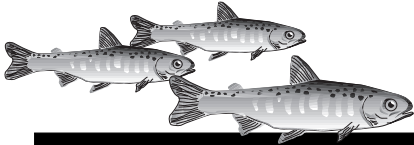




US Army Corps  
of Engineers®  
Walla Walla District

## Lower Snake River

# JUVENILE SALMON MIGRATION Feasibility Study



OCTOBER 1998

NEWSLETTER NO. 4

**The U.S. Army Corps of Engineers (Corps) is conducting a feasibility study of ways to improve juvenile salmon migration through the hydropower system on the lower Snake River. The study focuses on how the lower Snake River dams can be changed to improve survival and recovery prospects for Snake River salmon stocks listed under the Endangered Species Act.**



### STUDY UPDATE

**By Greg Graham, Corps  
Project Manager for the  
Study**

Since our last newsletter, many things have changed. Some of the more significant changes involve personnel rather than process. Pete Poolman, the feasibility study manager, has left the study team to accept a position as Chief for the Environmental Compliance Branch of the Walla Walla District, U.S. Army Corps of Engineers. Although this is a big loss to the team, we all wish Pete the best of luck in his new position and thank him for all his efforts in keeping the study on track and on schedule. Lonnie Mettler will be taking over Pete's duties. Lonnie is not new on the study team. He has been the National Environmental Policy Act Coordinator for the study for several years and knows all the study details very well. I have high confidence in Lonnie's ability to pick up where Pete left off. In addition, I would like to welcome Tim Kuhns and John Toll to the Drawdown Regional Economic Workgroup. They are filling in for the recent departure of Linda Wear, Tom Hackett, and Kristin Cothorn.

We are at a critical point in the study. The evaluations on the alternative

pathways continue to progress. However, there is still much to do and time is rapidly nearing for the completion of the draft feasibility report/environmental impact statement in April 1999. Each of the workgroups is committed to completing its analysis. Many of the workgroups depend on information from other workgroups. Through this sharing of information, we are finding data gaps on a daily basis and we continue to find creative ways to resolve these gaps, for which all involved are to be commended.

The region is eagerly waiting for results. We've been collecting and sharing a lot of information through roundtable workshops and workgroup meetings. But, the facts are not all in yet. There are some in the region who believe all the facts are in, and who are eager for the region to make decisions on which action to implement. It is the Corps' job to ensure that all the facts are in, that the facts are correct, and that all sides of the issues have been appropriately investigated. In addition, this information needs

to be presented clearly and concisely so it is useful to decisionmakers. There are potentially big decisions ahead of us. We all know how important the recovery of listed salmon and steelhead is to the region. It is also important to understand the tradeoffs for recovery (economic, social, and other environmental).

We have scheduled a series of public information meetings in November to provide a status of the study and present any pertinent *preliminary* results. The issues we are dealing with in this study are very significant regionally and nationally. I applaud your efforts to stay up-to-speed. I encourage all interested parties to attend one of these meetings. ☺

### NOVEMBER PUBLIC MEETING DATES (7 to 9 p.m.)

**Lewiston, Idaho - November 9**

**Richland, Washington - November 12**

**Portland, Oregon - November 16**

**Boise, Idaho - November 19**

**Spokane, Washington - November 23**

**(See back page for locations.)**



## REGIONAL COORDINATION UPDATE

### Coordination Efforts

In cooperation with the Bonneville Power Administration (BPA), the Bureau of Reclamation (BoR), and the Environmental Protection Agency (EPA), the Corps is working with the following groups to gather input and foster understanding:

- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- Northwest Power Planning Council
- Native American tribes
- State agencies in Washington, Oregon, and Idaho
- Stakeholders.

As part of its regional coordination efforts, the Corps has established a variety of technical workgroups to examine study issues from diverse perspectives. These workgroups and other briefings and meetings with interested parties are planned throughout the study process. ☉



### Roundtable Workshop Review

The July 15 Roundtable Workshop in Boise, Idaho, featured an overview of the feasibility study process by Greg Graham, Corps Project Manager; a discussion of

the socioeconomic analyses by Dennis Wagner, Corps economist; a presentation of the work status of the regional fisheries biological modeling workgroup (PATH) by Tom Cooney, NMFS fisheries biologist; and a presentation by Rich Rigby of the BoR on the upper Snake River flow augmentation analysis.

