House Committee on Natural Resources
Subcommittee on Fisheries, Wildlife and Oceans

"A Perfect Storm: How Faulty Science, River Mismanagement, and Ocean Conditions are Impacting West Coast Salmon Fisheries"

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Madam Chairwoman and members of the Subcommittee, it's a pleasure to provide you with my testimony today. My name is James Litchfield, and my background has focused on fish and wildlife recovery planning and the interactions between fish listed for protection under the Endangered Species Act (ESA) and the Federal Columbia River Hydropower System (FCRPS). I frequently, provide strategic and technical advice concerning the state of the latest scientific findings on salmon recovery and potential strategies to achieve recovery and delisting goals. I was one of a team of seven scientists on the Snake River Salmon Recovery Team tasked by NOAA to develop a recovery plan for the endangered salmon stocks in the Snake River. Most recently I have been involved in the 2 year collaborative process to develop the Biological Opinion addressing operations of the federal dams on the Columbia and Snake Rivers. For that reason, I would like to focus on the question raised by the subcommittee on the state of science, particularly as it applies to the Columbia and Snake River systems.

I am here today representing Northwest RiverPartners. Northwest RiverPartners is an alliance of farmers, electric utilities and large and small businesses in the Pacific Northwest that advocates for the use of best science and wise investments in salmon recovery efforts in the Northwest. The alliance promotes all of the benefits of the rivers: fish and wildlife, renewable hydropower, agriculture, flood control, commerce and recreation.

An Unprecedented Science Approach

I thank the Subcommittee for this inquiry into the impact of the current confluence of science, human management activities and ocean conditions on West Coast salmon. This is an important public policy inquiry; however, it must be grounded in our best scientific knowledge to be effective at addressing real world problems.

On May 5th NOAA Fisheries presented to Judge Redden, Judge King and the public three Biological Opinions (BiOps). These opinions cover the operation of the Federal Columbia River Power System, the operation of Bureau of Reclamation dams in the upper Snake River and the plan for harvesting fish. This includes the harvest of salmon and steelhead listed under the Endangered Species Act in the Columbia and Snake Rivers developed under the US v Oregon process, overseen by Judge King.

All three of these BiOps are supported by a common scientific foundation in a document called the Supplemental Comprehensive Analysis (SCA). The SCA is 1,230 pages developed through an unprecedented collaborative process. The Collaboration was not spontaneous, but rather ordered by Judge Redden to insure that NOAA would benefit from the scientific expertise of the sovereign parties involved in litigation over NOAA's BiOps. The sovereign parties involved in this collaborative effort included the four Northwest states and seven American Indian Tribes along with five federal agencies. The Collaboration involved these disparate parties working together for over 2 years and produced much of the analysis that provides the scientific foundation for the new NOAA FCRPS BiOp.

The Collaboration took a new approach to evaluating salmon status and what is needed to avoid jeopardy and ultimately achieve recovery. This approach focused on empirical data to describe the **historic condition** of the major population groups that make up each listed evolutionary significant unit (ESU). Based on this empirical data it was possible to estimate the **current status** of the salmon and steelhead populations factoring in the numerous changes the region has made improving salmon survival over the last 20 years. The Collaboration also evaluated the key **limiting factors** that are currently impacting fish survival and the likely response of fish populations of additional actions in the BiOp to improve productivity and genetic diversity.

This scientific process, analysis and analytical framework took a completely new scientific approach that focused on the unique needs of each listed salmon species. It literally put the needs of the fish first from a scientific perspective and in this way it is far more comprehensive and targeted to addressing activities or obstacles that limit salmon survival. It is important to understand that this species-specific analysis is much more useful in describing factors that drive salmon lifecycles, including **all human affects,** from headwaters to the ocean and their return to the spawning grounds.

