchery operated by the Washington Department of Fish and Wildlife where other funding sources are not currently paying for tagging. These tag groups represent the untagged portion of the hatchery population. Sub Tasks include tagging coordination between hatcheries and tag applicators, and the actual tagging of over 2 million chinook and coho at the Grays River, Elochoman, Beaver Creek, Toutle, Lewis, Kalama, Fallert Creek, Washougal, Klickitat, and Ringold Hatcheries. (Tagging of coho occurs from October to January and from May to July for chinook.)

Objective 2: Recover snouts from each hatchery, and selected spawning grounds in the Columbia Basin. Locate, remove, and decode each tag from each snout. Verify and error

check these data and send to PSMFC regional database. Use the data from these recoveries and from tags recovered in ocean and river fisheries to estimate survival and distribution of each tag group in the project. (Recovery of snouts and tags occurs from September to February, tag recovery data is error checked and entered into computer data base from December to June and routine data entry occurs from October to September)

Objective 3: Develop survival estimates and catch and escapement distributions for all WDFW Columbia River hatcheries using data from complete broods of data for chinook and coho. Compile and analyze these data annually and provide a written report. (Data retrieval and analysis occurs from June to August depending on availability of updated data in PSMFC data base. Analysis and reporting occurs in July and August.)

#### **f. Methods**

Survival differences between chinook and coho determine the number of fish needed for tagging such that at least 30 observed recoveries from each group are made in total or in each fishery or escapement location, and that sufficient power exists such that the probability of detecting a 50% difference in survival among groups is  $p = 1 - 0.95/2$ . These fish are randomly selected for tagging from the general hatchery population. At some hatcheries, more than one tag group is used for a species because the release timing or size of each group are different enough that survival may be different. Because each tag group may represent up to several million untagged fish, it is important to have as many tag groups at a particular hatchery as necessary to make an accurate estimate of total adult contribution. The critical assumptions for the project are: 1) tagged fish represent untagged fish, and, 2) the probability of recovering tagged fish is not contingent on hatchery location.

After fish are selected from the general rearing population, coded-wire tags are applied into the snouts of the fish and at least 75% of the adipose fin is removed. These procedures are approved by the Bonneville Power Administration and conform to the most recent edition of the "A Manual of Procedures for Coded-Wire Tagging of Pacific Salmonids" (Pacific Fisheries Management Council). Upon return as adults, tagged fish are identified by the missing adipose fin, and biological data is collected along with the snout of the fish. Beginning in 1998, all returning hatchery origin fish are missing adipose fins, thus identification of coded-wire tagged fish is done using a tag detector. Once the snouts are collected from the various fisheries (California to Alaska), hatcheries (Washington, Oregon, Idaho) and spawning ground locations (Washington, Oregon, Idaho), the coded-wire tags are removed from the snouts, the code identified, checked, and the data for all the individual tags recovered is recorded and sent to the Pacific States Marine Fisheries Commission where the data are collated, expanded based on the sampling rate of the various collection sites, and then entered into a central data base. Once in the central data base, anyone can access the data for any purpose.

After the data are finalized for the most recent year, we retrieve the total estimated recoveries by each catch type and location as well as the sum of the total recoveries for each tag group and calculate the total survival (estimated recoveries/total tags released)

and the contribution rate (total tags recovered by fishery or escapement/total tags recovered). Rates at which tags are applied are determined using techniques reported in : “DeLibero, F.E. 1986. A statistical assessment of the use of the coded-wire tag for chinook and coho studies. PhD dissertation, University of Washington, Seattle, WA” and “Hoffman, A., C. Busack and C. Knudsen. 1994. Experimental designs for testing differences in survival among salmonid populations. U.S. Dept. Energy, BPA Technical Report. DOE/BP-0029-3. Pp. 71.” Annual and quarterly reports are generated summarizing the results.

**g. Facilities and equipment**

Tagging occurs at WDFW Columbia Basin Hatcheries (Grays River, Elochoman, Toutle, Fallert Creek, Kalama Falls, Lewis River/Speelyai, Washougal, Klickitat, and Ringold hatcheries). Tagging trailers are used to facilitate tagging of each species at each hatchery. Snouts and biological data are taken from each adult fish identified by a missing adipose fin. Snouts are held in freezers, first at the recovering hatchery, and later at the WDFW Tag Recovery Lab, Olympia, WA. Snouts are defrosted and a coring tool is used to remove the tag from the snout. Tags in these cores are detected by a electronic tag detector and after further dissection the tag is removed and the binary code deciphered by the technician. Data from individual fish are recorded by computer and sent to the PSMFC Regional Date Base in Gladstone Oregon. programs

**h. Budget**

The scope of work for FY 2000 will not change appreciably from FY-99, however, we have included salaries for personnel that have done work on this project but have been compensated from this project. Additionally in July, 1999 the project leaders salary will increase an additional 5%. Additional salaries include 9 months for scientific technicians who locate, remove and decode each tag as well as error check these recoveries and enter the data for transfer to PSMFC. Also, one month of salary for administration personnel was added due to a directive by WDFW administration. The FY2000 budget includes a slight increase in the number of requested tags because we determined that 30,000 tags per coho group was likely insufficient to do statistical comparisons if poor ocean conditions continue to reduce survivals. We increased the number of tags per coho group to 50,000. Lastly, the amount of overhead charged by WDFW increased one percentage point, to 20%.

