

# 1997-98 EVAL. OF JUVENILE FALL CHINOOK STRANDING 9701400 ON THE HANFORD REACH

## SHORT DESCRIPTION:

Year 1 - 1997 conduct pilot field evaluation in cooperation with BRD (Project # 91029). Year 2 - 1998 conduct full scale evaluation involving series of controlled river elevation reductions to assess juvenile fall chinook stranding as well as effect on resident fish and benthic community.

## SPONSOR/CONTRACTOR: WDFW

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## SUB-CONTRACTORS:

Subrecipients Pacific Northwest National Laboratories,  
University of Idaho Department of Fish and Wildlife,  
Pacific States Marine Fisheries Commission.

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## GOALS

### GENERAL:

Supports a healthy Columbia basin, Maintains biological diversity, Maintains genetic integrity, Increases run sizes or populations, Provides needed habitat protection

### ANADROMOUS FISH:

Research, M&E

### NPPC PROGRAM MEASURE:

7.5B.3

### RELATION TO MEASURE:

This project seeks to determine the effect of diel discharge and ramping rate changes on rearing juvenile fall chinook and on rearing habitat.

### BIOLOGICAL OPINION ID:

XII Incidental Take Statement (page 162, #11)

### TARGET STOCK

Resident fish

Upriver Bright Fall Chinook

Resident fish

Upriver Bright Fall Chinook

### LIFE STAGE

All

Juvenile

All

Juvenile

### MGMT CODE (see below)

N

S

N

S

### AFFECTED STOCK

None

### BENEFIT OR DETRIMENT

No Effect

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## BACKGROUND

### Stream name:

Columbia River-Hanford Reach

### Subbasin:

Mid-Columbia

### Land ownership:

Public

### Hydro project mitigated:

Priest Rapids

### Habitat types:

Fish Project

## PURPOSE AND METHODS

### SPECIFIC MEASUREABLE OBJECTIVES:

FY98 - Objectives

- 1) Collect basic information on river basin slope and substrate composition.
- 2) Evaluate the extent of juvenile post-emergent fall chinook stranding and entrapment on the Hanford Reach below Priest Rapids Dam resulting from river elevation reductions.
- 3) Collect information on the effect of river elevation reductions on juvenile and adult resident fish on the Hanford Reach below Priest Rapids Dam.
- 4) Identify critical habitat zones where juvenile fall chinook are abundant and are more susceptible to stranding and entrapment as a result of river elevation reductions.
- 5) Establish a mechanism to seasonally estimate the primary period of vulnerability of juvenile fall chinook to stranding/entrapment due to river elevation reductions.
- 6) Determine effect of diel water fluctuations on invertebrate community.

### CRITICAL UNCERTAINTIES:

The Hanford Reach is large geographically, contains a large diversity in habitat, and supports an enormous population of juvenile fall chinook. Because of this, a complete assessment of the effect of river fluctuations on the entire population of fall chinook inhabiting the Hanford Reach is beyond the scope of this study. The effect of river fluctuations will be determined for index areas only and no attempt will be made to extrapolate the results.

In addition, determination of the effect of diel water fluctuations on the benthic community is largely dependent upon the establishment of a steady control state for comparison. Such a state may be difficult to establish given the frequency of fluctuations which occur under normal operations. The diversity of habitat present on the Hanford Reach may further complicate this analysis.

Completion of this work is contingent upon the implementation of a series of controlled river elevation reduction tests.

Unforeseen operational conflicts may occur, such as the need for flood control during periods of exceptionally high water, which may impact or preclude these tests.

### BIOLOGICAL NEED:

The focus of this project is to identify the impact of daily power peaking activities and resulting water level fluctuations in the Hanford Reach area on rearing juvenile fall chinook and resident fish. Information will also be collected regarding the impact on the river ecology (including benthic biota) which will be applicable to snake River mitigation planning.