This sovereign-based collaborative effort opened a normally closed process among federal agencies and resulted in a BiOp based on the best available science. Even though this extensive scientific collaboration was able to evaluate all sources of human caused mortality, not all human impacts on salmon survival have been **consistently** addressed in the BiOps. Much of the region's investment and survival improvements continue to focus on the hydropower system. The focus on hydropower improvements continues even though the latest research from NOAA is showing that juvenile salmon survival through the Lower Snake and Columbia Rivers is now higher than it was in the 1960s when there were only four dams in the Lower Columbia River (NOAA Presentation to the Policy Work Group, Smith, Williams and Muir, July 26, 2006).

Hydrosystem Performance Standards

The new FCRPS BiOp commits federal agencies to continue to improve survival at the dams. The hydro performance standards are greater than 96 percent survival for juvenile salmon migrating downstream through the dams in the spring, and 93 percent for summer migrants at each dam. These are extremely high survival commitments but they can be achieved.

It is obvious that survival of fish through any particular reach can never achieve 100 percent and as we try to achieve higher and higher survivals it becomes exponentially more difficult and costly. It is also important to recognize that salmon mortality is high in a natural river system where predators, diseases and other conditions are harsh. That is why Mother Nature has equipped these fish with a life cycle that provides returning female adult chinook with 5,000 eggs! Yet for the population to remain stable only two of these eggs need to survive to spawn to replace their parents.

Recent NOAA research (Smith, Muir and Williams, November 2007) shows that survival of fish in free flowing sections of the Snake River above the uppermost dam (Lower Granite) is directly proportional to how far the fish have to migrate to reach the dam. Fish released a relatively short distance (100 km) from Lower Granite dam survived at a relatively high 76 percent, yet survival for fish released over 500 km from the dam was less than 45 percent. This research shows that even for fish not passing through dams there are fairly high rates of natural mortality. Nevertheless, it is important to note that there also is cumulative mortality experienced by fish migrating downstream. NOAA's estimates for the survival in 2007 from above Lower Granite dam to below Bonneville dam are 56.0 percent for yearling chinook and 39.2 percent for steelhead.

Other NOAA research (R. Lynn McComas, et al, March 2008) studied survival in the free flowing reach from Bonneville dam (the lowest dam in the system) to the estuary. This research showed that the river below the last dam that juvenile salmon migrate past is also an area of significant mortality. In fact, this research found that survival from Bonneville dam to the estuary for yearling chinook was 69, 68 and 81 percent for 2005 – 2007. This research shows that even though survival at the dams is high, and reaching practical limits, natural mortality in free flowing stretches of the river above and below the hydropower system remains high and, in some parts of the system such as the estuary, is currently a key survival bottleneck limiting overall fish survival.

Hatcheries and Harvest Practices Create Risks

For most of the 13 listed salmon and steelhead in the Columbia River there continues to be concern over the interaction between hatchery practices and the survival of naturally spawning (wild) fish. NOAA's Supplemental Comprehensive Analysis identifies the following risks from hatchery programs.

> "[T]here is the potential for hatchery programs to increase the extinction risk and threaten the long-term viability of natural populations. For example, because the progeny of hatchery fish that spawn in the wild are known to be less likely to survive and return as adults than the progeny of natural-origin spawners (Berejikian and Ford, 2004), the fitness of a spawning aggregate or natural population is likely to decline (termed, outbreeding depression) if hatchery and natural-origin fish interbreed. For steelhead, outbreeding depression has been found to occur in the progeny of matings of hatchery and wild fish, even when the hatchery fish are the progeny of wild fish that were raised in a hatchery. Other potential risks posed by hatchery programs include disease

transmission, competition with natural-origin fish, and increased predator and fishing pressure based mortality."

