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Madam Chairman, members of the Committee, I appreciate the opportunity to appear before you today to provide my view as Senior Scientist for Trout Unlimited on "*A Perfect Storm: How Faulty Science, River Mismanagement, and Ocean Conditions are Impacting West Coast Salmon Fisheries*." I think we all share a strong concern for the health of salmon populations, which form an integral part of the ecological, social, and economic fabric of California and the Pacific Northwest.

Trout Unlimited (TU) is the nation's largest coldwater fisheries conservation group dedicated to the protection and restoration of our nation's trout and salmon resources and the watersheds that sustain them. TU has more than 150,000 members in 400 chapters across the United States. Our members genrally are trout and salmon anglers who give back to the waters they love by contributing substantial amounts of their personal time and resources to fisheries habitat protection and restoration. The average TU chapter donates 1,000 hours of volunteer time on an annual basis.

My name is Jack Williams and I serve as Senior Scientist for Trout Unlimited. Prior to working for TU, I was privileged to serve in a number of research and management positions in the federal government, including Endangered Species Specialist for the U.S. Fish and Wildlife Service, National Fisheries Program Manager for the Bureau of Land Management (BLM), Science Advisor to the Director of the BLM, Deputy Forest Supervisor on the Boise National Forest, and Forest Supervisor on the Rogue River and Siskiyou national forests. I have also served as a Professor at Southern Oregon University and retain the title of Adjunct Professor at that institution.

In my testimony today, I would like to briefly describe the current status of Pacific salmon and what will be required to maintain salmon and steelhead populations in light of existing stressors, which will be compounded by impacts from a rapidly changing climate. In particular, I would like to make four primary points, which I will highlight now before proceeding with my full testimony.

First, the long-term survival of salmon and steelhead depends upon the conservation of the genetic and ecological diversity of remaining stocks and the habitats that support them.

Second, climate change will pose significant new challenges to conservation of salmon and steelhead in both freshwater and marine environments. But, our only near-term opportunities to improve habitat conditions occur in freshwater habitats, where larger and lower-elevation rivers have been the most degraded and therefore need the most attention.

Third, we cannot solve the problems of salmon through reliance on artificial measures that not only fail to address the root causes of declines but create a new suite of problems in and of themselves. We need science-based and landscape-scale changes, particularly in the mainstem river reaches.

And finally, we need bold action and commitment to save our salmon. We must think bigger and involve more partners in solutions than we have before, including novel approaches towards protecting the best remaining ecosystems and restoring others to better health.

The Survival of Salmon

Salmon are remarkable animals. During their long migrations between spawning habitats in headwater streams and feeding grounds in the ocean, they encounter many natural and human-induced sources of mortality. The good news is that salmon are wonderfully resilient, having survived environmental change for thousands of years. If given a decent chance, they can persist even in the face of growing human populations and rapid climate change.

Salmon are able to adapt to change because of their high reproductive rates, remarkable life history, and the great diversity of local populations, or stocks, that provide the building blocks for local adaptation. In salmon, adaptation to local watersheds builds into a stock a set of unique characteristics that increase fitness in the local environment.

Diversity is the key to long-term survival in any species. The only way we can maintain the fitness and evolutionary potential of salmon is to protect the individual stocks and the habitats that support their life histories.

In 1991, the scientific community was put on notice that a substantial amount of this diversity was eroding on a coast-wide basis. That year, the American Fisheries Society published the first coast-wide review of stocks at risk of Pacific salmon, steelhead, and sea-run cutthroat (Nehlsen et al. 1991). Of 214 stocks examined in California, Idaho, Oregon, and Washington, 102 were considered to be at a high risk of extinction and another 58 at moderate risk of extinction. Perhaps more alarming was a list of 106 additional stocks from this same four-state region that were considered to be extinct.

A subsequent review of 192 populations of salmon, steelhead, and sea-run cutthroat trout within the Columbia River basin yielded the following results: 35% of populations were extinct, 19% at high risk of extinction, 7% at moderate risk, 13% of special concern, and only 26% were secure (Williams et al. 1992). As more and more of these populations become endangered or extinct, the capacity of future generations of salmon and steelhead to adapt to changing environmental conditions weakens.

