MYTHBUSTERS #9

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

MYTH: ***Spilling enormous amounts of water over the dams is the silver bullet for providing the best opportunity for Snake River adult fish returns.***

THE FACTS: ***(see attached supporting document and citation)***

- **Spill does not provide the safest route of passage through the federal hydrosystem.**
  - ⇒ Spill is not "natural" and has risks, such as physical injury and gas-bubble disease in juvenile fish.
  - ⇒ High spill volumes may delay or block upstream migration of adult salmon.
- **Transportation, not spill, provides the safest and quickest route of passage to the ocean for juvenile fish and provides higher adult returns for salmon and steelhead migrating through the Columbia and Snake Rivers.**
  - ⇒ Juvenile fish collected at the dams and transported to the ocean have a higher survival rate than do juvenile fish that are spilled as they migrate through the river.
  - ⇒ NOAA Fisheries researchers have demonstrated that, under most instances, fish transported to the ocean as juveniles have higher adult return rates than those fish that are spilled over dams as they migrate through the Columbia River. The benefits of transport are more obvious in low water years.

What arguments are used to support this myth?

- **Spilling water at dams helps juvenile fish migrate to the ocean more naturally.**
  - ⇒ ***Counter:*** Spill is not natural. Spill places juvenile fish at risk for physical injury and disease caused by gases put into the water because of spill.
  - ⇒ ***Counter:*** Spill results in a lower survival rate for juvenile fish. Only about 50% of the juvenile fish make it safely through the Snake and Columbia Rivers to the ocean.
- **Spilling water at dams increases the rate at which juvenile fish return as adults.**
  - ⇒ ***Counter:*** Spilling too much water at the dams actually injures juvenile fish which results in fewer adult salmon and steelhead returning to the Columbia River.

What this means:

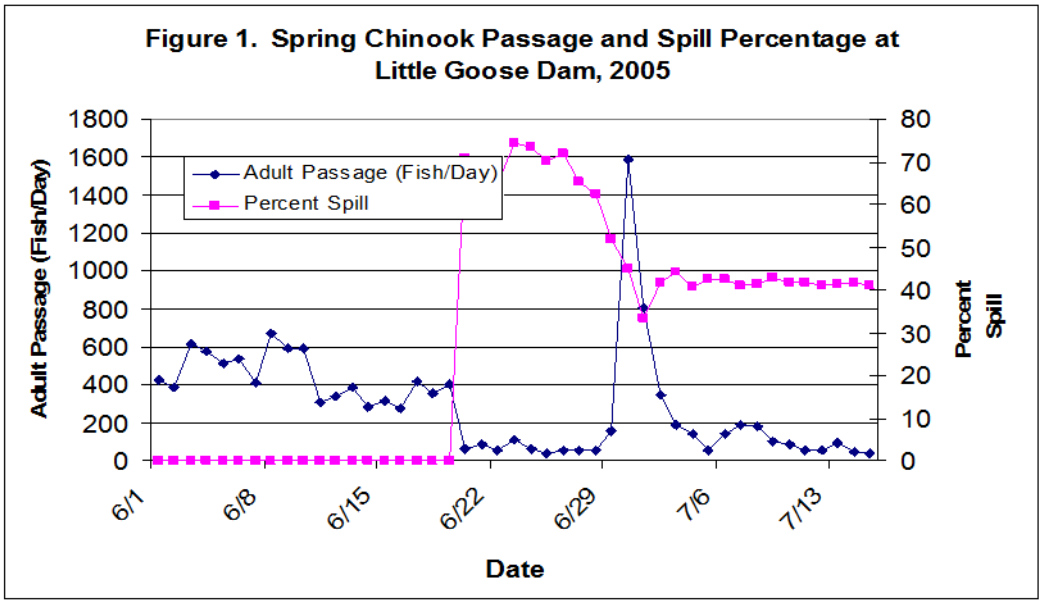
- Spill is not the silver bullet measure to recovering Snake River salmon.
- Other methods of juvenile fish passage provide better opportunities for increased adult returns.
- Spill is not natural and places juvenile salmon at risk for physical injury and gas bubble disease. It may also block or delay passage of adult salmon returning to the river.
- Only 50% of fish spilled as they migrate to the ocean survive.
- Spill can be an important tool to help recover ESA-listed salmon and steelhead in the Columbia River. However, it must be balanced with other dam operations and juvenile fish transportation to maximize fish survival under ever-changing river conditions.
- Efforts by dam operators to aid salmon passage through a variety of measures are working. New fish slides at the dams, improved dam operations and removal of predators from the river have increased the survival of juvenile salmon and steelhead passing thorough the federal hydrosystem. Due in large part to these improvements, salmon and steelhead are already returning to the Columbia River in record numbers.
- The Lower Snake River dams only impact 4 of the 13 ESA-listed salmon and steelhead stocks. We must be careful not to focus salmon protection measures only on these dams, but on the river system as a whole. All of these Snake River stocks and the remaining 9 ESA-listed stocks are increasing in population with the current measures in place.

