

# RUN TIMING PREDICTIONS FOR THE COLUMBIA RIVER BASIN INCLUDING INDIVIDUAL ESA DEMES AND ANALYSIS OF TAGGING DATA 9105100

**SHORT DESCRIPTION:**

Develop statistical methods to predict the timing of the smolt outmigration at Columbia and Snake River Dams in real-time and convey results to the fisheries community via the World Wide Web. Develop analytical ability to improve matching of flow augmentation to coincide with migratory timing of ESA stocks in real-time. Evaluate historical data to improve analytical and decision support tools and improve evaluation programs.

**SPONSOR/CONTRACTOR:** UW

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**SUB-CONTRACTORS:**

Subcontractor: BioAnalysts, Inc.

## GOALS

**GENERAL:**

Supports a healthy Columbia basin, Adaptive management (research or M&E)

**ANADROMOUS FISH:**

Research, M&E

**NPPC PROGRAM MEASURE:**

3.2F.2; 5.2A7

**RELATION TO MEASURE:**

Project develops analysis and decision support tools to predict and monitor outmigration timing, spill timing, level of barging effectiveness of matching of water management and operations to migration timing to benefit ESA stocks in real-time for resource management. Project improves access to in-season information by conveying results interactively to the fisheries community via the Internet to assist decision making on hydrosystem operations to benefit fish passage and to enhance monitoring and evaluation and adaptive management capabilities. Project also evaluates historical data to design better analysis tools and evaluation programs.

**BIOLOGICAL OPINION ID:**

NMFS Hydrosystem Operations Biological Opinion RPA Sec. 1A and 13f

**OTHER PLANNING DOCUMENTS:**

Snake River Recovery Plan: 2.1.a; 2.1.d.5

**TARGET STOCK**

**LIFE STAGE**

**MGMT CODE (see below)**

Snake River Basin Steelhead	Smolt and Adult	P
Columbia River Basin Chinook	Smolt and Adult	L, P
Snake River Basin Chinook	Smolt and Adult	L, P

## BACKGROUND

**Project is an office site only**

**HISTORY:**

Project 9105100 was initiated in 1991 in response to the Endangered Species Act (ESA) listings in the Snake River Basin of the Columbia river system. Primary objectives were 1) to address the need for further synthesis of historical tagging and other biological information to improve understanding and to help identify future research and analysis needs and 2) to develop

improved monitoring and evaluation capabilities, statistical methodologies and software tools to assist in-season river management in optimizing operational and fish passage strategies to maximize the protection and survival of listed threatened and endangered Snake river salmon populations.

Project performs analysis and integration of historic and in-season mainstem migration timing data collected by the Smolt Monitoring Program and other mainstem research projects on wild and hatchery-reared salmonid smolts, with emphasis on Snake River wild threatened or endangered stocks. This project has evaluated the information content of historical tagging studies on Columbia and Snake River salmonids. Information is being supplied to help design and direct future research efforts and determine reliability of existing information. Historical data has and continues to be explored to reveal possible relationships between river conditions and salmonid survival, outmigration timing, speed, and outmigration success.

This project has developed new approaches and tools which generate on-line Internet-based information including real-time in-season predictions of the general migration status of Columbia and Snake River smolt migrations with emphasis on Snake River ESA stocks. In 1994, Program RealTime was developed to take advantage of historical PIT-tagging and passage index data for listed threatened and endangered Snake River wild salmon populations to make real-time in-season predictions of general migration timing to assist fish and hydrosystem management in optimizing operational and fish passage strategies to maximize protection and survival. Program RealTime uses state-of-the-art approaches to pattern recognition, nonlinear least-squares, feedback loops, numerical logic, and bootstrap variance estimation in making predictions. Since 1995, program RealTime has provided in-season predictions of the "percent run-to-date" and "date to specified percentiles" for a number of individual streams included in the National Marine Fisheries Service (NMFS) ecological significant unit (ESU) for Snake River wild spring/summer yearling chinook. Beginning in 1995, program RealTime was extended to generate predictions of the general migration status and trend of the summer outmigration of Snake River wild subyearling chinook.

Specific accomplishments by year include:

1991: Report on historical brand release data for the Snake River.

1992: Report on a "strawman" smolt monitoring design for Snake/Columbia River systems.