This meeting was the seventh in a series of Regional Roundtable Workshops being sponsored by the Corps to ensure an opportunity for participation in the study by groups and individuals not involved in other forums. More than 45 people participated in the July workshop. A summary of the meeting will be posted on the study website under public involvement (see Page 6 for address). ☉

## FEASIBILITY STUDY GOALS AND PATHWAYS

The Corps is conducting this feasibility study at the request of the National Marine Fisheries Service (NMFS). In their 1995 Biological Opinion, they directed the Corps to conduct a feasibility study to look at drawdown on the lower Snake River and to look at alternatives to drawdown. Furthermore, they requested that a decision or recommendation be made in 1999. The Corps has made a commitment to NMFS and the region to do this work and meet the 1999 recommendation date.

The ultimate goal of the study is to improve survival for listed Snake River anadromous salmon and steelhead stocks as they migrate downstream through Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams.

To comply with the National Environmental Policy Act and the 1995 Biological Opinion issued by NMFS, the Corps is gathering public and interagency input to define and evaluate three courses of action (pathways) for improving juvenile fish survival during migration through the hydropower system, and will provide a final recommendation in 1999. Congress will review the recommendations, appropriate funding, and authorize a course of action.

Individual pathways and their alternatives will be discussed in each newslet-

ter; see page 3 of this newsletter for a summary of some of the components of the major system improvements pathway.



### Existing System

Ocean-going juvenile salmon pass the dams through turbines, fish bypass systems, or over the spillways. In accordance with the 1995 Biological Opinion issued by NMFS for operation of the Federal Columbia River Power System, the Corps also implements flow augmentation and increased spill measures to assist migration. Screens are used to guide most fish away from turbines and into a bypass system. The young salmon and steelhead are then routed back to the river or into barges or trucks for transport downriver. The Biological Opinion states that approximately 50 percent of the smolts are to be transported. This system is constantly being evaluated and improved by scientists and engineers. Ongoing improvements include longer screens, additional barges, and flow deflectors on spillways.



### Major System Improvements

These improvements are aimed at increasing the

effectiveness and efficiency in how smolts are bypassed around dams. They include construction of surface bypass collection systems (fish bypass systems that divert fish nearer the water's surface than current systems), fish guidance improvements, turbine modifications, structural changes to reduce harmful dissolved gas levels from spillways, and possible operational changes such as modifying river flows and spills. These improvements could be used with the juvenile fish transportation system or by letting juveniles migrate in-river.



### Natural River Drawdown

Four of the existing Snake River reservoirs would be permanently lowered to a natural free-flowing condition by removing a section of each dam's earthen embankment, creating a 140-mile free-flowing river. This would eliminate existing reservoir-related and dam passage mortality at the four lower Snake River dams, as well as speed the downriver migration of juvenile salmon. (The juvenile fish would, however, still have to pass the four lower Columbia River dams to reach the ocean.) Commercial navigation and hydropower production would cease. Irrigation and recreation opportunities would be affected and ongoing wildlife compensation efforts would be impacted as well. ☉



## ROADMAP TO THE PATHWAYS: MAJOR SYSTEM IMPROVEMENTS PART II—TURBINE IMPROVEMENTS, REDUCTION OF HARMFUL GAS LEVELS, AND INCREASES IN FLOW

In addition to the surface bypass collection system discussed in the last newsletter, engineers and scientists are working on additional options for improving safe passage through major system improvements. Some options under consideration are modifying turbines to reduce fish harm, making structural changes to reduce the harmful dissolved gas levels fish encounter as they are passed over the dam via spillways, and possibly increasing the amount and speed of water that flows at certain times.

### Turbine Improvements

Through the surface bypass collection system and other means, the Corps is working to divert juvenile fish away from the turbines, but some fish will still take the turbine passage route. The first challenge the Corps faces in modifying turbines to reduce harm, is to understand what about the turbines actually injures the fish.

