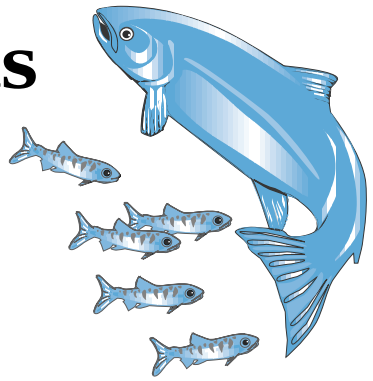
US Army Corps of Engineers
Northwestern Division

Salmon Passage Notes

Snake and Columbia River Fish Programs Oct 1997

Bonneville Dam To Get Fish Bypass Improvements



Bonneville Lock and Dam on the Columbia River, just 40 miles upriver from Portland, Oregon, is the most complex of the Corps Columbia River dams. It has two large powerhouses, with a shared spillway between them, and a newly-constructed navigation lock.

Bonneville Dam also has the least success in bypassing juvenile fish of the eight Corps lower Columbia and Snake river dams. Because of this, a number of improvements to fish passage systems are in the works.

Construction of Bonneville Dam was completed in 1938 with a single powerhouse, a navigation lock, and a spillway. The original Bonneville construction included three fish ladders for adult salmon passage, and three bypasses for downstream migrating juveniles. While the ladders were effective for adult passage, few juveniles used the bypasses. Most went over the spillway or through the turbines. As biologists and engineers learned more about fish behavior and requirements, more effective juvenile bypass systems have been installed and later modified.

In 1982, a second powerhouse was added to help meet the ever-increasing demand for power in the region. The powerhouse was built with state-of-the-art fish passage systems, including another adult fish ladder and a juvenile bypass system.

When the National Marine Fisheries Service (NMFS) conducted tests in 1983 on the performance of the juvenile fish bypass system at the Bonneville Dam second powerhouse, scientists were surprised at the results. The system was guiding only about 19 percent of juvenile spring chinook salmon away from the turbine intakes, compared with an expected 70 percent guidance rate.

Research indicated that the hydraulic conditions at the powerhouse, especially near the turbine intakes, were a major factor in this unexpected performance. Three improvements were soon implemented to address the problem:

- the guidance screens in front of the turbines were lowered further into the water column to intercept more fish as they approached the turbines;
- structures were installed along the upstream face of the powerhouse to mimic the turbine intake configuration at other dams where guidance was higher;
- the angle of the trash racks that collect river debris was changed to align the flows differently.

These changes increased the guidance percentage efficiency for spring chinook to about 48 percent—better, but still a long way from the goal.

Another problem with juvenile passage at the second powerhouse surfaced in studies of juvenile survival: the location of the juvenile bypass system "outfall." The outfall is the pipe through which juvenile fish exit the bypass system, on the downstream side of the powerhouse. The existing outfall deposits the juvenile salmon into a slow-moving stretch of water, which makes it easy for birds and squawfish to catch them. An eddy downstream of the outfall area also contributes to the predation problem.

In 1991 and 1992 NMFS listed three Snake River salmon populations under the Endangered Species Act (ESA). Effective October 17th, two populations of steelhead in the Columbia and Snake rivers have been added to the ESA listings (see story this issue). All of these populations of salmon migrate past the Bonneville Dam as juvenile fish on their way to the ocean.

The 1995 NMFS Biological Opinion for Snake River salmon identifies measures for Federal Columbia River Power System operators to improve migration conditions for fish in the reservoirs and at the dams. Many of these are also identified in the Northwest Power Planning Council's fish and wildlife program.

Two primary construction activities and several related investigations are being carried out under the Biological Opinion to improve juvenile survival at Bonneville Dam. Contractors will begin construction this fall on $62 million of improvements to the Bonneville second powerhouse juvenile passage system. Physical modifications to juvenile fish passageways within the powerhouse will be completed in 1999 as well as a new juvenile bypass outfall approximately two miles long to release fish downstream in swifter currents. Smolt monitoring capability similar to that just installed at John Day Dam (see story this issue) will be completed in 2000.

Similar improvements are being designed for the first powerhouse and

scheduled to be completed in spring 2001. Evaluation is underway on applying surface bypass technology at the first powerhouse, reducing adult fallback at the spillway, and improving fish guidance efficiency at turbine intakes at both powerhouses.