1993: Report on adult PIT-tag returns.

1994: Development and testing of Program RealTime PIT Forecaster statistical software using pattern recognition and neuronets to predict the outmigration timing of spring runs of wild Snake River spring/summer chinook at Lower Granite Dam real-time.

1995: Refinement of RealTime PIT Forecaster statistical software and initial testing of RealTime Passage Index Forecaster statistical software to predict outmigration timing of summer/fall runs of juvenile subyearling chinook at Lower Granite Dam. Report on transportation benefit analysis methods

1996: RealTime model of this project linked with CRiSP model of project 8910800 to extend predictions of migration timing to include Lower Snake River hydroprojects and McNary Dam. Investigated extending real-time outmigration prediction to Mid-Columbia hydroprojects. Expansion of Internet access to cover historical run timing and flow data at all major hydroprojects. Expansion of on-line interactive Internet-based information to include in-season time series of PIT detections for the three NMFS Snake River Basin Ecologically Significant Units (ESUs) [i.e. ESA-listed juvenile spring/summer chinook, fall chinook and sockeye salmon] as they pass through the FCRPS. Report on Priest Rapids hatchery returns of fall chinook versus river conditions.

1997: Investigate extending outmigration timing predictions to Lower Columbia hydroprojects through inking program RealTime with CRiSP model. Incorporate predictions of flow augmentation and percent of run barged.

#### **BIOLOGICAL RESULTS ACHIEVED:**

Tens of millions of coded-wire-tagged (CWT) and hundreds of thousands of passive-integrated-transponder-tagged (PIT-tagged) salmonid smolt are released into the Snake/Columbia River system annually. The data derived from these tagged fish provide needed information for post-season evaluation of outmigration success and inseason management of flow and spill. This project has provided needed analyses of smolt travel time, survival, and outmigration timing used in mainstem management and protection of endangered stocks of salmon.

Specific biological results of this project include:

1. Evaluation of travel time information contained in freeze-brand data.
2. Evaluation of the annual pattern of adult salmon returns to the upper Snake River from PIT-tag data.

3. Recommendations for complete life cycle survival studies using combined PIT/CWT releases.
  4. Evaluation of the relationship between Priest Rapids hatchery fall chinook adult returns and river conditions.
  5. Evaluation of effects of river pulsing on smolt travel times.
  6. Evaluation of the benefits of smolt transportation at Priest Rapids and McNary Dams.
- Together, these biological results are helping to evaluate past management decisions and improve future efforts to enhance wild salmonid stocks. Additionally, since 1994, the project has been providing run timing predictions of endangered wild salmonid stocks in the Snake River and making these predictions publicly available to the fisheries community.

**PROJECT REPORTS AND PAPERS:**

BPA Contract Reports:

DOE/BP-16570-1: Giorgi, A. E. 1990. Mortality of Yearling Chinook Salmon Prior to Arrival at Lower Granite Dam on the Snake River. Technical Report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-3: Skalski, J. R. and A. E. Giorgi. 1993. Juvenile Passage Program: A Plan for Estimating Smolt Travel Time and Survival in the Snake and Columbia Rivers. Technical Report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-4: Smith, S. G., J. R. Skalski, and A. E. Giorgi. 1993. Statistical Evaluation of Travel Time Estimation Based on Data from Freeze-Branded Chinook Salmon on the Snake River, 1982-1990. Technical Report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-6: Newman, K. 1995. Adult Salmonid PIT-Tag Returns to Columbia River's Lower Granite Dam. Technical Report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-7; Skalski, J. R., G. Tartakovsky, S. G. Smith, P. Westhagen, and A. E. Giorgi. 1994. Pre-1994 Season Projection of Run-Timing Capabilities Using PIT-tag Databases. Technical Report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-8; Townsend, R. L., P. Westhagen, D. Yasuda, and J. R. Skalski. 1995. Evaluation of the 1994 Predictions of the Run-Timing of Wild Migrant Yearling Chinook in the Snake River Basin. Technical Report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-9: Townsend, R. L., P. Westhagen, D. Yasuda, J. R. Skalski, and K. Ryding. 1996. Evaluation of the 1995 Predictions of the Run-Timing of Wild Migrant Yearling Chinook in the Snake River Basin using Program RealTime. Technical report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-10: Skalski, J. R., R. L. Townsend, R. F. Donnelly, and R. W. Hilborn. 1996. The Relationship between Survival of Columbia River Fall Chinook Salmon and Inriver Environmental Factors. Final Report. Analysis of Historic Data for Juvenile and Adult Salmonid Production: Phase II. Technical report to Bonneville Power Administration, Portland, Oregon.