Most of the turbines used at the lower Snake River dams are Kaplan turbines. They consist of a vertical shaft with propeller-type blades which turn when water flows over them. The blades turn the shaft, which turns the rotor, which spins inside the stator to generate electricity. The angle of the blades on Kaplan turbines is automatically adjusted according to flow for peak efficiency. The flow areas between the blades are fairly wide. Turbines are large (up to about 27 feet across) and they spin at about 70 to 90 revolutions per minute, with water and blades and fish all swirling in the same direction and moving together. It is important to understand that the blades are not moving in the opposite direction of the fish and cutting them as they cross paths.

Preliminary studies have revealed some of the causes of fish injury. One main cause appears to be when fish hit solid parts or surfaces of the machine. Scientists call this “strike.” Injury also seems

to occur when the blades are slanted at certain angles, causing gaps between the edge of the blades and the hub or the discharge ring, the outer casing around the turbine. Scientists believe fish can be pulled through these gaps and be injured by rapidly moving parts or large pressure differences. Pressure changes and water shear (which occurs when two jets of water with different speed or direction pass near each other) can also harm fish. Because of the high velocities in the turbines, there are some limited zones of extremely low pressure which cause vacuum-like conditions called Cavitation. Cavitation can injure fish.

Scientists and engineers are using models to identify specific zones where there is a high potential for injury from the hazards just described. Once the high injury zones have been identified, the team will be able to decide how to reduce this harm. Possible changes include reducing the gaps between the blades and the hub, using a smoother

surface on turbine parts to reduce contact injuries, and changing turbine operations to lessen pressure changes.

### Reduction of Harmful Gas Levels

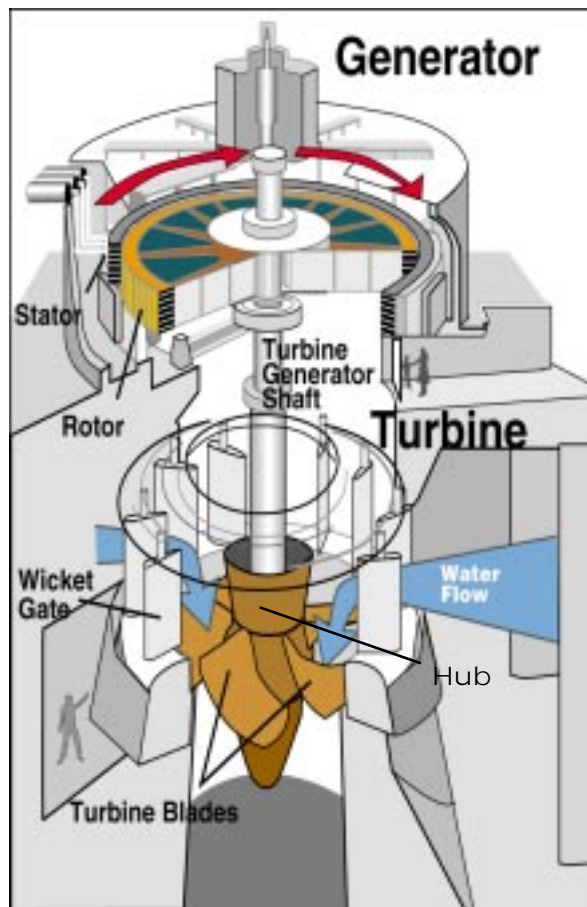
Since 1985, intentional spill at the dams has been used to get juvenile fish past the dams. Water is released over the dam spillway, carrying fish with it into the basin below. High levels of spill can harm fish because as the water passes over the dam and hits the water in the basin on the other side, the levels of some dissolved gases in the water rise from bubbles that are trapped and carried under with the force.

One option for reducing dissolved gas levels is a spillway flow deflector. Flow deflectors are installed in the basins below all four dams to interrupt the downward plunge of spilled water and direct it in a more horizontal flow.