A related activity being undertaken as part of the Bonneville first powerhouse rehabilitation is installation of "fish friendlier" turbines. Initial installation and testing of a modified turbine is planned for 1998.

These improvements are expected to raise survival of juvenile chinook salmon migrating past the dam from the current level of around 88 percent to approximately 95 percent.

Adult Improvements at Bonneville

An adult fishway problem at Bonneville Dam second powerhouse this summer underscored the need to address issues with adult passage systems as well as juvenile passage. In late July, personnel at the dam discovered that 25 diffuser gratings had dislodged from the north adult fishway Auxiliary Water Supply (AWS) system, allowing fish to enter the area and become trapped. Excessive amounts of debris in the river, resulting from very high flows this season, had plugged the gratings, causing them to blow out from pressure build-up. Divers were called in to retrieve, clean and replace the gratings.

Hydroacoustic monitoring in the AWS indicated that there were fish trapped inside. From their size it was unlikely any of them were adult salmon. The main power units were shut down at the powerhouse for nearly a month, while biologists and engineers monitored the situation to determine whether the debris situation was under control and adult fish were travelling through the ladder safely.

Improvements at the adult fishways, such as better debris handling, are being evaluated to address such problems as this one.

Steelhead Listed Under Endangered Species Act

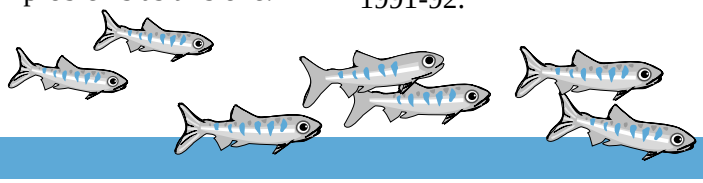
The National Marine Fisheries Service has added two Columbia Basin steelhead populations to the Endangered Species Act (ESA) listings effective October 17, 1997. In the Columbia Basin, the Upper Columbia River steelhead are listed as endangered. These anadromous fish inhabit the river from the Yakima River upstream to Chief Joseph Dam. An "endangered" listing indicates that the population is at risk of becoming extinct in the foreseeable future. Steelhead in the Snake River Basin, which includes parts of Washington, Oregon and Idaho, are designated "threatened" meaning that they are likely to become endangered in the foreseeable future.

Three steelhead species in California have also been listed. A decision on whether to list five steelhead populations in Oregon, Washington and California has been deferred for six months because of scientific disagreement about their status.

Since steelhead are a type of salmon, these listings bring the number of Columbia Basin ESA-listed salmon populations to five. The Snake River sockeye, fall chinook, and spring/summer chinook salmon populations have been listed since 1991-92.

As with other declining species of salmon in the Columbia Basin, habitat degradation, effects of hydropower dams, hatchery production practices, and over-harvest have reduced the fishes' ability to cope with changes in environmental conditions, such as poor ocean conditions.

Many of the steps the Corps and the region are taking to protect listed Snake River salmon will also benefit listed Columbia and Snake steelhead. For example, the region has been augmenting flows in the Columbia and Snake rivers during juvenile salmon migration periods for a number of years, to help overcome the slowing effects of dam reservoirs. Augmented flows should be of help to juvenile steelhead travelling downstream to the ocean. Transportation for juvenile fish is a boost to steelhead smolts since research indicates a substantially higher rate of return for barged steelhead over those that travel in-river.



Monitoring Juvenile Fish at John Day Dam

The new smolt monitoring facility at John Day Dam is nearly ready for service. Construction began on the facility in 1996, and clean-up activities are under way to have it up and running in time for the 1998 spring migration of juvenile salmon.

John Day Smolt Monitoring Facility

Juvenile fish coming down the river toward the John Day Dam will—unless they take the turbine passage route or pass via the spillways—travel past the dam in a 1,200-foot long elevated chute at speeds of about four to five feet per second. At the "dewatering" facility, some of the water in the chute is siphoned off, and the fish are guided through a 1,200-foot long flume to a research facility or back out into the river below the dam.

As a juvenile fish travels through the flume, it passes by a device that instantaneously detects whether the fish has a Passive Integrated Transponder, or PIT tag, and reads the tag. At upstream facilities, a certain number of fish are tagged by specialists who anesthetize the fish and insert the rice-grain sized tag into the fish's body cavity. An integrated circuit chip in the PIT tag provides an identification code for the fish. As the tag is read, data about that particular fish is retrieved by computer. This information includes such things as where the fish originated; whether it is a hatchery or wild fish and, if hatchery, what the rearing conditions were; when the fish was tagged; and the condition of the fish when it was tagged.

