Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Evaluate fall chinook and chum spawning, production and habitat use in the mainstem Columbia River

Bonneville project number, if an ongoing project 9131

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

Business acronym (if appropriate) WDFW

Proposal contact person or principal investigator:

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Subcontractors.

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USFWS	**9317 N.E. Hwy. 99 Suite C**	**Vancouver, WA 98665**	**Don Anglin**

NPPC Program Measure Number(s) which this project addresses.
2.2a, 3.3d, 5.4a, 5.9a, 6.1a, 6.1c, 7.1, 7.1c, 7.1d, 7.5d, 7.6, 7.8g, 7.8j, 8.4a, 8.4d, 9.1a

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

NA

Other planning document references.

Our proposal is designed to identify, preserve, and enhance naturally spawning anadromous fish and their habitat in the mainstem Columbia River. This is consistent with goals put forth in the ***WDFW=s Wild Salmonid Policy*** and in ***Wa-Kan-Ush-Mi Wa-Kish-Wit***. ISG=s ***Return to the River*** discusses the importance of Apopulations spawning in large alluvial mainstem reaches that may have functioned as critical core populations≅. They also state Ait is important to consider small subunits of a stock during management of river flows≅.

Subbasin.

Mainstem Columbia

Short description.

Survey the mainstem Columbia below The Dalles, John Day, and McNary dams to locate and quantify mainstem spawning populations of fall chinook. Quantify mainstem spawning fall chinook and chum salmon populations below Bonneville Dam. Describe life history, stock structure and origin, habitat used, and river flows necessary to protect and enhance these populations.

Section 2. Key words

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

Other keywords.

Habitat suitability criteria, chum salmon, endangered species, fall chinook salmon, Instream Flow, mainstem spawning, habitat quantification, habitat modeling

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
	NA	

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
14	Construct hydraulic models for chum and fall chinook spawning area below Bonneville Dam and for potential fall chinook spawning areas below The Dalles, John Day, and McNary dams.	a	Determine sampling design, establish reference marks and cross sections, survey real elevations to reference marks and cross sections.
		b	Measure four velocity distribution/water surface elevation/discharge data sets for each cross section.
		c	Characterize substrate.
		d	Build and calibrate hydraulic models for main channel and off-channel spawning and rearing areas and conduct hydraulic simulations.
		e	Determine flows required to protect spawning fish and/or redds.
		f	Investigate the potential for stranding of juveniles based on rearing area morphology and magnitude and configuration of water level changes associated with hydrosystem operation.
15	Describe habitat used by fall chinook and chum salmon and develop habitat suitability criteria.	a	Measure depth, velocity, substrate, and temperature within spawning and rearing areas and near locations where fish are observed.
		b	Investigate hyporheic flow.
		c	Develop appropriate suitability functions.
16	Quantify spawning and rearing	a	Develop habitat models to quantify

	habitat available, used, and potential as a function of total river discharge.		spawning and rearing habitat over a range of river discharges.
		b	Relate available habitat area during spawning time period to actual habitat used to refine models and link habitat to observed numbers of fish and/or redds.
		c	Investigate spawning habitat potential over a range of river discharges, and over a range of downstream pool elevations for The Dalles, John Day, McNary tailraces.
17	Conduct habitat time-series analysis.	a	Quantify spawning habitat during past spawning seasons and relate to estimates of returning adults to describe relationship.
		b	Evaluate the effect of various operational scenarios (hourly) on spawning habitat, and estimate associated production based on results from Task a.
18	Document findings	a	Prepare annual progress reports and final report.

Objective schedules and costs

Objective #	Start Date Mm/yyyy	End Date mm/yyyy	Cost %
14	09/1999	08/2001	40
15	09/1999	08/2001	15
16	09/1999	08/2001	15
17	09/1999	08/2001	15
18	09/2000	08/2001	15

Schedule constraints.

Lack of an adequate flow range for calibrating hydraulic models, low numbers of returning fish might preclude development of habitat suitability criteria.

Completion date.

2001

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	USFWS ($21,038): One Part-time position of GS-11, GS-09, GS-07, and 2 Part-time GS-05	$21,038
Fringe benefits	25% Fringe Rate	$5,259
Supplies, materials, non-expendable property	flow meter, ($3000), other, ($1000)	$4,000
Operations & maintenance	Vehicle Rent ($1,775) Boat Rent ($4,125)	$5,900
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		$0
PIT tags		$0
Travel	Various Travel for 4 personnel to conduct field work	$5,867
Indirect costs	USFWS overhead 33%	$13,881
Subcontracts		$0
Other		
TOTAL		$55,945

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$58,742	$61,679		
O&M as % of total	10	10		

Section 6. Abstract

What spawning habitat characteristics are they looking for and how is that habitat affected by river discharge? Where did they come from? The goal is to answer this question by measuring the spawning habitat they select and using hydraulic and habitat models to quantify the effect of river discharge. These methods are consistent with those used by WDFW, ODFW, and USFWS in other areas of the Columbia River. Hydraulic and habitat conditions would be measured adequately to characterize the areas, and the data would be used to construct models to quantify spawning and rearing habitat for evaluation of the effect of river discharge. This project would run from October 1998 to

March 1999. Results would be summarized in a written report. Annual observations and funding would be needed to monitor any populations that are found. Hydraulic and habitat models would be constructed as data collection is completed in each area. Data collection would likely not be completed until after the second season. Models and model results would began to be available during FY2000.