What is the supporting evidence for these facts?

1.) Spill does not provide the safest route of passage through the federal hydrosystem.

Spill is not "natural" and has risks: Juvenile fish migrating downstream via spill conditions must dive before passing under spillgates. These conditions are very turbulent and may injure fish and increase predation. High spill volumes create tiny bubbles inside fish resulting in "gas-bubble disease" which is similar to the "bends" observed in SCUBA divers. This weakens the fish and either kills them directly or injures their fins and gills which make them more likely to be eaten by a predator.

High spill volumes may adversely affect the upstream migration of adult salmon: High spill volumes can slow or stop the migration of adult fish, or cause fish to "fall back" through the spillways after they pass through the adult fish ladder. This delay in migration caused by high water velocities below the dams was dramatically demonstrated in 2005 at the Little Goose Dam when summer spill was ordered by the Oregon District Court (Figure 1). The University of Washington found that spill over 50% of river flow nearly stopped the migration of adult fall chinook. Migration successfully continued when spill was reduced to about 40%. Also, high volumes of spill have been observed to sweep adult fish back down over the spillway after they have passed over the dam through the adult fish ladder (Boggs, et al. 2005).



Courtesy Columbia River DART, University of Washington, School of Aquatic & Fishery Sciences

2.) Transportation, not spill, provides the safest and quickest route of passage to the ocean for juvenile fish and provides higher adult returns for salmon and steelhead migrating through the Columbia and Snake Rivers.

Transportation is the safest way to get juvenile fish safely to the ocean. According to research by NOAA-F (2010) survival of in-river migrating fish ranges from 0% to about 60% due to natural mortality, disease, predatory birds and fish, and passage at the dams. Transported fish have a 98% survival rate to the ocean. Transporting juvenile fish often doubles the number of juvenile fish safely entering the ocean.

Juvenile salmon and steelhead are impacted by a wide variety of factors, both natural and manmade, as they migrate downstream to the ocean. Juvenile fish collected at the dams, loaded on barges and shipped to the ocean have an estimated survival rate of 98% (NOAA-F 2008; McMichael, et al. 2011). In-river survival numbers are lower (Faulkner, et al. 2010).

Some argue that transportation does not return more adult fish to the Columbia River because transported fish suffer from "delayed mortality." Delayed mortality is the idea that fish die as a result of transport but that the mortality does not occur until well after the transport actions. They hypothesize that the stress of being collected and put on a barge reduces the survival rate of transported juveniles below that of in-river migrating juveniles, and argue that fish should be left in-river and the dam operators should spill more water at the dams to pass fish to the ocean. Recent research has begun to rebut this hypothesis.

Research indicates that a majority of juvenile salmonids in the Columbia River Basin are infected with bacterial and/or viral pathogens as they begin their seaward migration (Dietrich, et al. 2008; Mesa, et al. 2007). As long as the environment is suitable for the juvenile fish, disease outbreak will not occur (Woods 1968). As fish are exposed to stressors during their outmigration, some portion of that population may succumb to the pathogens and die (Woods 1968; Dietrich, et al. 2008). As with most pathogens, it sometimes takes days for the symptoms of a disease to manifest and mortality to occur from the disease or predators.

