

MYTHBUSTERS #5

Public Power Council Fish and Wildlife Committee *Revealing Fish and Wildlife Myths*

MYTH: *Little has been done to improve fish survival past the federal dams.*

THE FACTS:

- Utility customers have funded approximately \$9.4 billion in fish and wildlife mitigation actions for the impacts of the federal dams in the Columbia River Basin since 1978 (NPCC 2008), creating vast survival improvement past the hydropower system.
- Almost \$2.5 billion has been spent to improve the fish passage structures at the eight federal dams on the Snake and Columbia Rivers.
 - ⇒ Screens have been installed in front of the turbines to keep juvenile fish from entering, juvenile bypass systems have been built to collect juvenile fish and route them around the dams and new “fish slides” that pass fish safely over the dams have been installed at 7 of 8 dams.
- Approximately \$1.8 billion has been spent to improve fish and wildlife habitat and to construct hatcheries.
- Many juvenile salmon are collected and transported past the dams on barges to facilitate travel and avoid fish and bird predators in the river.
- Spill and flow changes have cost over \$5 billion in lost generation and opportunity costs.
- Under existing agreements and the proposed Biological Opinion, it is projected that utility ratepayers will annually fund approximately \$800 million in fish and wildlife protections in the Columbia and Snake River Basins over the next 10 years.

What arguments are used to support the myth?

- **Many salmon still die at the federal dams.** Parties state that improvements at the federal dams have not significantly improved fish survival since the first federal dam was built in 1938.
- **Fish and wildlife populations have not returned to historic levels.** Parties state that fish and wildlife populations have not returned to historic levels, and that not enough has been done to improve fish survival at the federal dams.

What this means:

- Utility customers have funded extensive modifications to the federal dams in the Columbia and Snake Rivers that improve fish passage at the dams and there are other mortality factors that need to be considered.
- Fish survival past the dams has improved significantly because of a diverse array of measures and new technology.
- Human development and activities outside of the federal hydrosystem will continue to impact fish and wildlife populations. Returning to historic fish and wildlife populations would require an environment that no longer exists.

What are the supporting arguments for these facts?

- 1. Significant improvements have been made, and continue to be made at the federal dams to improve fish survival.** Through the Bonneville Power Administration, utility customers fund fish passage improvements and other fish and wildlife mitigation for the federal hydrosystem. The U.S. Army Corps of Engineers, the Bureau of Reclamation and BPA work with the NOAA-Fisheries (NOAA-F) and other federal, state and tribal natural resource managers to identify ways to improve both the way the dams are operated and fish passage structures at the federal dams. The following figures illustrate the various fish passage improvements. *(All figures are used courtesy of the U.S. Army Corps of Engineers. Costs for various facilities and operations were obtained from the Corps and BPA (2007)).*

Structural Improvements at the Dams

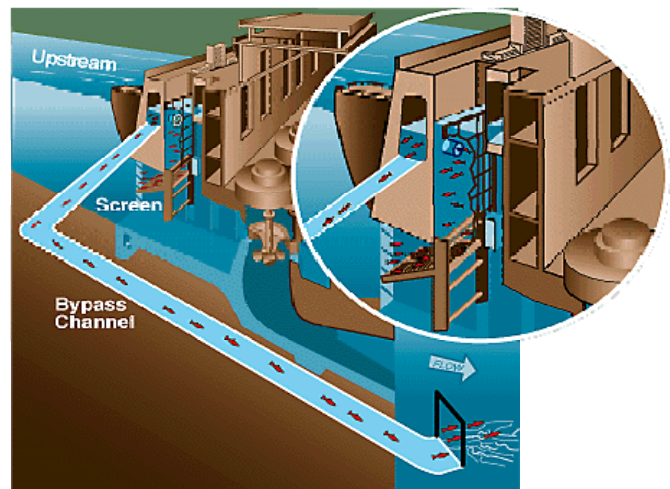
From the early 1990's through 2006, over \$2.5 billion has been invested in development and installation of new and improved fish passage facilities at federal dams in the Columbia and Snake Rivers (Corps and BPA 2007). As an example, **Table 1** provides a summary of the juvenile fish passage systems at each dam and current survival rates through each of these routes for Snake River spring chinook (this stock is used as an indicator for other spring populations passing through all eight federal dams).