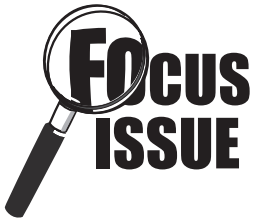
When Ice Harbor flow deflectors were installed in 1997, improvements to the designs of those installed at the other dams were identified. Major system improvements designed to reduce harmful gas levels would include updating the deflectors at the other three dams and installing flow deflectors on the end bays of those dams without end bay flow deflectors. Another option is to raise the floor of the basin, reducing the pressure which is a key driving force in the production of high gas levels.

### Increases in Flow

Scientists and engineers have been analyzing the effects to many resource areas of increasing flow at certain times to speed the downriver migration of the juvenile salmon and steelhead. The current Biological Opinion dictates a volume of 427 thousand acre-feet. Scientists and engineers, in association with the U.S. Bureau of Reclamation's upper Snake River flow augmentation study, are investigating the effects of a volume of 1,427 thousand acre-feet and 0 acre-feet. ☹







## DRAWDOWN REGIONAL ECONOMIC WORK GROUP (DREW)

The potential economic effects of lower Snake River drawdown are the subject of a number of studies. The Drawdown Regional Economic Workgroup (DREW) was formed to develop a combined "regional economic analysis" designed to reduce conflicting analyses and pool resources for a more efficient effort. Members of DREW include the Corps, Bonneville Power Administration, Bureau of Reclamation, National Marine Fisheries Service, Northwest Power Planning Council (NPPC), the Columbia River Inter-Tribal Fish Commission, Environmental Defense Fund, Pacific Alternatives Project, Save Our Wild Salmon, Northwest Energy Coalition, and representatives of other interested groups. Agency expertise is supplemented by contracted professional and academic economists who are regional experts in their respective fields.

DREW meetings, held at various locations throughout the region on a roughly bimonthly basis, are regularly advertised and open to the public. Members of the public and representatives of various interest groups regularly participate in and contribute to the meetings.

The role of DREW is to conduct the necessary technical analyses to assess the potential economic impacts of the three pathways and their various alternatives. The areas of analysis include:

- power
- recreation
- transportation
- irrigation and water supply
- anadromous fish
- Tribal circumstances
- flood control
- implementation costs
- avoided costs
- allocation of costs
- cost effectiveness/incremental cost analysis

- risk and uncertainty
- social and community effects
- regional effects
- mitigation
- financial analysis
- relevant agreements

Within DREW, smaller workgroups oversee and provide technical support for each area of analysis. Study design and technical analysis is, as a result, a collaborative process that aims to include a range of viewpoints and technical skills.

Work products produced by DREW are reviewed by the NPPC's Independent Economic Advisory Board (IEAB), a review board of economists drawn from academia and private industry. IEAB provides independent peer review of work products and advice in resolving technical issues, as necessary.

The key areas of analysis being evaluated by DREW are closely related to one

another. Results from some studies are required inputs for others. A number of the analyses also depend on the results of the ongoing Plan for Analyzing and Testing Hypotheses (PATH) analysis. PATH is a workgroup of regional fishery biologists using analytical methods to measure the effects of various river and salmon management alternatives on listed salmon stocks.

Technical reports, developed for each area of analysis, will be combined to form a coherent document that addresses the potential economic effects of the pathways currently under consideration. This document will be an appendix to the Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement (FR/EIS), and the information it contains will be condensed in the FR/EIS. A draft economic appendix is scheduled to be completed in time to be issued with the Draft EIS in April 1999. ☉





## STUDY MILESTONES

= Task already completed

- Notice of Intent ..... June 1995
- Scoping Meetings ..... July 1995
- Interim Status Report ..... December 1996
- Regional Roundtable Workshops Initiated ..... April 1997
- First Set of Public Information Meetings ..... September 1997
- Second Set of Public Information Meetings ..... November 1998
- Technical Analysis Complete (Economics, Engineering, Biological, etc.) ..... January 1999
- Distribute Draft Environmental Impact Statement ..... April 1999
- Public Review of Draft Environmental Impact Statement ..... May/June 1999
- Distribute Final Environmental Impact Statement ..... October 1999
- Public Review of Final Environmental Impact Statement ..... November/December 1999
- Sign Record of Decision ..... June 2000



## COMMONLY ASKED QUESTIONS

Question:

Is it true that Federal dams are responsible for 95 percent of the human-caused mortality to Snake River salmon?