DOE/BP-35885-11: Townsend, R. L., D. Yasuda, and J. R. Skalski. 1996. Evaluation of the 1995 Predictions of the Run-Timing of Wild Migrant Subyearling Chinook in the Snake River Basin using Program RealTime. Technical Report to Bonneville Power Administration, Portland, Oregon. (Final Draft submitted for peer review).

DOE/BP-35885-12: Yasuda, D., R. L. Townsend, and J. R. Skalski. Evaluation of the 1996 Predictions of the Run-Timing of Wild Migrant Yearling Chinook in the Snake River Basin using Program RealTime. Technical report to Bonneville Power Administration, Portland, Oregon. (Final Draft submitted for peer review).

Other Scientific Reports Produced for Publication:

Newman, K. 1995. Experimental Designs and Statistical Models to Estimate the Effect of Transportation on Columbia River System Salmonid Survival (draft report under peer review).

Newman, K. 1995. Survival Information Provided by Combined PIT-CWT Tagging (draft report under peer review).

Perez-Comas, J. A., and J. R. Skalski. 1995. Preliminary Assessment of the Effects of Pulsed Flows on Smolt Migratory Behavior (draft report).

**ADAPTIVE MANAGEMENT IMPLICATIONS:**

This project promotes adaptive management by making available statistical, computer, and telecommunications resources which analyze, integrate and disseminate real-time information on the status and timing of Columbia and Snake River spring and summer smolt migrations. To this end, Program RealTime uses passage indices and PIT-tag detections to make daily predictions of the "percent run to date" and "date to specified percentiles" of wild endangered salmonid stocks in the Snake River and posts results daily on the World Wide Web for the fisheries community. These on-line Internet-based run timing predictions and historic and current timing plots for ESA stocks and NMFS Snake River Basin ESUs are available for use by NMFS, the TMT and other members of the fisheries community to assist in-season river management in optimizing operational and fish passage strategies to maximize the protection and survival of listed threatened and endangered Snake river salmon populations.

This project also promotes adaptive management by making the statistical tools and software programs produced by this effort available to all parties wishing to enhance the monitoring and evaluation and adaptive management capabilities of their projects or agencies.

**PURPOSE AND METHODS****SPECIFIC MEASUREABLE OBJECTIVES:**

1997 Investigate extending outmigration timing predictions to Lower Columbia hydroprojects. Incorporate predictions of flow augmentation and percent of run barged.

1998 Adapt program RealTime data analyses of outmigration timing to the changing needs of river managers. Add predictions of steelhead run timing and adjustments of run timing to changes in ambient conditions. Other analyses will examine return rates of PIT-tagged adult salmonids.

**CRITICAL UNCERTAINTIES:**

Project strives to use statistical methods to unravel the uncertainties of tagging data and outmigration dynamics.

**BIOLOGICAL NEED:**

Prediction of where the wild stocks of salmonid smolt are in their outmigration facilitates management decisions on the timing and placement of flow augmentation and spill to protect endangered stocks. Improved analytical ability to target flow augmentation to coincide with migratory timing of ESA and other salmonid and steelhead stocks in real-time supports the regional biological goal of increasing juvenile passage survival through the FCRPS.

**HYPOTHESIS TO BE TESTED:**

The project's analyses of historical tagging data routinely tests hypotheses and looks for correlations between tag returns and environmental and human-related effects. Specific hypotheses include:

1. Flow-travel time relationships of outmigrating smolt
2. Flow-survival relationships of outmigrating smolt
3. Travel time-river pulsing relationships of outmigrating smolt
4. Temperature, turbidity, hatchery release numbers on in-river smolt survival
5. Low-adult return rate relationships.

With the increased focus on outmigration predictions, the project is testing basic hypotheses concerning outmigration timing and dynamics, that are tested annually when actual run timing is compared to daily predictions at the end of the season.