A recent report entitled, "Genetic Effects of Captive Breeding Cause a Rapid, Cumulative Fitness Decline in the Wild" (Hitoshi Araki, et al, *Science*, October 5, 2007), found that hatcheries used to supplement populations of naturally spawning species can have a significant impact on overall fitness of steelhead. This research showed that lifetime reproductive success of the first two generations of steelhead trout that were reared in captivity and bred in the wild after they were released was significantly impaired. In fact, these researchers showed that genetic effects of domestication reduce subsequent reproductive capabilities by 40% per captive-reared generation. The researchers summarized their findings with the following statement,

> "These results suggest that even a few generations of domestication may have negative effects on natural reproduction in the wild and that the repeated use of captive-reared parents to supplement wild populations should be carefully reconsidered."

This and other research is now showing that hatcheries can have a major impact on the fitness and genetics of naturally spawning fish. Yet the current strategy for mitigating the impacts of humans on fish populations by merely building another hatchery is over 100 years old. One unintended consequence of increased use of hatcheries is to create significant numbers of fish that compete with natural stocks for habitat and food sources. Hatchery fish can also support larger numbers of predators that also prey on natural fish and encourage harvest rates that naturally produced fish cannot support. Yet, integrating hatchery practices into the region's recovery efforts lags significantly behind hydropower and habitat improvements. Several efforts are underway to audit and reform hatchery practices but most of the region's more than 130 hatcheries have yet to undergo ESA consultations that would insure that hatchery practices are consistent with the overall recovery effort.

The current hatchery strategy predates the ESA by more than 70 years. A lot has happened in the field of genetic science since the first hatcheries were constructed. The hatchery strategy was historically based on the premise that a "fish" is a "fish" and that loss of one fish to habitat degradation, dams, irrigation, harvest and increasing human population pressures was easily compensated by merely producing more fish in hatcheries. However, the new paradigm under the ESA requires the preservation of unique life histories that NOAA calls Evolutionary Significant Units (ESUs). ESUs are being protected under the ESA because they represent natural genetic diversity that has allowed salmon and steelhead to evolve for millions of years. The promise of hatcheries compensating for man-caused impacts on salmon habitat combined with the higher harvest rates that large hatchery production encourages has put less productive naturally spawning populations at significant risk of extinction. The current hatchery-harvest strategy is now inconsistent with the ESA's mandate to preserve every unique life history. This is a fisheries management strategy that must be reformed so that hatcheries can assist in recovery of ESA listed populations.

Dam Breaching a False Promise

You will probably hear that to save Snake River salmon and steelhead the Lower Snake River Dams should be removed. Dam removal is a "silver bullet" advocated by those that believe the construction of the four dams on the Lower Snake River caused all the problems that led to ESA listings for salmon and steelhead.

Yet, one of the biggest problems with proposals to remove the Snake River dams is the limited scope of this strategy. Even if the dams were removed, it would only potentially help 4 of the 13 listed fish in the Columbia River Basin. Removing the Snake River dams is an expensive and controversial strategy that could require so much time and money that it would leave the other 9 listed stocks without significant support.

Removal of dams also couldn't be achieved quickly. Years of political and legal battles will be fought and, even if there is the political will, Congress would need to appropriate significant funds to pay for removal of the four dams, estimated to be over $1 billion dollars. During the decades of fighting, recovery actions will not be pursued because of the uncertainty that the dams maybe removed at some time in the future. The Snake River dams also currently provide the necessary revenues to fund comprehensive recovery efforts for Snake River anadromous fish.

The four Lower Snake Dams also produce more than 1020 MW of carbon free energy and 2650 MW of sustained power production capacity. These are significant quantities of power production that can serve the needs of a large city the size of Seattle, Washington. You will hear that the energy lost from the dams could be replaced by wind and conservation. This is simply not true. Calls for removing the four Lower Snake dams led the Northwest Power and Conservation Council (the Council), authorized under the Northwest Electric Power Planning and Conservation Act, to evaluate the possible consequences of removing the Snake River Dams to the region and the environment.