**Section 9. Key personnel**

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Research Scientist  
Washington Department of Fish and Wildlife  
600 Capitol Way N  
Olympia, Washington 98501-1091

360-902-2664  
fusshjf@dfw.wa.gov

Work Hours for Project 8906600: 2 months (352 hours)

Duties: 1) Identify production groups for tagging; 2) Determine tagging level for each group; 3) Supervise staff to coordinate tagging and collect pertinent data on tag groups at time of tagging and time of release; 4) Supervise staff in coordinating collection of snouts at hatcheries and retrieval of data from PSMFC data base; 5) Supervise staff collating, analyzing and reporting of coded-wire tag recovery data; 6) Supervise staff in preparation of quarterly and annual reports; 7) Prepare annual budget and complete annual project review; 8) Represent project in discussions with CBFWA, NPPC staff, and participate in coordinating process with other umbrella project leaders.

Qualifications: 1) Eight years as project leader; 2) Sixteen years experience analyzing survival and distribution trends of hatchery reared salmon including several publications and professional presentations; 3) Master Degree in Fisheries Science from University of Washington, 1982.

#### Pertinent Work History

Current Employer: Washington Department of Fish and Wildlife  
600 Capitol Way N  
Olympia, WA 98506

1996-Present: Research Scientist 1, Washington Department of Fish and Wildlife.

Principal Duties: (1) Monitor and evaluate long term trends in post-release survival and catch distribution of hatchery reared salmonids; (2) Define type and degree of interactions of post-release hatchery juveniles and wild juveniles; (3) Compare survival and physiological differences of fish reared in semi-natural and standard hatchery environments; (4) Determine survival and migrational characteristics of hatchery-reared fall chinook salmon reared in two types of rearing containers; (5) Develop operation plans for all WDFW fish rearing facilities; (6) Determine relationship of rearing density and survival of hatchery-reared steelhead and develop profile of successful hatchery steelhead smolts.

1980-1996: Fish Biologist 1,2,3,4, Washington Department of Fisheries. Principal Duties: (1) Research effects of rugose substrate on developing alevins in relation to size at yolk absorption and initial survival; (2) Determine time to initiate feeding of salmon alevins; (3) Develop low cost system to manipulate incubation temperatures; (4) Determine survival and fishery contribution of chinook and coho salmon reared at hatcheries; (5) Determine ( $\text{Na}^+ - \text{K}^+$ ) gill-ATPase levels of hatchery chum salmon with respect to freshwater rearing and exposure to brackish water; (6) Determine alevin development rates for each species of salmon and develop guide for hatchery personnel to initiate feeding; (7) Determine benefits of alternative feeding schedules and methods and how they affect post-release survival of hatchery chinook and coho.

#### Publications

Fuss, H.J and C. Johnson. 1988. Effects of artificial substrate and covering on growth and survival of hatchery-reared coho salmon. *Progressive Fish Culturist* 50: 232-237.

Pascual, M.A., T.P. Quinn, and H. Fuss. 1995. Factors affecting the homing of Columbia River hatchery-produced fall chinook salmon. *Transactions of the American Fisheries Society*, 124: 308-320.

Fuss, H.J. and C.W Hopley. 1990. Survival, marine distribution, and age at maturity of Hood Canal hatchery chum. *Proceedings of the 1989 N.E. Pacific Pink and Chum Salmon workshop*, 1991.

Fuss, H.J., J. Byrne, and C. Ashbrook. 1998. Stock Characteristics of Hatchery-Reared Salmonids at Washington Department of Fish and Wildlife Columbia River Hatcheries: Annual Report 1997. National Marine Fisheries Service. July 1998.

#### Other Key Personnel

Nine other Fish and Wildlife employees split a total of 15 months (2,520 hours) of time on various aspects of the project:

Fish Biologist 2 (Hatcheries division), 3 months doing routine paper work and data entry associated with rearing of project fish and releases of coded-wire tagged fish.

Fish Biologist 2 (Hatcheries division), 2 months doing coordination of tagging related activities at hatcheries and collecting snouts from hatcheries and processing paper work and checking accuracy of data.

Scientific Technician 2 (3 total, 3 months each; Resource Assessment Division), 9 months total activities associated with location, removal, decoding and error checking, and entering data from tags recovered in snouts of salmon collected at hatcheries, spawning grounds and in various fisheries.

Administration Division, 1 month total for activities related to WDFW Fish Program administration, internal processing of payments, travel vouchers, word processing, general reception, and computer maintenance including network.

## **Section 10. Information/technology transfer**

All recoveries of tags from this and companion projects is stored on a regionwide database maintained by the Pacific States Marine Fisheries Commission, Gladstone, Oregon. These data are accessible by virtually anyone and are used for a variety of purposes. Data generated from this project can be used by other projects funded by Bonneville to meet Fish and Wildlife Program goals. Comparison of performance of salmon tagged under this project can be compared with performance of salmon tagged in other projects to compare such things as above and below dam survival and distribution. For example, coho tagged as part of the restoration programs in the Umatilla, Wenatchee, Methow, or Yakima rivers can be compared to survivals of coho tagged in lower river hatcheries to assess if mortality due to freshwater or ocean productivity is equal. Other uses include determining hatchery effectiveness, stray rates into watersheds with critical or listed stocks, and comparison of survival trends of Columbia River salmon with salmon from

other geographic areas. These kinds of relational comparisons provide insight to relative productivity's of the Columbia River system. We also summarize the data annually and report these summaries in Annual Reports that are published by Bonneville and available upon request. Lastly, results are often presented at professional meetings such as those sponsored by the American Fisheries Society, or the Bonneville Power Administration.

**Congratulations!**