**ALTERNATIVE APPROACHES:**

Alternatives for predicting outmigration timing were analyzed in technical reports DOE/BP-35885-7, DOE/BP-35885-8 , and DOE/BP-35885-9. Best approaches adopted.

**JUSTIFICATION FOR PLANNING:**

Managing the river to protect Endangered Species and other salmonid and steelhead stocks requires knowing where the fish are and when and how to best augment flows to coincide with their migratory timing.

**METHODS:**

Historical databases on tag detections (brands, PIT-tag), tag recoveries (CWT and PIT), and ambient river conditions (flows, temperatures, spill volumes, etc.) are analyzed using SUN workstations and a variety of statistical methods (e.g., generalized linear models, nonlinear regression, mark-recapture theory). Predictions of outmigration timing are based on advanced mathematical/statistical techniques including fuzzy logic, generalized models, and bootstrap/jackknife procedures. Output of outmigration timing predictions posted on the World Wide Web.

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## PLANNED ACTIVITIES

### SCHEDULE:

**Planning Phase**                      **Start** 1991                                      **End** Indefinitely                                      **Subcontractor**

**Task** Continue to promote adaptive management and transfer of technology by making the statistical, analytical and decision support system tools produced by this effort available to all parties.

**Planning Phase**                      **Start** 1991                                      **End** Indefinitely                                      **Subcontractor**

**Task** Continue evaluations of historical and current tagging data to design better analysis and decision tools and improve research and evaluation programs.

**Planning Phase**                      **Start** 1993                                      **End** Indefinitely                                      **Subcontractor**

**Task** Continue development of analytical tools to monitor outmigration timing, spill timing, level of barging, effectiveness of the timing of flow augmentation to benefit ESA and other salmonid and steelhead stocks in real-time to assist resource management.

**Implementation Phase**                      **Start** 1997                                      **End** Indefinitely                                      **Subcontractor** No

**Task** Continue to assist transfer of technology associated with migratory timing forecasting and Internet display to responsible regional entities.

**Implementation Phase**                      **Start** 01/98                                      **End** Indefinitely                                      **Subcontractor** Yes

**Task** Improve ability to target flow augmentation to coincide with migratory timing of ESA and other salmonid and steelhead stocks in real-time to increase juvenile passage survival through the FCRPS. In 1998 integrate run timing forecasts for ESA stocks with flow augmentation timing particularly associated temperature fluctuations in summer, through key index reaches in the Snake River.

**Implementation Phase**                      **Start** 1991                                      **End** Indefinitely                                      **Subcontractor** No

**Task** Continue analyses of historical and current tagging data to improve understanding, to develop improved analytical capabilities and to help identify and design future research and analysis needs. In 1997 investigate alternative approaches to using adult return data to estimate and assess survival relationships. In 1998 analyze PIT tag data from returning adults, using the partitioning suggested by HARZA Northwest in their 1996 report to the U.S. Army Corps of Engineers. Treat all species returning to the Snake River.

**Implementation Phase**                      **Start** 1994                                      **End** Indefinitely                                      **Subcontractor** No

**Task** Continue to adapt RealTime data analyses of outmigration timing to other sites to meet the changing needs of river managers. In 1997, in conjunction with the CRiSP project, investigate extending outmigration timing predictions to Lower Columbia hydroprojects. In 1998, add predictions of steelhead run timing and adjustments of run timing to changes in ambient conditions.

**O&M Phase**                                      **Start** 1994                                      **End** Indefinitely                                      **Subcontractor**

**Task** Development and maintenance of program RealTime software and Internet and decision analysis and support tools. The goal is to improve access to real-time information available to support and assist in-season management of FCRPS operations for fish passage.

### PROJECT COMPLETION DATE:

N/A

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

Changes in fish marking programs could impact ongoing and scheduled tasks.

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# OUTCOMES, MONITORING AND EVALUATION

## SUMMARY OF EXPECTED OUTCOMES

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

The project will provide daily predictions of outmigration timing of ESA-listed stocks at Lower Granite, Little Goose, Lower Monumental, Ice Harbor, and McNary Dams and associated confidence intervals during spring and summer 1997 and subsequent years. Subsequent years will proceed with predictions in the Mid-Columbia and Lower Columbia.

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

ESA-listed stocks presently utilize the entire migration corridor during outmigration.