The Council's analysis showed that the lost renewable power produced by the dams could **not** be replaced by power from conservation and new renewable resources, such as wind generation. This is because all available conservation and renewable power generation is already allocated to meeting future regional load growth in the Council's regional power plan, and will be acquired with or without dam removal. For this reason, the Council found that if the Snake River dams are removed, the most likely replacement resource would be gas-fired combustion turbines that emit significant quantities of carbon dioxide. In the context of efforts by the region to reduce our carbon footprint, the Council found that, "discarding existing CO_2-free power sources has to be considered counterproductive."

The Council's analysis specifically showed that if the Snake River dams were removed it would result in increased power production from new gas-fired combustion turbines and by other thermal power plants in the western United States. The new fossil fueled power that replaces the dams would cause the release of 5.4 million tons of CO2 per year. For perspective, this is equivalent to the CO2 produced by a 540 MW new modern coal plant.

As a matter of sound science or good public policy it makes no sense to remove renewable, non-polluting power from the Snake River Dams and replace the lost renewable power with fossil fired power plants that accelerate global climate change. Unfortunately, the campaign to remove the dams has diverted significant time and resources from moving forward with the recovery efforts that our region really needs to implement.

Significant Regional Investment in Fish & Wildlife

The Council also monitors Bonneville's expenditures to support fish and wildlife mitigation. Much of the funds documented by the Council are in support of ESA recovery efforts but there are also significant investments in resident fish and wildlife that are not ESA listed. The Council report entitled, "Sixth Annual Report to the Northwest Governors on Expenditures of the Bonneville Power Administration", August 2007, documents the investment by Pacific Northwest ratepayers in fish and wildlife. The Council's report shows that Northwest ratepayers invested about $9 billion by the end of 2006 in fish and wildlife recovery efforts since the passage of the Northwest Power Act in 1980. The attached graph (see Attachment 1) is from this report.

The results of this massive investment are now being seen through increased hydropower system survivals for most of the listed fish. Moreover, the Bonneville Power Administration has just signed Memorandum of Agreements (MOA) with four tribes and two states that will significantly increase investments in fish mitigation and recovery efforts over the next ten years. The total commitment in these MOAs is reported to be more than $900 million. Importantly, the actions that will be funded under these MOAs will be scientifically reviewed by the Independent Science Review Panel and the Council. The investment by Northwest ratepayers far exceeds any investment in an ESA-related recovery effort for any other species in the nation. Yet this investment has generally been supported by citizens of the Northwest in the hopes that we can prevent future extinctions and bring about recovery of the salmon that have been affected by the region's hydropower, hatchery, harvest and habitat impacts.

Ocean Conditions - Confounding Factor

It is important to understand, however, that such investments alone cannot solve a problem where factors largely outside our control – ocean conditions – have a dramatic impact on salmon survival and productivity. Ocean conditions are complex and not completely understood by the science community. However, extensive research is underway in the Northwest to better understand ocean food webs and their impacts on salmon survivals and growth. Some of this research is being led by Ed Casillas from NOAA Fisheries Northwest Fisheries Science Center in Newport, Oregon.

Dr. Casillas presented results of his work into ocean productivity to the Council at their meeting in March 2008. This work helps to indentify when ocean conditions are supportive of salmon growth and survival and when they are not. This is new work has not yet found its way into fisheries management, but it needs to, because it can provide the leading indicators of when harvest can be permitted and when it needs to be restricted. Attachment 2 contains a summary of a number of ocean productivity indicators that Dr. Casillas measured for four historic years and two possible forecasts of future conditions.

Attachment 2 illustrates the status of various factors that affect salmon survivals. Green shows a good condition, yellow is neutral and red is a poor condition. The first two factors[1] are related to large-scale weather and ocean conditions that have been shown to correlate with upwelling that provides food sources for salmon. Forecasting is still under development and Dr. Casillas said that additional development work is needed before it will be a reliable management tool, but this work is a very promising effort that can allow us to better understand ocean conditions and the likely affect on salmon productivity.