A more comprehensive review published in 2007 has updated our knowledge of salmon status. Historically, the six species of Pacific salmon comprised approximately 1,400 Pacific populations that occurred in the Columbia River basin and coastal drainages in Washington, Oregon, and California, and according to the 2007 review, an estimated 29% or 406 of these have become extinct since Euro-American contact (Gustafson et al. 2007). Relative to geography, there is a greater proportion of extinctions in those populations that spawn the farthest south, that is in California, and those populations that spawn farthest inland, such as the Snake River populations. Relative to species, coho salmon, stream-maturing types of Chinook salmon, and sockeye salmon have been especially hard hit.

In salmon, there are three major lines of diversity that are critical to persistence: genetic, ecological, and life history. Scientists from the National Marine Fisheries Service, who authored the 2007 report (Gustafson et al. 2007), estimate losses of 33% of the ecological diversity, 15% of the life history diversity, and 29% of the genetic diversity within Pacific salmon. Many of the remaining populations, which are lumped into Evolutionarily Significant Units for purposes of administration by the Endangered Species Act, are listed as threatened or endangered. These facts demonstrate the substantial threat for salmon in this region.

It is tempting to believe that improved technologies in the form of new hatcheries, or transportation devices, or other such artificial means, will enable salmon to survive and prosper into the future. Unfortunately this is not the case. Hatchery programs for salmon have not proven sustainable and often cause more harm than good because of artificial selection of detrimental genes, introduction of diseases, and numerous other problems (Hilborn 1992; Lichatowich 1999). In fact, in the long term, hatcheries depend on wild fish for brood stock. As Dr. Gary Meffe (1992) aptly described it, “A management strategy that has as a centerpiece artificial propagation and restocking of a species that has declined as a result of environmental degradation and over exploitation, without correcting the causes for decline, is not facing biological reality.”

There are no silver bullets, no slick new transportation programs that will solve our problems. New technologies can help us, but for salmon to survive in the future they must encounter at least minimum acceptable habitat conditions:

- in spawning streams for successful spawning, egg incubation and rearing of young
- in mainstem river habitats for successful migration between headwaters and the ocean; and
- in estuaries and oceans to allow for growth and return to natal streams.

Long-term survival of salmon and steelhead depends upon maintenance of genetic and ecological diversity of existing stocks and the habitats that support them.

Rapid Climate Change in Freshwater and Ocean Environments

Salmon are especially vulnerable to climate change and global warming because they are dependent on an abundance of clear, cold water. As coldwater habitats warm, rising temperatures will negatively impact a variety of salmon life history phases – from eggs to juveniles and adults. For those populations already listed as endangered or threatened, climate change is likely to push them further to the brink of extinction. Impacts of climate change are an additive stressor to systems already degraded by too many roads, too many dams, and too much water diversion.

For Pacific salmon and steelhead, climate change will result in warmer waters, reduced snowpacks, earlier spring runoff, reduced summer flows, more floods, more drought, and more wildfires in their watersheds (Poff et al. 2002; Battin et al. 2007). Changes in wind patterns will in turn impact oceanic currents and offshore conditions. In recent years, for example, a "dead zone" nearly devoid of dissolved oxygen has appeared off the Oregon coast. This is not a dead zone resulting from some form of pollution but rather from changes in ocean currents that are consistent with predictions of climate change (Oregon State University 2007 Press Release). In 2006 until winds changed and conditions improved, the dead zone comprised an area equivalent to the state of Rhode Island.

For salmon populations to persist, they must sustain suitable spawning numbers and survival of progeny in the face of changing ocean and freshwater conditions. Historically, populations have survived and even thrived during times of environmental change. In the past, ocean productivity has oscillated in response to coastal currents resulting in substantial interannual variation in survival of out-migrating salmon. During some years conditions would be poor for migrating salmon but in other years conditions would improve. Poor ocean survival can be offset to a lesser or greater degree by increased survival in the freshwater system. The ability of the freshwater system to offset poor ocean survival depends on the quality of the freshwater environment and the severity of the oceanic environment.

Unfortunately for salmon, the rate of environmental change is growing rapidly. The impacts of climate change already are evident in freshwater and ocean environments. Over the next two to three decades, we have little opportunity to change ocean conditions. In fact, they are likely to get worse. If both freshwater and ocean habitats continually decline, we have created an extinction vortex from which salmon cannot escape. If ocean conditions are beyond our control, at least in the near term, we still have the ability to change freshwater conditions. Simply stated, we must address the fundamental stressors in freshwater environments including mainstem river and lower-elevation valley bottom habitats.