What type of habitat do spawning and rearing fall chinook and chum salmon use, how much is there, how does river discharge and hydrosystem operation affect it, and and is the amount of habitat related to the number of fish? Habitat work conducted below Bonneville Dam would be similar to that discussed above for the other areas. In addition, we will quantify flows needed to protect spawning and incubating fall chinook and chum salmon during and following the spawning season.

Section 7. Project description

a. Technical and/or scientific background.

The overall problem is that with current funding, the areas below The Dalles, John Day, and McNary dams cannot be adequately surveyed for either evidence of spawning fall chinook, or habitat use, availability, or potential for fall chinook. If funds were transferred for sampling these areas, sampling goals for the Columbia River and its tributaries would not be met. However, limited sampling has shown that fall chinook have been spawning below John Day Dam. WDFW investigated some areas below the dam in 1982. Eighty-five fall chinook carcasses were found that year and one CWT was recovered, a Hagerman (Snake River) fish (WDFW memorandum, 1983). The following year, five spawned-out carcasses were found (WDFW memorandum, 1984). WDFW revisited the area in 1995 and found a handful of live and dead fish. River flows during that one-day survey were extremely high.

There currently is known to be a fall chinook population spawning below Bonneville Dam; however, there has been no information gathered concerning juveniles produced by this population. In addition, habitat requirements and availability and the effect of hydrosystem operations have not been measured. Currently there are no plans and no funding available to collect any data concerning the juveniles produced by this population or to describe and quantify habitat conditions (both spawning and rearing). Critical data concerning emergence timing, migtration timing, and juvenile to adult survival rates will be collected by this project. A logical extension of identifying an adult naturally spawning population would be to sample the juveniles produced by that population. Currently similar studies are being performed by WDFW on the upper Columbia River in the Hanford Reach area and by USFWS on the Snake River. This project would also obtain excellent data on habitat use by spawning fall chinook and chum, the effect of river discharge on habitat, and flows necessary to protect and enhance fish during the spawning season. Similar studies have been conducted in the Hanford Reach by Battelle PNL, and we are currently conducting a multi-year habitat study in the Hanford Reach for

white sturgeon under BPA Project 86-50.

Though this project itself is not a mitigation project, insight into the relationship between habitat, river discharge, and hydrosystem operations produced by this project may allow us to enhance conditions and help maintain current populations of mainstem spawners, or even build those populations.

b. Proposal objectives.

14. To construct hydraulic models for chum and fall chinook spawning below Bonneville Dam and for potential fall chinook spawning areas below The Dalles, John Day, and McNary Dams.

15. To determine flows required to protect spawning fish and redds.

16. To investigate the potential for stranding of juveniles based on rearing area morphology and the magnitude and configuration of water level changes associated with hydrosystem operation.

17. To describe habitat used by fall chinook and chum salmon and develop habitat suitability criteria as a function of depth, velocity, substrate and temperature.

18. To quantify spawning and rearing habitat available, used and potential as a function of total river discharge for a range of possible river discharges and relate available and used habitat to refine models.

19. To investigate and quantify spawning and rearing habitat potential over a range of pool elevations or drawdown scenarios for The Dalles, John Day and McNary tailraces.

20. To conduct habitat time-series analysis necessary to quantify spawning habitat during past spawning seasons and relate to estimates of returning adults in order to describe the relationship below Bonneville Dam.

21. To evaluate the effect of various operational scenarios (hourly) on spawning habitat, and estimate associated production based on results from the previous task.

22. Report findings in annual progress reports and a final report.

c. Rationale and significance to Regional Programs.

Specific Benefits to NPPC=s Fish and Wildlife Program

1. Collection of Population Status, Life History, and Other Data on Wild and Naturally Spawning Populations (7.1C) : Base-line information that will improve management of wild and naturally spawning stocks is needed and long term monitoring strategies must be developed.

d. Project history

New project - Not Applicable

e. Methods.

15. The Beacon Rock Island complex, downstream from Bonneville Dam where a notable number of fish spawn, is vulnerable to the daily fluctuations which occur due to hydro-power peaking. We will use hydraulic models for the area to determine optimum flows which will maintain adequate water elevations over fish and redds to sustain them to emergence. This will be an analytical task performed using the RHABSIM software package upon completion of task # 14. This procedure will be performed for other areas when spawning areas are found.