Turbine screens

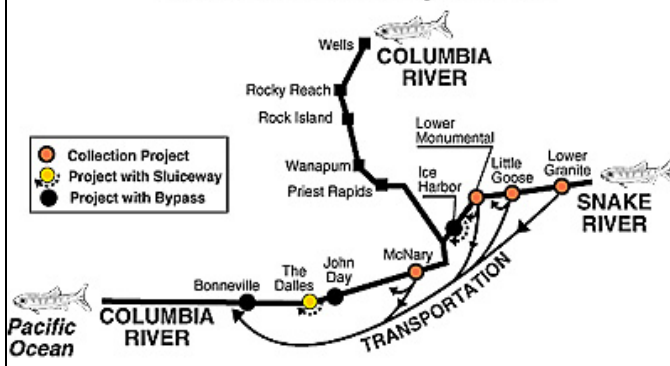
- Large screens in front of turbines are designed to keep most fish from entering them.
- Screen systems typically cost between \$10 million and \$22 million to install.

Juvenile Bypass Systems

- Fish are diverted by the screens in front of turbines and pass into a channel inside of the dam. They are then routed through a pipe and released below the dam.
- Juvenile bypass systems cost between \$20 million and \$115 million to install.



Columbia/Snake River System Juvenile Fish Passage Routes

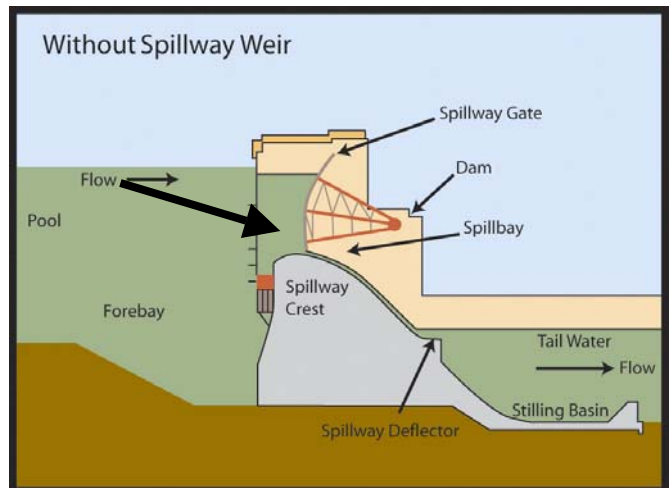
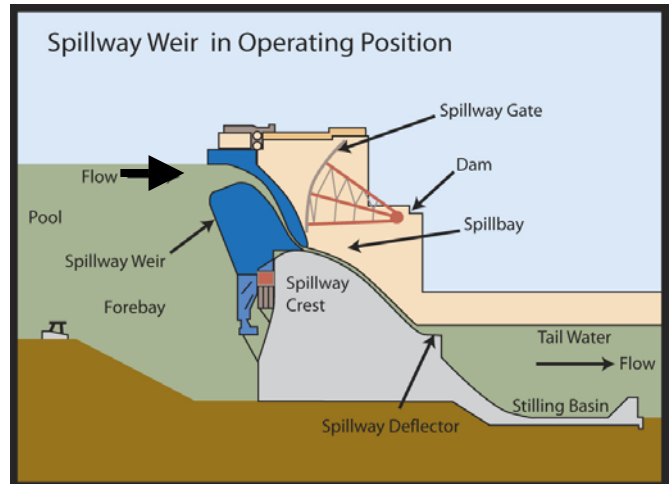


Fish Transportation Systems

- Some juvenile fish are collected in the juvenile bypass system and are then put into barges or trucks and transported for release below Bonneville Dam.
- NOAA-F estimates that 98% of fish survive being transported.
- There are significant annual costs to operate and maintain the Juvenile Fish Bypass and Transportation Systems and the barges used to transport fish.