### HYPOTHESIS TO BE TESTED:

1) Juvenile fall chinook are stranded/entrapped as the result of power peaking operations and subsequent sudden river elevation reductions on the Hanford Reach.

null hypothesis = no effect, alternative hypothesis = juvenile fall chinook are stranded/entrapped as a result of power peaking operations. If alternative hypothesis is determined to be true, quantitative assessment of impact/mortality in index areas will be conducted.

2) Resident fish are stranded/entrapped as the result of power peaking operations and subsequent sudden river elevation reductions on the Hanford Reach.

null hypothesis = no effect, alternative hypothesis = resident fish are stranded/entrapped as a result of power peaking operations. If alternative hypothesis is determined to be true, quantitative assessment of impact/mortality in index areas will be conducted.

3) The benthic community is negatively impacted as the result of power peaking operations and subsequent sudden river elevation reductions on the Hanford Reach. null hypothesis = no effect, alternative hypothesis = benthic community is impacted by power peaking operations. Note: The workplan to assess the effect on the benthic community is being developed during pilot year 1997. Specifics as to the approach, methodology, and quantitative evaluation are therefore not available at the time of this submittal.

### ALTERNATIVE APPROACHES:

The upcoming (1997) field season will be the pilot year for this evaluation. Based upon the results of this upcoming season the 1998 workplan may be subject to some revision. In addition, a study coordination group consisting of member representatives from all affected parties will be assembled to review the 1997 work and guide the development of the work proposed for 1998.

**JUSTIFICATION FOR PLANNING:**

Considerable coordination with hydro-operators and ongoing research programs will be necessary to conduct this work in 1998. However, the proposed work is an on the ground effort to benefit anadromous and resident fish.

**METHODS:**

1998 - Multiple index sampling areas representing each habitat type will be established on the Hanford Reach. On specific test days, discharge from Priest Rapids Dam will be reduced and the river elevation will be lowered. Both the rate and magnitude of the test flow reductions will be controlled. One sampling crew per sampling area will then collect data pertaining to the number of chinook fry stranded on the substrate surface (direct counts) and beneath cobble substrate (excavation of subsampling areas and extrapolation) and the number of fry entrapped in backwater depressions (electroshocking). Size and life stage of stranded/entrapped salmonids will be determined. Similar data will also be collected for juvenile and adult resident fish. Benthic sampling will also be conducted ( the workplan for this is being developed in pilot year 1997). Predator activity will be documented. Dissolved oxygen levels, water temperature, and rate of drainage of entrapment areas will also be measured as well as basic information pertaining to substrate composition. Habitat data/mapping will also be collected throughout the field season in coordination with USGS\BRD personnel. RHABSIM (Hanford Reach Flow Model) data from the USFWS will be combined with Fall Chinook Habitat data from USGS\BRD along with stage\discharge (Unsteady Flow Model) data provided by PNNL and GCPUD to create a juvenile fall chinook susceptibility model. Coordination with USFWS, USGS\BRD, and PNNL for GIS modeling will occur throughout this phase of the study. Possible collaboration with PNNL hyporheic work may also occur as well as with USGS\BRD predator prey work.

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**PLANNED ACTIVITIES**

**SCHEDULE:**

**Planning Phase**                      **Start** 02/10/97                      **End** 01/31/98                      **Subcontractor** PNNL,UofI, SPC

**Task** Year 1- 1997

- February 10, 1997 - March 31, 1997 - Recruit and hire personnel, purchase field equipment, establish survey schedule.
- April 1, 1997 - October 31, 1997 - Develop benthic evaluation workplan - (University of Idaho, Streamside Programs Consultation - subcontracts).
- February 10, 1997 - April 1, 1997 - Obtain unsteady flow model to determine stage/discharge relationship - (Pacific Northwest National Laboratories subcontract).
- April 1, 1997 - October 31, 1997 - Conduct pilot evaluation field work, assess Hanford Reach habitat, identify chinook production and rearing areas, establish transects, sampling zones, and statistical design, conduct habitat mapping surveys in conjunction with BRD personnel, work with GCPUD staff and review Priest Rapids discharge data to determine scheduling for controlled river elevation reduction tests.
- November 1, 1997 - January 31, 1998 - Analyze field data, prepare and finalize interim report.