16. The morphology of spawning and rearing areas will be recorded during information collection for the hydraulic models using the electronic total station and ADCP. The models will allow predictions on the effect of various water surface elevations based on discharge on the cross sections which will be representative of the area. From this we will be able to identify areas of potential stranding and to suggest appropriate discharges to protect juveniles and adults in these areas.

17. Staff will measure ther physical and biological parameters at a number of known spawning redds. Measurements of depth and velocity will be recorded with portable flow meters and substrate will be recorded by an underwater video system or snorkeling. Temperature data will be recorded and downloaded with thermographs. The desired suitability criteria will then be used to calculate the appropriate suitability functions.

18. Based on the derived suitability functions and habitat calculations, habitat modeling will provide calculations at all possible flows of potential spawning and rearing habitat available at each study site.

19. Calibrated habitat models will address the range of possible downstream scenarios by providing calculations of spawning and rearing habitat. Each incremental decrease in pool elevation will allow calculations of potential habitat.

20. Habitat time-series analysis will be used to calculate the amount of spawning habitat that was available during past spawning seasons below Bonneville Dam. Using habitat models for fall chinook produced under item 18 above, together with hourly or daily hydrographs for the appropriate time period during October and November, we will calculate the amount of spawning habitat that was available during past years. Considering most chinook that have been sampled by WDFW and ODFW have been 4 or 5 years old, we will determine if there is a relationship between the amount of spawning habitat 4 and 5 years earlier, and the returning adults during the current year.

21. Habitat time-series analysis will be used to calculate the amount of spawning habitat available under different operational scenarios and estimate potential production. If we can reasonably infer from the data (see item 20) that there may be a relationship between

spawning habitat and numbers of adults returning 4 or 5 years later, we will calculate the amount of habitat that would be available under various hydrosystem operational scenarios by integrating habitat models from item 18 above with the hourly hydrographs from those scenarios. We would then estimate the expected number of returning adults. This would allow hydrosystem operators and salmon managers to evaluate trade-offs associated with different scenarios.

22. Annual progress reports would be produced for FY1999 and FY2000, and a final report would be produced for FY2001. Reports will use professional journal standards.

f. Facilities and equipment.

USFWS staff members will utilize existing U.S. Fish & Wildlife Service office resources at the Columbia River Fisheries Program Office in Vancouver Washington. The office currently provides space for the three proposed project biologists as well as for two technicians and parking space for two GSA vehicles. Warehouse facilities are available in Vancouver where project boats and equipment will be stored.

Two jetsleds will be leased from USFWS. Both are of sufficient size, power, and quality to meet the demands of river boat operations and data acquisition. Custom modifications to these boats have been made to expedite hydraulic data collection in riverine environments.

Personnel will implement an Acoustic Doppler Current Profiler (ADCP) purchased by B.P.A. from a previous B.P.A. project 85-50 for collecting hydraulic data. ADCP=s are state of the art instruments in hydraulic data collection, saving time and money. Hand held flow meters will be used to collect data in situations unsuitable for the ADCP such as in shallow redds. An electronic total station will be used to calculate and map physical habitat parameters.

Habitat types such as that of an irregularly shaped spawning site will be quantified with Rockwell=s Precision Lightweight G.P.S. Receivers accurate to +/- 4 meters. These G.P.S. units allow waypoints to be marked at strategic points, facilitating their relocation for subsequent data collection. Support software for the units also provides analytical tools required to do the calculations such as the area of a polygon. Software for the G.P.S., ADCP and thermographs is installed on Service computers including a portable laptop for collecting field data . The Service will deploy its own thermographs but will require additional instruments to cover the study area. The acquisition of an additional portable flow meter will be necessary to facilitate data collection.

g. References.

Bovee, K. D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Instream Flow Information Paper 12. U.S.D.I. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-82/26.

Bovee, K. D. and R. T. Milhous. 1978. Hydraulic simulation in instream flow studies: theory and techniques. Instream Flow Information Paper 5. U.S.D.I. Fish and Wildlife Service, Office of

Biological Services. FWS/OBS-78/33.

Milhous, R. T., M. A. Updike, and D. M. Schneider. 1989. Physical habitat simulation system reference manual - version II. Instream Flow Information Paper 26. U.S. Fish and Wildlife Service Biological Report 89(16).

Section 8. Relationships to other projects

Section 9. Key personnel

Don Anglin - US Fish and Wildlife Service

(See Attached Resume)

Section 10. Information/technology transfer

Annual progress reports would be produced for FY1999 and FY2000, and a final report would be produced for FY2001. Reports will use professional journal standards.