“Fish Slides” or Surface Bypass Systems

- Fish slides route fish over dams instead of through them. Fish passage survival is nearly 100%.
- Fish slides also pass juvenile fish more quickly through the federal dams, reducing the incidence of predation by birds and other fish species.
- Costs to build fish slides have varied from \$1 million to over \$23 million.
- There are now fish slides at 7 of the 8 federal dams on the Columbia and Snake Rivers.
- Fish passing under spillway gates are exposed to high pressures and extreme turbulence which may damage small fish.

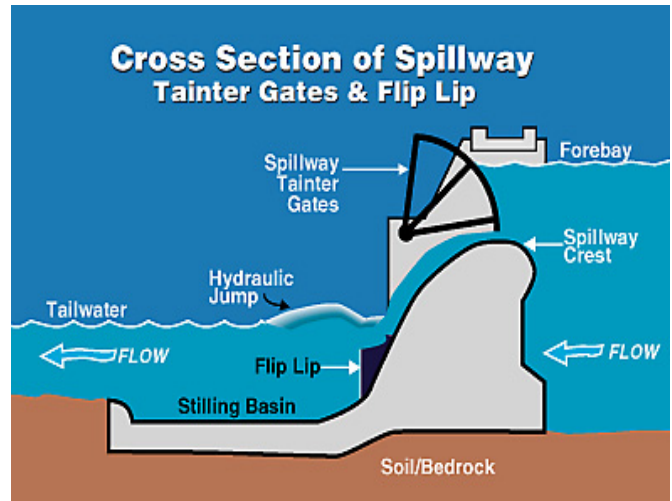


Minimum Gap Runners

- Runners are the “propeller” portion of the turbine unit over which water passes to spin the generator and create electricity.
- Gaps between the blades and the hub in the center of the runner, and between the ends of the blades and the turbine wall are reduced to decrease injury to juvenile fish passing through the turbine.
- These improvements are being made as older turbines are being replaced throughout the federal hydrosystem.
- Over 95% of fish survive passage through turbines with minimum gap runners.

Flip Lips or Spillbay Flow Deflectors

- Spilling water over a dam for fish passage oversaturates the water with air, which may cause the “bends” in small fish.
- Flip lips (or Spillway Flow Deflectors) are constructed in each spillway to limit the drop of falling water, thereby reducing the amount of gas in the water.
- Flip lips cost about \$3 million to install in each spillway. The federal dams have from 8 to 22 spillway bays. Several flip lips are installed at each dam.



Operational Changes at the Dams

Spill

- It was once thought that the more water spilled over a dam, the better. However, large spill volumes may actually harm juvenile fish and block adult fish from migrating over the dam. Now, the safe passage of both juvenile and adult fish is balanced with safe river conditions.
 - Too much water passing over the dam causes a lot of turbulence that hurts juvenile fish as they pass the dam.
 - Large volumes of water spilling over dams may become supersaturated with nitrogen and other atmospheric gasses causing the “bends” in juvenile fish as seen in scuba divers.
 - Adult fish migrating upstream may be swept back downstream over the spillway if spill volumes are too large.
- New “fish slides” more safely and quickly pass fish over the dams with less water than do spillways.

Turbine Operations

- Turbines are operated within 1% of the ideal hydraulic efficiency to reduce turbulence and create a safer passage environment for juvenile fish.

Flow Augmentation

- Compared to past conditions, more winter snowmelt is stored in reservoirs in the upper Snake and Columbia Rivers and released in spring and summer to increase river flows and improve water quality as juvenile fish are migrating to the ocean. This flow augmentation reduces power generation capability by approximately 1000 aMW.
2. **Continued improvements in fish and wildlife habitat will be made and hatchery programs will be expanded and improved.** Utility customers have funded over \$1.8 billion in improvements for fish and wildlife habitat and for building and operating hatcheries. Projects include improving spawning and rearing habitat in tributaries and purchasing and protecting important habitats for wildlife such as water fowl and large mammals. Many projects like these will continue.
 3. **Barge transportation improves the downstream survival of juvenile salmon and steelhead passing through the federal hydrosystem.** Over 98% of juvenile salmon and steelhead collected

and transported past the federal dams survive the trip to their release below Bonneville Dam. For comparison, survival rates of spring migrants traveling through eight federal dams are estimated to be between 50% and 60%. (NOAA-F 2008).