There is little that we can do to change either the weather or ocean productivity. Both are related to critical upwelling that causes the food webs that salmon depend upon to bloom. **The management challenge is to first recognize when ocean conditions are poor for salmon survival and then to reduce human caused mortality as much as possible during that time. It is interesting to note in the previous chart that 2005 was a particularly poor year for ocean conditions. Juvenile salmon entering the ocean that year experienced an oceanic desert. Knowing this could help us to recognize that there are likely to be reductions in salmon populations for the next several years following poor ocean conditions and that fish harvest is likely to need to be reduced.**

When fish populations plummet in the ocean the strategies to reduce human caused mortality are limited. Temporary closure of fisheries is the only management response that can effectively reduce human caused mortality quickly. Because land-based sources of mortality are difficult to affect and are slow to cause changes in numbers of salmon, they are not well suited to sudden drops in salmon productivity in the ocean. If human caused harvest mortality is not reduced when there are low numbers of fish present, it is likely that overharvest will require ESA protection for even more fish. (See stripped bass as an example of a successful closure.)

Mixed Stock Fisheries Problematic - Snake River Fall Chinook Example

Even with the high level of protection provided under the ESA, it is difficult to protect weak populations when mixed with much more numerous hatchery fish. The Northwest has our version of the Sacramento fall chinook with the Snake River fall chinook. This fish is listed under the ESA, yet the new FCRPS BiOp reports that it continues to experience extremely high harvest rates of approximately 45 percent. Snake River fall chinook are currently harvested in Alaska, Canada, off the coast of Washington and Oregon, and in the Columbia and Snake Rivers by commercial, sport and tribal fishers.

The high harvest level that occurs in both the ocean and the river is caused by current harvest techniques and the fact that weak Snake River fall chinook commingle with much larger and stronger populations from the Hanford Reach of the Columbia River. In attempting to harvest Hanford Reach fall chinook with non-selective gill nets, almost half of the returning Snake River **listed** fish are also harvested. This makes it extremely difficult to achieve recovery for Snake

[1] The two factors shown in the chart are the Pacific Decadal Oscillation (PDO) and the Multivariate El Nino Southern Oscillation Index (MEI).

River fall chinook while at the same time maintaining the current rate of harvest for other chinook. The region is investing hundreds of millions of dollars in strategies to recover Snake River fall chinook only to have nearly half of them caught – after they have migrated down the river, past the dams and survived years in the ocean – just as they are ready to return and spawn.