**Implementation Phase**                      **Start** 01/01/98                      **End** 02/01/99                      **Subcontractor** University of Idaho

**Task** Year 2 - 1998

- January 1, 1998 - December 31, 1999 - Continue coordination with USFWS, USGS/BRD, and PNNL.
- January 1, 1998 - March 15, 1998 - Recruit and hire field personnel, purchase equipment.
- March 16, 1998 - July 15, 1998 - Conduct basic field work and controlled river elevation tests. - collect basic river basin slope and substrate composition data from specified sampling areas.-evaluate extent of juvenile fall chinook stranding and entrapment in specified sampling areas.-evaluate extent of juvenile and adult resident fish stranding and entrapment in specified sampling areas.-Identify critical habitat zones where juvenile fall chinook are abundant and more susceptible to stranding and entrapment.- Conduct benthic field work (University of Idaho subcontract - workplan and specific tasks to be developed in 1997).
- July 16, 1998 - December 31, 1998 - Analyze data, write draft report summarizing first two years of study. January 1, 1999 - Draft report completed and submitted for 30 day peer review.

**O&M Phase**                      **Start** 03/01/99                      **End** 12/31/99                      **Subcontractor**

**Task** March 1, 1999 - December 31, 1999 - Completion of susceptibility model- Establish a mechanism to seasonally determine the primary period of vulnerability of juvenile fall chinook to stranding/entrapment.

**PROJECT COMPLETION DATE:**

**CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:**

The controlled river elevation reductions (year 2 - 1998) will be conducted to simulate real power peaking operations. The primary risk associated with these controlled tests will be the potential for massive stranding of juvenile fall chinook throughout the Hanford Reach. To minimize this risk, both the rate and magnitude of flow reductions will be set at conservative levels during the initial tests. Movement to greater magnitude flow reductions at faster rates will occur after the effect of the initial tests have been determined. If the impact of these tests is determined to be unacceptable, termination of the entire project may be necessary.

The benthic analysis which is planned for 1998 is currently in development. Some revision to the 1998 budget may be necessary dependent upon the outcome of the benthic analysis workplan.

During the pilot (1997), a study coordination group consisting of member representatives of all affected parties will be assembled to review the pilot work and guide the future (1998) study. Some revision to the 1998 workplan and budget may result from recommendations from the study coordination group.

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**OUTCOMES, MONITORING AND EVALUATION**

**SUMMARY OF EXPECTED OUTCOMES**

**Expected performance of target population or quality change in land area affected:**

Increased survival of juvenile fall chinook in Hanford Reach through reduction of losses in rearing areas resulting from daily power peaking activities (Time Frame - 1999 and beyond).

**Present utilization and conservation potential of target population or area:**

Hanford Reach presently under review for Wild and Scenic River status. The fall chinook population inhabiting this area is the largest of only two remaining wild fall chinook populations in the Columbia River system. Current minimum escapement target to the Hanford Reach is 45,000 hatchery and wild adult fish. This population is a primary contributor to ocean and freshwater sport and commercial fisheries and inriver tribal fisheries. It is also a primary component of an intertional Pacific Salmon Treaty between the United States and Canada.

**Assumed historic status of utilization and conservation potential:**

Run size estimates prior to hydroelectric development and power peaking activities in the Columbia River are not available. Historic escapement past McNary Dam ranges from 11,000 to 154,000 adult fish with a harvest to escapement ratio typically 4: 1 (i.e., for every fish that crosses McNary Dam, 4 are harvested in sport, commercial, or tribal river fisheries or in ocean fisheries).

**Long term expected utilization and conservation potential for target population or habitat:**

To maintain the minimum escapement goal of at least 45,000 adult hatchery and wild fish past McNary Dam.