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

N/A

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

The recovery of ESA-listed and non-listed stocks.

### **Contribution toward long-term goal:**

Improved real-time access and integration of information on outmigration timing and success for ESA-listed and non-listed chinook, sockeye and steelhead for use in decision analysis and adopted adaptive management framework.

### **Indirect biological or environmental changes:**

Improved matching of flow augmentation to coincide with migration timing of ESA-listed stocks.

### **Physical products:**

Provision of real-time predictions of smolt migration timing with emphasis on individual and/or composite ESA stocks for potential use in in-season management of operations and fish passage strategies.

### **Environmental attributes affected by the project:**

Real-time predictions on outmigration timing could influence decisions on timing and pattern of flow augmentation and other operations of the FCRPS.

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

Changes in ambient river conditions e.g. flow, water velocity, water temperature.

### **Measure of attribute changes:**

N/A

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

Project addresses uncertainties of outmigration timing dynamics in real-time. To assess the impact on this critical uncertainties, we make post season evaluations of the performance by a comparison of the actual to the predicted in-season migration timing.

### **Information products:**

Provides daily predictions of migrating timing posted on World Wide Web. Post-season evaluation of seasonal performance in technical reports. Analysis of historical tagging studies presented in technical reports.

### **Coordination outcomes:**

This project has evaluated the information content of historical tagging studies on Snake and Columbia River salmonids. Information is being used in an adaptive management framework to help design and direct future research efforts and determine

reliability of existing information. Historical data has and continues to be explored to reveal possible relationships between river conditions and salmonid survival, outmigration timing, speed and outmigration success. The transfer of information and learning to the region by year include:

1991: Report on historical brand release data for the Snake River.

1992: Report on a "straw man" smolt monitoring design for Snake/Columbia River systems.

1993: Report on adult PIT-tag returns to Lower Granite Dam.

1994: Report on development and testing of RealTime PIT Forecaster statistical software using pattern recognition and neuronets to predict the outmigration timing of spring runs of wild Snake River spring/summer chinook at Lower Granite Dam.

1995: Report on testing of RealTime PIT Forecaster in 1994. Refinement of RealTime PIT Forecaster and initial testing of RealTime Passage Index Forecaster statistical software to predict outmigration timing of summer/fall runs of juvenile fall chinook at Lower Granite Dam. Report on transportation benefit analysis methods. Draft report on Priest Rapids hatchery returns versus river conditions.

1996: Reports on spring and fall chinook run timing. Final Report on Priest Rapids hatchery returns versus river conditions.

In addition, since 1995, real-time predictions on the migration timing of spring and summer smolt outmigrations of ESA-listed wild Snake River salmon stocks have been generated by Program RealTime and made available via the World-Wide Web for potential use by NMFS, the TMT and other members of the fisheries community to assist in-season river management in optimizing juvenile fish passage survival through the FCRPS.

## **MONITORING APPROACH**

The ultimate outcome - increased survival due to improved matching of water management and operations to migration timing - depends upon the effective use of these tools and forecasts by regional managers. The products of this effort - passage timing forecasts - are, in part, self evaluating since they incorporate precision or uncertainty estimates. The ultimate evaluation of these products will come from annual post-season evaluations performed by the contractor and possibly from other regional entities involved in in-season management, including the Fish Passage Center.

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

This contract provides a direct measure of current passage timing status of individual and composite (e.g. ESU) juvenile runs.

### **Data analysis and evaluation:**

Actual application during juvenile migration will permit in-season managers to access the utility and accuracy of predictions. The model itself (Program RealTime) assists the evaluation by including precision estimates. Post-season analyses by the contractor and other regional entities will address overall performance.

### **Information feed back to management decisions:**

Use and evaluation of these tools will provide direct feed back, both during and after the migration season. Posting of predictions via the World-Wide Web permits regional review and critique.

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

N/A

## **EVALUATION**

The region will have direct opportunity to evaluate performance by following that performance via the Internet during the in-season period. The model provides viewable measures of uncertainty that allow managers and the region to assess performance. Post-season analysis is automatically provided by the tool upon completion of the migration of interest and management entities can be expected to evaluate the tool's utility and performance.