Answer:

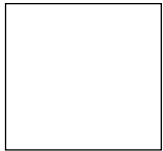
No. This figure was inaccurately stated at the Salmon Summit Conference in 1990, and has since been widely quoted by the media. The Corps traced this figure to fishery research from 1973. The NMFS estimated that in 1973, 95% of the salmon migrating from the Salmon River perished before they reached The Dalles Dam. Most of the loss was attributed to passage through dams and reservoirs in this very low flow year. However, it was recognized that some mortality occurred before the predominantly wild fish reached Little Goose Reservoir, the uppermost dam at the time.

In the 1970s, juvenile fish mortality through the hydropower system ranged from a high of 99% in 1977, a severe

drought year, to about 70% in good flow years. In recent years, 50 to 60% of chinook (90% of which are now hatchery fish) have been lost before they reach Lower Granite Dam, the uppermost dam now. Since 1989, the Federal fisheries agencies have found that up to 78% of wild fish died between the hatchery and the head of Lower Granite Reservoir, and 80 to 90% of wild fish marked in the previous summer did not reach the reservoir the following spring. This mortality is likely due to the marked decline in the quality of spawning and rearing habitat since the 1940s. This decline is attributed to human-caused activities such as grazing, mining, logging, road building, irrigation diversion, and development.

Efforts over the last 25 years have significantly improved fish passage through the hydropower system. Currently, the juvenile fish mortality high is about 50%. This year, PIT tag studies showed that mortality could be as low as 32%. The 95% figure from 1973 is no longer accurate due to improvements such as the following:

- In 1973, nearly all fish went through turbines. Today, fish screens at seven of the eight dams divert 50 to 95% of the fish into bypass systems. Survival through these systems ranges from 98 to 99.5%. There are juvenile bypass systems at all eight dams.
- Juvenile transportation systems of barges and trucks now carry about 50% of fish around dams and reservoirs, avoiding in-river mortality.
- Turbines used to operate at over 115% overload most of the time. They now run within 1% of peak efficiency nearly all the time. This reduces turbine mortality by about half—from 15% to 6 or 7%.
- No predation control was practiced in 1973. Since 1990, various programs have significantly reduced squawfish populations.
- Flow augmentation measures and improved in-river bypass systems are now in place to get fish to dams sooner and past dams more quickly. 



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## LET'S TALK!

The Corps is offering you a chance to learn more about the study and voice your questions and concerns to the study team at a series of public workshops in November. Each meeting will feature a general introduction to the study and the possible pathways, followed by a question and answer period; presentations on economics and on fisheries modeling, followed by question and answer periods; and a panel discussion with members of the study team. Meetings will run from 7 to 9 p.m. Please call Dave Dankel, Public Involvement Coordinator, at (509) 527-7288 with questions about these meetings. We hope to see you there!

**Monday, November 9**  
Red Lion Hotel  
621 21<sup>st</sup> Street  
**Lewiston, Idaho**

**Thursday, November 12**  
Shilo Inn  
50 Comstock  
**Richland, Washington**

**Monday, November 16**  
Doubletree Hotel—Lloyd Center  
1000 Northeast Multnomah  
**Portland, Oregon**

**Thursday, November 19**  
Boise Centre on the Grove  
850 West Front Street  
**Boise, Idaho**

**Monday, November 23**  
Spokane Falls Community College  
Student Union Building #17,  
Lounges A&B  
3410 West Fort George Wright Drive  
**Spokane, Washington** ☺



## FOR MORE INFORMATION

Our website has been expanded and is updated regularly. It is a great place to go for updated project information and upcoming opportunities to be involved in the study process. You can visit the Walla Walla District home page at <http://www.nww.usace.army.mil>. Look for the study under public involvement.

Traveling displays and an information video are also available to interested groups for events, conferences, and meetings. To request information, please contact Dave Dankel, Public Involvement Coordinator at (509) 527-7288 or [dave.a.dankel@usace.army.mil](mailto:dave.a.dankel@usace.army.mil) (e-mail). ☺