- 4. Beginning in FY 2010-2011, utility customers will fund approximately \$800 million per year in mitigation for fish and wildlife impacted by the federal hydrosystem.** The new Biological Opinion for the federal hydrosystem requires continued survival improvements at the federal dams and improvements in fish habitat in the Columbia River tributaries.
- An estimated \$354 million per year will be spent on spill, flow augmentation and turbine operations.
 - About \$24 million will be spent annually to fund fish hatcheries in the Snake River.
 - Approximately \$49 million will be spent annually on maintenance and operation of fish collection and transportation systems at the dams.
 - Approximately \$230 million will be spent annually by BPA on an array of projects funded through the Northwest Power and Conservation Councils' Fish and Wildlife Program.
 - ⇒ An additional \$5 million funds Council staff and expense.
 - Approximately \$137 million will be spent annually on depreciation and interest on capital investments.

Figure 1. Typical Fish Passage Routes at Federal Dams

Each federal dam is equipped with a variety of fish passage and collection facilities that improve the survival of juvenile salmon and steelhead migrating to the ocean. **Figure 1** illustrates the typical fish passage and transport facilities at the federal dams.

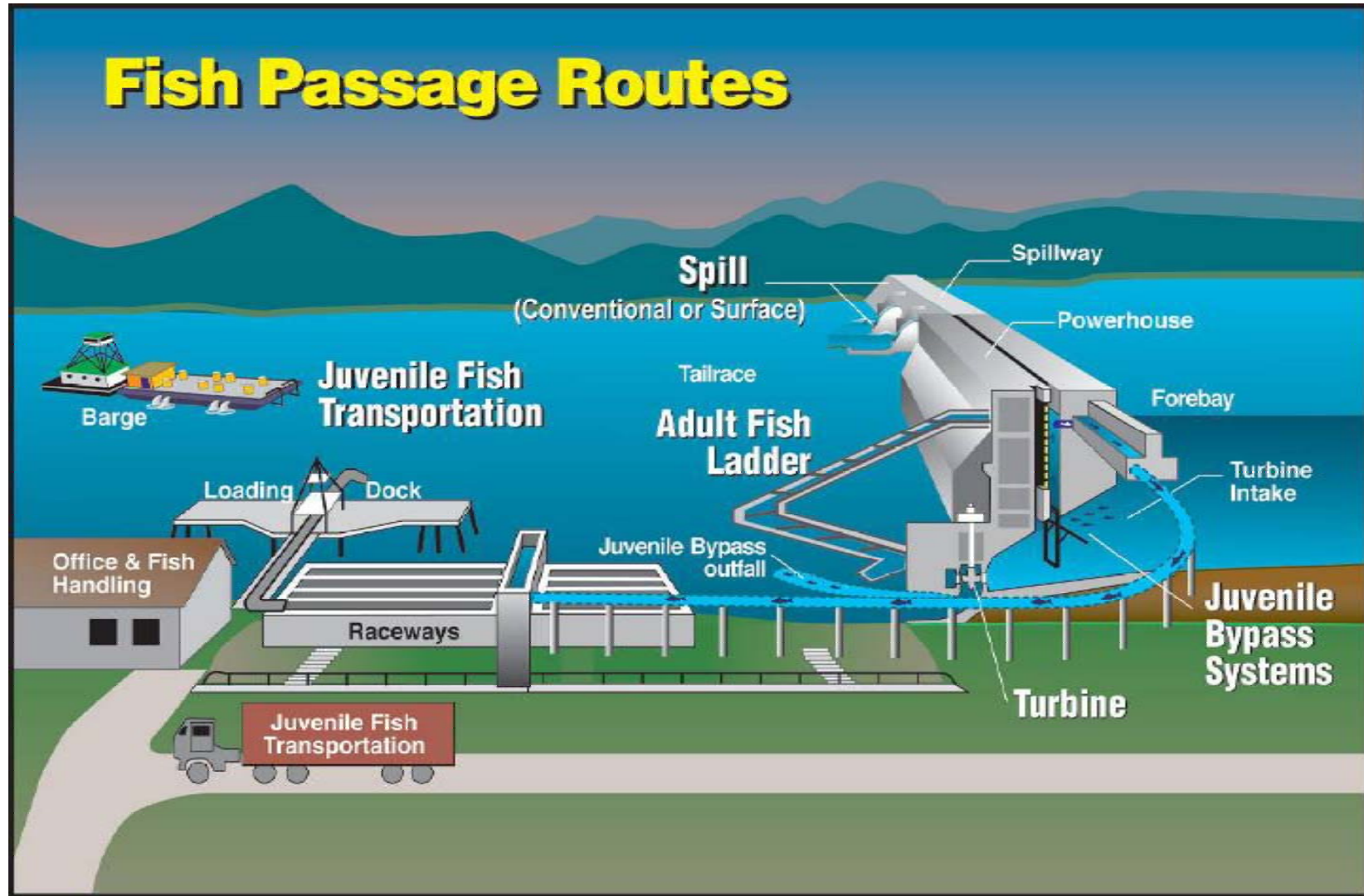


Table 1. Summary of Fish Passage Routes and Survival Rates for Snake River Spring Chinook at Mainstem Dams in the Federal Columbia River Power System

Hydroelectric Dam	Route of Passage and Survival									
	Surface Bypass System and/or "Fish Slides"		Juvenile Fish Bypass System		Spillway Passage		Transport System		Turbine Survival	OVERALL DAM SURVIVAL
Lower Granite	✓	98%	✓	97%	✓	93%	✓	98%	95%	96%
Little Goose	✓	2009	✓	96%	✓	91%	✓	98%	92%	96%
Lower Monumental	✓	95%	✓	92%	✓	96%	✓	98%	88%	92%