**Indirect biological or environmental changes:**

Enhanced macroinvertebrate production. Enhanced resident fish production. Reduced predation in waterfowl nesting areas. (Time Frame - 1999 and beyond)

**Physical products:**

Susceptibility Model - A mechanism to seasonally determine the primary period of vulnerability of juvenile fall chinook to stranding/entrapment as a result of power peaking activities. Such a model will incorporate emergence timing, water temperature, habitat utilization at susceptible life stages, and discharge information from Priest Rapids Dam to determine primary periods of vulnerability in primary rearing areas. RHABSIM (flow model) data from USFWS work, Habitat Mapping data from BRD work, and Unsteady Flow Model data from PNNL work, will be included in the final Susceptibility Model . (Time Frame - 1999).

**Environmental attributes affected by the project:**

The results of the proposed work are likely to restrict power generation activities to minimize changes in river elevation levels (flo

w) during the juvenile fall chinook rearing period. (Time Frame - 1999 and beyond).

**Changes assumed or expected for affected environmental attributes:**

Near and long term changes expected to be the same. Adjustment of power peaking activities at Priest Rapids Dam and as needed throughout the hydrosystem to minimize water level fluctuations in the Hanford Reach during the juvenile fall chinook rearing period. (Time Frame - 1999 and beyond).

**Assessment of effects on project outcomes of critical uncertainty:**

Field data pertaining to juvenile fall chinook stranding and entrapment will be collected in index sampling areas only during controlled river elevation reduction tests. The sampling index areas will represent general habitat types and include primary rearing areas. The information collected will be assumed to be representative of other similar areas within the Hanford Reach. A workplan to address the effect of power peaking activities on the benthic community of the Hanford Reach is at the time of this submittal, still in development. Critical uncertainties related to this aspect of the proposed project will be addressed during the development process.

If unfavorable environmental conditions, such as extreme high river flows, occur which preclude the controlled river elevation reduction tests scheduled to occur in 1998, then these tests will be post-poned until suitable environmental conditions exist.

**Information products:**

Evaluation information on the effect of power peaking activities on the benthic community of the Hanford Reach. (Time Frame - 1998).

Evaluation information on the effect of power peaking activities on the resident fish population of the Hanford Reach (Time Frame - 1998).

Evaluation information on the effect of power peaking activities on the rearing juvenile fall chinook population of the Hanford Reach (Time Frame -1998).

A predictive model to seasonally monitor when power peaking activities should be restricted to protect rearing juvenile fall chinook in the Hanford Reach. (Time Frame -1999 and beyond).

**MONITORING APPROACH**

The chief environmental outcome of this work will likely be the stabilization of Hanford Reach river flows during the juvenile fall chinook rearing period. An annual monitoring program to be conducted by WDFW and GCPUD personnel will likely be necessary to determine the time period when flow fluctuations should be restricted. Such a monitoring program would begin after the conclusion of this proposed project and would be used in conjunction with the susceptibility model.

The biological outcome of this proposed work is likely to be improved survival/productivity of: 1) juvenile fall chinook, 2) resident fish, and 3) macroinvertebrates through the restriction of power peaking activities and associated water fluctuations in the Hanford Reach. Monitoring/measurement of 1) could potentially be accomplished through BPA funded Smolt Monitoring Program activities currently conducted at McNary Dam. Monitoring/measurement of 2) and 3) will require additional future field work not included in this proposal.

**Provisions to monitor population status or habitat quality:**

Smolt Monitoring Program at McNary Dam can potentially be used to monitor juvenile fall chinook stock status. Habitat quality/availability will require some level of annual monitoring in conjunction susceptibility model use to determine period of flow fluctuation restrictions.