The migration of the PIT-tagged fish can be tracked through the river system as it passes through smolt monitoring facilities at various dams. Scientists are then able to determine how quickly the fish moves downstream through the dams, changes in the fish's condition as it migrates through the system, and mortality rates through the dams and reservoirs. Scientists can glean even more information about survival by trapping and "reading" tagged fish when they return as adults to migrate upriver and spawn.

With the completion of the John Day smolt monitoring facility, researchers will now be able to tag and monitor fish at five of the eight Corps dams along the lower Columbia and Snake rivers. Scientists are compiling this PIT-tag information, along with other biological, hydrologic and physical data to determine the best means of operating and configuring the hydrosystem for safe juvenile fish passage.

Public Meetings Held on Lower Snake Study

A series of public meetings held in September around the region brought home once again the difficult choices the region faces in 1999 concerning four federal dams in the lower Snake River.

The meetings focused on the Corps' Lower Snake River Juvenile Salmon Migration Feasibility Study, which examines three pathways to improved salmon migration through the river corridor: existing systems with planned improvements; major system improvements other than dam drawdown; and natural river drawdowns.

The sessions began with a short video which provided a good background on Columbia and Snake river salmon and effects of dams. This was followed by a question and answer session and breakout groups to discuss the major alternatives and specific engineering studies to date, the type of biological information being sought in the Lower Snake feasibility study, and economic issues that are being evaluated.

At meetings in Idaho, Washington, and Oregon, audience members expressed strong views on how the river system should be configured and operated. A good cross-section of the region was represented at the meetings and people were sincerely interested in the options being evaluated in the Lower Snake River Juvenile Salmon Migration Feasibility Study.

It was clear that some attendees regarded juvenile fish transportation as a good way to increase fish survival while preserving other current uses of the river, and feared the potential loss of livelihoods and communities if the dams are removed. Others saw drawdowns to natural river level as the only option for a return of abundant salmon populations, and believed the juvenile fish transportation program has failed and should be discontinued. Many were interested in the potential for new surface bypass technology to improve ability to safely and effectively guide juvenile fish past the dams.

Greg Graham, study program manager (right) listens to concerns of a citizen at the Boise public meeting.

There was also a concern raised that the study should be more comprehensive and consider, for example, the economic tradeoffs of Snake River dam drawdowns and flow augmentation from the upper Snake River. In other words, what would be the costs and benefits of more flow augmentation for juvenile fish migration by releasing more upstream water, versus losing the power, navigation and other benefits of the Snake River dams with dam decommissioning. Another concern is

that the potential to mitigate for economic losses to river users and communities affected by dam closure should be examined, rather than assuming there would be economic devastation with return to natural river.

The study continues to investigate ways to improve juvenile salmon migration through Lower Granite, Little Goose, Lower Monumental and Ice Harbor dams. It responds to recommendations by the National Marine Fisheries Service in its 1995 Biological Opinion for Snake River salmon listed under the Endangered Species Act. The Biological Opinion focuses on operational measures, physical modifications and evaluation of potential future actions at the federal hydropower dams on the Columbia and Snake Rivers, to improve salmon migration conditions.

For more information on the Lower Snake River Juvenile Salmon Migration Feasibility Study contact Dave Dankel at the Corps of Engineers, 201 North 3rd Avenue, Walla Walla WA 99362-1876; telephone at 509-527-7288; or electronic mail at salmonstudy@usace.army.mil.

Public Meeting on Research Results

The annual review meeting of the Anadromous Fish Evaluation Program is scheduled for October 28-30 at Whitman College in Walla Walla, Washington. Researchers will share their findings from studies conducted this year on adult and juvenile salmon behavior and survival. There will be a special session on adult passage studies by Ted Bjornn of the Idaho Cooperative Fishery Research Unit, University of Idaho, as well as presentations on surface bypass evaluations, mainstem passage evaluations, drawdown studies and gas abatement studies. FOR FURTHER INFORMATION please contact Rebecca Kalamasz at the Corps of Engineers, 201 North 3rd Avenue, Walla Walla, Washington 99362; telephone (509)527-7277.

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