Ice Harbor	✓	97%	✓	No est.	✓	95%	-	-	No est.	97%
McNary	✓	99%	✓	96%	✓	97%	✓	98%	90%	95%
John Day	✓	98%	✓	95%	✓	96%	-	-	82%	93%
The Dalles	✓	99%	-	-	✓	94%	-	-	84%	93%
Bonneville - Powerhouse 1	✓	92%	✓	91%	✓	94%	-	-	91%	97%
Powerhouse 2	✓	99%	✓	99%	✓		-	-	97%	

Notes:

- All values are +/- 3%.
- Survival goal for Snake River spring chinook is 96% at each dam.
- Data Sources: Research and analysis conducted from 2003-08 by USGS – Biological Survey, Battelle/Pacific Northwest National Laboratories, University of Idaho, University of Washington, NOAA-Fisheries and Normendau Assoc. Inc. Test fish were yearling (spring) chinook. Surface Bypass System survival data for John Day and Lower Monumental dams are preliminary.
- “ - “ denotes not applicable or is currently being evaluated
- Surface Bypass System - allows fish to pass naturally over dam spillways with minimal spill (e.g., Removable Spillway Weir, sluiceway, etc).
- Juvenile Fish Bypass System - large screens that route fish around the turbines then convey them through a pipe to a holding pond to be transported or released below the dam.
- Transport System – Systems to hold fish collected from the juvenile bypass facilities then place them on a barge to be transported downstream. Transportation survival rate is 98% for all species.

Literature Cited

- U.S. Army Corps of Engineers and the Bonneville Power Administration 2007. Structural and Operational Changes at FCRPS Dams To Improve Fish Survival. June 19, 2007. United States Army Corps of Engineers Bonneville Power Administration. Portland, Oregon.
- NOAA-Fisheries (NOAA-F) 2007. Direct Survival of Migrating Salmonid Smolts in the Snake and Lower Columbia Rivers: Update with 2007 Results. Northwest Power and Conservation Council Science Policy Exchange, September 12, 2007. Portland, Oregon.
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