**Data analysis and evaluation:**

Field data will be collected from index sites. These sites will be selected to be representative of a variety of habitat types present throughout the Hanford Reach and will include primary fall chinook rearing areas. Data collected pertaining to visible stranding of juvenile fall chinook and resident fish will consist of direct counts from index sampling sites. Subsurface stranding in either cobble type substrate or terrestrial vegetation will involve excavation of subsampling sites and extrapolation to area of similar substrate type throughout the rest of the index site. Hand counts of fish sampled from backwater entrapment areas will be expanded using common population estimate techniques (i.e., Zippin, 1956) to provide overall estimates of entrapment in index areas. Size of stranded/entrapped fish will also be measured to determine susceptibility relative to life stage. Drainage rate of entrapment areas will also be determined as will changes in water temperature and dissolved oxygen levels to determine relationship to duration of water elevation reduction. The above listed information will be combined with an Unsteady Flow Model (PNNL), Fall Chinook Habitat Mapping Data (USGS-BRD), and Hanford Reach IFIM data (USFWS), along with

emergence timing data and Priest Rapids discharge information (GCPUD) to produce a susceptibility model. The susceptibility model will be used for future monitoring .

**Information feed back to management decisions:**

Quarterly fiscal/employee activity reports will be provided to funding sources. A study coordination group consisting of member representatives from all affected parties will be assembled to oversee/review/guide the work. This group will receive weekly field activity reports during the field season. An interim progress report will be completed by January 31, 1998 summarizing the first year of work. A final report will be completed by February 28, 1999 summarizing the two years of the study.

**Critical uncertainties affecting project's outcomes:**

Uncertainties pertaining to the benthic analysis will be resolved during the planning and development process presently occurring in 1997. Increased sampling effort beyond specified index sampling sites could be undertaken to allow estimation of fish losses throughout Hanford Reach. Extreme environmental conditions which may preclude sampling activities cannot be immediately resolved but will result in delay of work only. If such conditions occur, the work will be completed when environmental conditions allow.

**EVALUATION**

The project will first serve to identify if power peaking activities are impacting fish and macroinvertebrate life in the Hanford Reach. If so, the impact will be quantified and reported. Recommendations for corrective action will be developed. Implementation of these corrective actions will require some level of annual monitoring through some future form of cooperative agreement between affected parties. Assessment of the performance of this project should be based upon the projects ability to: 1) identify and 2) quantify the problem, 3) report the results and develop recommendations through coordination with affected parties, and 4) result in effective of implemented corrective action.

**Incorporating new information regarding uncertainties:**

This project is being submitted as ongoing for FY98. However, the field work for the FY97 pilot evaluation has, at the time of this submittal, not yet begun. Therefore all actual field data to be collected through this project will be new. Overall, and within given funding constraints, this project serves to provide a comprehensive assessment of the effect of power peaking activities on fish and macroinvertebrate life inhabiting the Hanford Reach. All new information will be weighted in accordance with established project objectives, reported, and incorporated into the decision process used to develop recommendations for corrective action.

**Increasing public awareness of F&W activities:**

Project may solicit public volunteer effort to provide limited assistance in resident fish work.

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**RELATIONSHIPS**

**RELATED BPA PROJECT**

9406900 A Spawning Habitat Model to Aid Recovery Plans for Snake River Fall Chinook

8605000 White Sturgeon Productivity Status and Habitat Req.

9102900 Supplementation and Survival of Fall Chinook in Snake River

**RELATIONSHIP**

PNNL research is currently being conducted in the Hanford Reach on adult fall chinook. Information pertaining to flow-stage relationships and habitat/hyporheic zones is being provided in FY97 by PNNL and will be available in FY98.

ODFW subcontracts USFWS/BRD to conduct flow modeling of Hanford Reach. This information will be incorporated into the proposed work.

USGS BRD has collected data pertaining to juvenile fall chinook habitat utilization which will be incorporated into the proposed work.

**RELATED NON-BPA PROJECT**

**RELATIONSHIP**

Assessment of macroinvertebrate abundance in 3 lower Snake River Reservoirs/COE University of Idaho (UI) assesses effect of longterm drawdown on macroinvertebrates as a limiting factor to fall chinook production(COE). Similar work to be conducted on the Hanford Reach by UI relative to diel water fluctuations (BPA).