### **Incorporating new information regarding uncertainties:**

The project has annually incorporated constructive criticisms and suggestions to improve methods and limit the effects of uncertainties associated with input information, predictive methods, and error estimation.

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

Public has real-time access to all data and findings reported daily on World Wide Web pages.

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## RELATIONSHIPS

### RELATED BPA PROJECT

9202604 Spring Chinook Salmon Early Life History

8401400 Smolt Monitoring At Federal Dams

8712700 Smolt Monitoring By Non-federal Entities

8332300 Smolt Condition & Arrival Timing At Lwr Granite

8910800 Monitoring and Evaluation Modeling Support [UW]

9008000 Columbia Basin PIT-Tag Information System [PSMFC]

9008000 Columbia Basin Pit-tag Information System

8332300 Smolt Condition & Arrival Timing At Lwr Granite

9102800 Monitoring Smolt Migration of Wild Snake River Sp/Sum Chinook

9700200 PATH-UW Technical Support

### RELATIONSHIP

Spring Chinook Salmon Early Life History [ODFW Research Project]

Smolt monitoring at Federal Dams [NMFS]

Smolt Monitoring by Non-Federal Entities [PSMFC contract subrecipients CPUD, IDFG, NPT, ODFW, WDFW]

This projects integrates the PIT tag detection information generated by the PIT tag marking and monitoring activities of the Smolt Monitoring projects 8332300, 8401400 and 8712700 to generate real-time on-line, World-Wide Web-based information which presents an in-season time series of PIT detections for the three NMFS Snake River Basin Ecologically Significant Units (ESUs) [i.e. ESA-listed juvenile spring/summer chinook, fall chinook and sockeye salmon] as they pass through the FCRPS, for potential use by the in-season operations Technical Management Team (TMT).

The RealTime model of this project is linked with the CRiSP model of project 8910800 to extend predictions of migration timing to sites below Lower Granite Dam. Project 8910800 in conjunction with this project supports the DART (Data Access in Real Time) second-tier database which provides on-line, World-Wide Web-based database services and presentations prepared from a subset of regionally-dispersed databases (FPC, Corps, BPA, PTAGIS/PSMFC, USGS, etc.). The DART system generates the historical and in-season datasets critical to producing the run timing predictions for this project.

Provides high quality PIT tag data to the region via the PIT Tag Information System (PTAGIS). The PIT tag data provided through this primary-tier database service is used by this project via the RealTime PIT Forecaster program to generate on-line, World-Wide Web-based forecasts of inseason passage stage for individual and combined ESA stocks for potential use by the in-season operations Technical Management Team (TMT).

Smolt Condition & Arrival Timing at Lower Granite Dam [IDFG]

PIT tags wild ESA-listed Snake River chinook parr in their natal streams during the summer period. PIT tag detections at Lower Granite Dam from migrants marked by project 9102800 are used by this project via program RealTime PIT Forecaster to generate on-line, World-Wide Web-based forecasts of inseason passage stage for individual and combined ESA stocks for potential use by the in-season operations Technical Management Team (TMT)

9202604 Spring Chinook Salmon Early Life History

PIT tags ESA-listed chinook parr in the Grande Ronde and Imnaha basins. PIT detections at Lower Granite Dam from migrants marked during the summer period by project 9202604 are used by this project via program RealTime PIT Forecaster to generate on-line, World-Wide Web-based forecasts of inseason passage stage for ESA stocks for potential use by the in-season operations Technical Management Team (TMT).

9403300 Fish Passage Center [PSMFC]

This project uses the in-season smolt index passage information that is compiled and provided by the Fish Passage Center's primary-tier database center in the RealTime Passage Index Forecaster program to generate on-line, World-Wide Web-based forecasts of inseason passage stage for Snake River ESA-listed wild subyearling chinook for potential use by the in-season operations Technical Management Team (TMT).

9507000 An Evaluation of the Effectiveness of Flow Augmentation in the Snake River [BioAnalysts]

This UW contract provides the opportunity to explore and perhaps resolve some of the remaining issues identified/revealed in that study i.e. further development of the analytical tools and/or capability to optimally target the timing of flow augmentation with migratory timing of composite and/or individual ESA stocks.