Conclusion

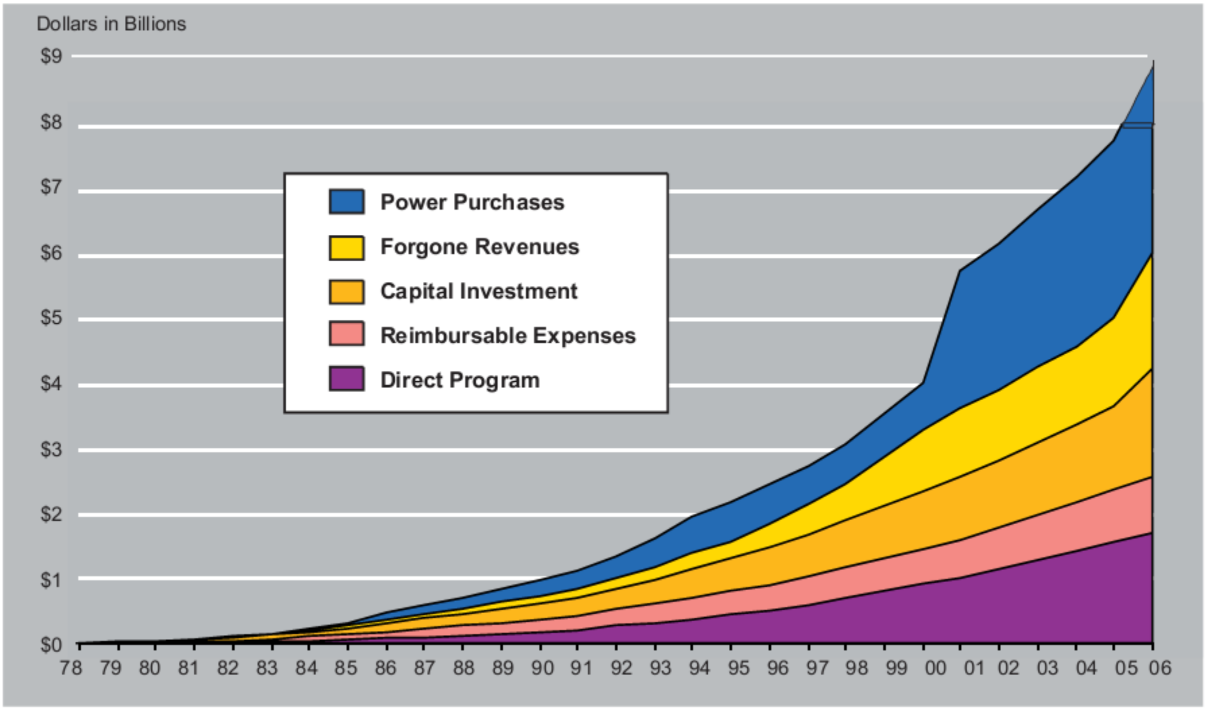
It is obvious that ocean conditions have a major impact on the health and productivity of salmon and steelhead stocks; however, our ability to change ocean conditions is limited. The work of Dr. Casillas is helping us to better understand the weather patterns and linkages in the ocean that cause oscillation in the food web upon which salmon depend. Critical environmental ocean conditions need to be better monitored and understood before we will be able to effectively forecast salmon populations and use this information in harvest management. However, fisheries management strategies need to be revisited based on the current science on the interactions between hatchery and harvest policies and overall salmon survival and recovery. Addressing key factors limiting salmon survival is not without scientific, technical and political difficulty, but it is far more feasible than attempting to control ocean conditions through human policies. Meanwhile, research on ocean conditions must continue.

That is the state of the science, as we know it in the Pacific Northwest. Research has identified habitat, hydro, hatcheries, harvest and ocean conditions as the key factors limiting the recovery of the ESA-listed salmon and steelhead stocks. The region has invested billions in refitting the hydro system and improving habitat for increased salmon protection and NOAA has just produced a new FCRPS BiOp detailing future investments in both hydro and habitat. What we haven't seen, but need to, are commensurate actions on harvest and hatcheries. Since the science and the ability to manage harvest and hatcheries is much more developed than our ability to change ocean conditions, we need to focus on those elements first, while continuing our research on the ocean.

RiverPartners appreciates this opportunity to address the Subcommittee. I am more than happy to answer any questions you may have.

Attachment 1

Figure 1A: BPA Fish and Wildlife Cumulative Expenditures 1978-2006



Source: Bonneville Power Administration

Attachment 2

	Juvenile migration year				Forecast of adult returns	
					Coho	Chinook
	2000	2005	2006	2007	2008	2009
Large-scale ocean and atmospheric indicators						
PDO	🟩	🟥	🟥	🟨	🟡	🟡
MEI	🟩	🟥	🟨	🟩	🟢	🟢
Local and regional physical indicators						
Sea surface temperature	🟩	🟥	🟨	🟥	🔴	🔴
Coastal upwelling	🟩	🟥	🟩	🟩	🟢	🟢
Physical spring transition	🟩	🟥	🟩	🟨	🟡	🟡
Deep water temp. & salinity	🟩	🟥	🟨	🟩	🟢	🟢
Local biological indicators						
Copepod biodiversity	🟩	🟥	🟥	🟨	🟡	🟡
Northern copepod anomalies	🟩	🟥	🟩	🟩	🟢	🟢
Biological spring transition	🟩	🟥	🟨	🟩	🟢	🟢
Spring Chinook--June	🟩	🟥	🟨	🟩	--	🟢
Coho--September	🟩	🟥	🟨	🟥	🔴	--