Both transported and in-river migrating fish experience a variety of stressors as they outmigrate (Dietrich, et al. 2008; Mesa, et al 2007). Since it takes two weeks or more for the in-river migrating juveniles to pass through the federal hydrosystem, a portion of this population will succumb to pathogens and die before they reach the ocean. This in-river mortality can be measured in fish passage studies. Transported fish are also subject to stress as they are collected at dams and loaded on barges (McMichael, et al. 2011). However, since barging takes only two days, transported fish are released before potential diseases are manifested and subsequent mortality is expressed. Past fish passage studies were not designed to measure juvenile fish survival in the estuary. More recent studies found that many transported fish die as a result of disease after they are released from barges (McMichael, et al. 2011). This explains a portion of the "delayed mortality" presumed in past studies, which was errantly attributed to the barging itself.

An additional research project has identified that the actual way scientists study juvenile fish passage has produced results that appear to support the delayed mortality hypothesis. The tags used to measure juvenile fish passage survival appear to either cause an additional mortality and/or "fall-out" of the fish. This research indicates that the use of PIT tag data underestimated SAR for hatchery spring chinook salmon from the Yakima River by an

average of 25% (Knudsen, et al. 2009). PIT-tagged fish had an average 10% lower survival than untagged fish. This difference in SAR is attributed to tag loss in that study.

Juvenile fish that are transported to the ocean have a higher adult return rate as compared to fish that migrate through the river on their own.

The most recent fish passage research finds that spring chinook and steelhead transported from the Snake River have an equal or better SAR than in-river migrating populations (Marsh 2010). Also, transportation neither benefits nor impacts the SAR of Snake River fall chinook. However, more juveniles enter the ocean, increasing the probability that more adults will return. Researchers concluded that the benefit of transportation varies by species and brood year. In a 2010 analysis of juvenile survival data collected from 1998-2008 to study the benefits of transportation, NOAA-F (2010) concluded that…*"The results indicated that transported fish had significantly higher rates of return compared to migrant fish over the majority of most of the outmigrations."*

In the latest NOAA-F transportation research (Marsh 2010), transported juvenile Snake River steelhead have an almost 500% higher SAR than the in-river migrating population. Transported Snake River spring chinook have a 30% higher SAR. Transportation seems to neither increase nor decrease the adult return rate of Snake River fall chinook.

Some argue that transporting juvenile salmon and steelhead increases the stray rate of returning adult fish. That is, the adults have a harder time finding their stream or hatchery of origin. Some earlier research indicated that transported fish have a slightly higher stray rate than non-transported fish (Keefer, et al. 2005). More recent research, however, demonstrates no increase in stray rates (Marsh, et al. 2007). The increased number of adult fish returning because of the benefits of transportation would mitigate any negative effects in increased straying.

The groups advocating additional spill at the Snake River dams base their opinions on faulty research.

The Northwest Power and Conservation Council's Independent Science Advisory Board (ISAB) has on several occasions reviewed the research from those who advocate that more spill will return more adult fish to the Columbia River. Most recently, the ISAB once again criticized the Fish Passage Center (FPC) for faulty analysis on the effects of juvenile fish passing through the federal hydrosystem. The FPC has long advocated that fish passing through the juvenile bypass systems (JBS) at the dams have a lower adult return rate than those that pass over the spillways. This theory is the basis for all their arguments to increase spill in the federal hydrosystem.

The ISAB found that juvenile fish are exposed to a large variety of both natural and man-made factors that may affect their survival. Focusing just on the juvenile bypass systems at the dams is overly simplistic and could lead to incorrect study conclusions. The ISAB said it is quite likely that fish which pass through the JBS are smaller and/or less healthy than fish that pass over the spillways. This would provide a more likely explanation as to why JBS

passed fish return at lower numbers. The ISAB criticized the FPC for not considering these factors in their analysis.

Additionally, spill advocates maintain that spill should occur from April through August each year. The regional fish monitoring program shows that juvenile fish usually do not outmigrate during the end of this period.

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