9600600 PATH-Facilitation, Technical Assistance & Peer Review [Essa Technologies]

This project performs tasks that analyze and interpret tagging data in ways that other research entities currently do not perform. This project provides an added value to historical tagging data by testing hypotheses, estimating parameters, and modeling interrelationships without the tremendous costs of additional field studies. These analyses provide information to the PATH process that is currently reviewing available information and assessing future information needs.

8401400 Smolt Monitoring At Federal Dams

Same as 8332300

8712700 Smolt Monitoring By Non-federal Entities

Same as 8332300

9600800 PATH-Participation by State & Tribal Agencies [ODFW]

9601700 Technical Support for PATH [BioAnalysts]

9102800 Monitoring Smolt Migration of Wild Snake River Sp/Sum Chinook

Monitoring the Smolt Migrations of Snake River Spring/Summer Chinook Salmon [NMFS Research Project]

**RELATED NON-BPA PROJECT**

Mid-Columbia PUDs Smolt Monitoring & Assessment Programs

**RELATIONSHIP**

Technology transfer and learning from this UW contract are integrated and applied to developing migration timing predictions for mid Columbia River salmon stocks from acoustic index programs at mid-Columbia River projects.

Technical Management Team (TMT) Web Page maintained by the Corps of Engineers

The purpose of the TMT Web Page is to facilitate communication among participants in the TMT through timely access to data and information, enhanced mechanisms of on-line communication, and archival and retrieval of historical information. This project generates on-line Internet-based run timing predictions and historic and current timing plots for ESA stocks and NMFS Snake River Basin ESUs that are available for incorporation on the TMT Web Page.

**OPPORTUNITIES FOR COOPERATION:**

The full value of the statistical models, tools and decision analysis and information support systems being developed and provided

through this project can be achieved by close cooperation with the Federal, State and Tribal fisheries agencies and the PATH, Council/ISRP/ISAB expert scientific panels.  
 Examples of cooperation and interactions include:

1. This project has worked with technical staff of the Fish Passage Center in the development and refinement of the RealTime migration forecasters.
2. This project generates on-line Internet-based run timing predictions and historic and current timing plots for ESA stocks and NMFS Snake River Basin ESUs that have been made available in-season for use by the fisheries community.
3. In-season predictions of migration timing for individual and composite ESA stocks and NMFS ESUs have been made available for potential use by the inseason operations Technical Management Team (TMT).
4. Evaluations of the RealTime migration timing forecasters and results of historical tagging and other analyses have been published in reports and made available for use by PATH groups and other scientific panels.
5. Results of analyses, RealTime migration timing forecasts and decision analysis tools are available for potential presentations to Council/ISRP/ISAB expert scientific panels.
6. Developed statistical tools, analytical capabilities, Web-based tools, and statistical models like program RealTime are available to all parties wishing to enhance the monitoring and evaluation and adaptive management capabilities of their projects and/or agencies.

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## **COSTS AND FTE**

**1997 Planned:** \$0

### **FUTURE FUNDING NEEDS:**

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$310,000	5%	80%	15%
1999	\$310,000	5%	80%	15%
2000	\$310,000	5%	80%	15%
2001	\$310,000	5%	80%	15%
2002	\$0			

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

<u>FY</u>	<u>OBLIGATED</u>
1991	\$321,453
1992	\$47,337
1993	\$255,248
1994	\$219,308
1995	\$286,062
1996	\$457,393
1997	\$192,000

TOTAL: \$1,778,801

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

### **OTHER NON-FINANCIAL SUPPORTERS:**

Data provided by Fish Passage Center (FPC), PTAGIS, and Army Corps of Engineers (ACOE) on a daily basis.

### **LONGER TERM COSTS:**

Project is anticipated to continue in some form beyond 2002 as part of a fixed-base program. Level of costs is likely to be dependent on the continuing need of in-season products and information services and analytical and decision analysis tools for program evaluation. The status of any transfer of technology and products could also impact level of costs. The estimated annual cost is \$250,000.

Most of the costs would be for continued implementation. Planning costs would be minimal and costs for operation and maintenance would be dependent on the need to maintain developed tools and information display and analysis systems and the status of any transfer of technology and tools to other responsible parties.

**1997 OVERHEAD PERCENT:** 27.3%

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

On all direct cost except the following; equipment over \$2K, lease, and graduate student operating fees.

**SUBCONTRACTOR FTE:** 0.21

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