**OPPORTUNITIES FOR COOPERATION:**

The proposed work is a cooperative project with WDFW acting as the lead agency. Completion of the 1998 work will be contingent upon the implementation of controlled river elevation reductions on the Hanford Reach below Priest Rapids Dam. Coordination of this work through the Grant County Public Utility District (GCPUD), the Bonneville Power Administration, and the Columbia River power network will be necessary. Coordination with the U.S. Department of Energy for access to the Hanford Nuclear Reservation will also be necessary. GCPUD will also share in the funding of this work along with BPA as well as provide some equipment\manpower for the field work, provide Priest Rapids Project discharge information, and fall chinook emergence timing information. Other cooperators/contributors include: USFWS - providing IFIM model of Hanford Reach, USGS/BRD - Providing field equipment/personnel, shared technology and technical training involving juvenile fall chinook habitat mapping, PNNL - providing shared personnel, technology (unsteady flow model), technical literature, and laboratory resource access, University of Idaho - conduct benthic analysis. Information pertaining to the impact of aquatic predators as influenced by diel water fluctuations will also be collected by will be largely qualitative. More precise quantitative data may be available through a collaborative effort with a potential BRD study in the Hanford Reach. Evaluation of the influence of hyporheic flow on distribution of juvenile chinook and susceptibility to stranding may potentially be assessed through a collaborative effort with PNNL in FY98.

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**COSTS AND FTE**

**1997 Planned:** \$174,521

**FUTURE FUNDING NEEDS:**

**PAST OBLIGATIONS (incl. 1997 if done):**

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$350,000	5%	95%	0%
1999	\$50,000	0%	100%	0%
2000	\$10,000	0%	0%	100%
2001	\$10,000	0%	0%	100%
2002	\$10,000	0%	0%	100%

<u>FY</u>	<u>OTHER FUNDING SOURCE</u>	<u>AMOUNT</u>	<u>IN-KIND VALUE</u>
1998	Grant County PUD	\$87,500	25%
1999	Grant County PUD	\$12,500	25%
2000	Grant County PUD	\$2,500	25%
2001	Grant County PUD	\$2,500	25%
2002	Grant County PUD	\$2,500	25%

**OTHER NON-FINANCIAL SUPPORTERS:**

US. Fish and Wildlife Service, U.S. Geological Service - Biological Records Division, Pacific Northwest National Laboratories, Streamside Programs Consultation, University of Idaho Department of Fish and Wildlife, Pacific States Marine Fisheries Commission, Columbia River Intertribal Fish Commission.

**LONGER TERM COSTS:** \$10,000 per year

Operation and maintenance in the form of monitoring activities necessary to determine when flow restrictions should be in place to protect rearing fall chinook.

**1997 OVERHEAD PERCENT:** WDFW=19%, PSMFC=15%

**HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:**

All project costs except capital expenditures.

**CONTRACTOR FTE:** 8

**SUBCONTRACTOR FTE:** 8

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**SUPPLEMENTAL FACTORS**

**SUPPLEMENTAL ANADROMOUS FISH EVALUATION FACTORS:**

This is a cost-sharing project which utilizes multiple agencies in a coordinated fashion to minimize duplication of effort and maximize cost efficiency while using "state of the art" technology. This project has clearly defined measurable objectives with an expected outcome to increase survival of the juvenile stage of one of the most important stocks of fish on the Pacific Coast thereby increasing adult returns and promoting restoration of the Columbia River. This project is consistent with the objectives as indicated in both the NMFS - ESA Section 7 Biological Opinion and the Columbia River Basin Fish and Wildlife Program. In addition, this project may involve some level of public participation and therefore promote public awareness and education.

**SUPPLEMENTAL RESIDENT FISH EVALUATION FACTORS:**

This project serves to address resident fish concerns in the same general context as indicated in the previous anadromous section.

**SUPPLEMENTAL WILDLIFE EVALUATION FACTORS:**

This project is not a wildlife project but outcome may indirectly benefit nesting waterfowl.