In an article published in the Proceedings of the National Academy of Sciences (Battin et al. 2007), scientists demonstrated that the impacts of climate change in the freshwater environment could be offset by restoration of lower-elevation river corridors. That is, the larger, valley river systems that have been most impacted by human activities also are the areas where we have the most to gain from restoration efforts. If restoration efforts are accelerated, they predicted that the impacts of climate change, at least in the freshwater portion of the life cycle, could be completely mitigated through ecologically sound restorative programs.

Sound Science Must Drive Decisions

Proper administration of the Endangered Species Act is dependent upon proper application of the best available scientific information. The drafters of the ESA recognized this need, for example, by requiring that listing decisions be made "solely on the basis of the best scientific and commercial data available…" {Sec 4(b)(1)(a)}. Endangered and threatened salmon are among the more scientifically and socially complex of species managed pursuant to the ESA because of their long migrations across multiple jurisdictions and threats, multiple and overlapping generations, and stock structure.

Despite the widely recognized importance of science to watershed and salmon management, and the wealth of well-respected scientists employed by agencies charged with implementing the ESA, federal courts have determined that NOAA has failed in its responsibility to protect salmon from jeopardy in the Sacramento, Snake, and Klamath river systems. Most recently on May 5, 2008, NOAA's National Marine Fisheries Service issued their court-remanded, final biological opinion to federal agencies responsible for management of the Federal Columbia River Power System. Despite in-river mortality estimates for juveniles migrating downstream through the Snake/Columbia hydropower system as high as 91.8% for listed Snake River sockeye salmon and 92.5% for listed Snake River steelhead, the National Marine Fisheries Service appears satisfied with circumventing the dams by moving fish downstream via barges and offsetting mortality by "improvements" to headwater habitats, many of which already are in excellent condition and are located in wilderness or inventoried roadless areas of National Forests (National Marine Fisheries Service 2008).

In 1990, Forest Service scientist Russ Thurow who has studied salmon and steelhead in central Idaho for more than 20 years, provided the following testimony before the U.S. Senate Committee on the flawed logic behind our failure to address the "dam problem" and our insistence on focusing instead on headwater habitat improvements. Thurow said:

"If freshwater habitats were the primary cause for declines, then stocks in high quality habitats should be faring substantially better than stocks in degraded habitats. The preponderance of evidence demonstrates this is not the case. Snake River Chinook salmon redd counts in both wilderness and degraded habitats have similarly declined since the mid-1970s."

Unfortunately, agency managers responsible for implementing the Endangered Species Act seem to have learned little since that time and have repeatedly ignored the biological reality of the problems imposed by the lower Snake River dams on migrating salmon and steelhead despite considerable scientific evidence to the contrary. At the 1999 meeting of the Idaho Chapter of the American Fisheries Society, more than 90% of the fish biologists and aquatic ecologists in attendance supported dam breaching as the single most effective management strategy for long-term survival of Snake River salmon and steelhead. A similar measure was unanimously adopted by the Oregon Chapter of the American Fisheries Society at their 2000 annual meeting (Dombeck et al. 2003).

Restoring Resistance and Resilience to Disturbances

Existing stressors of salmon are often classified by the shorthand nomenclature of the “4-H’s”: Habitat, Harvest, Hatcheries, and Hydropower. Each factor -- habitat degradation, over harvest, hatchery production, and dams and diversions -- has resulted in sufficient population and habitat declines to cause many remaining populations to be listed as threatened or endangered species. The combination of rapidly changing climate with existing stress of the 4-H’s is likely to cause significant further erosion of diversity in salmon and steelhead unless proactive habitat protection and restoration measures are implemented at a watershed scale.

To help salmon survive the effects of rapid climate change, there needs to be an active and integrated effort to **protect** the best remaining populations and their habitats, to **reconnect** headwater streams with mainstem rivers by removing instream barriers and providing normal flow regimes, and to **restore** vital mainstem river and riparian habitats. For these efforts to be sustainable they must be founded in the best available science and implemented at local, state and regional levels.

The following figure illustrates a paired watershed where the protect-reconnect-restore strategy has been implemented to produce conditions shown on the right half of the graphic that strengthen resilience to disturbance and reduce existing stressors.

The Protect-Reconnect-Restore approach provides a general model based on accepted principles of conservation biology and restoration ecology. This approach should be tailored to the specific needs of each endangered or threatened population. Successful restoration must treat the root causes of the decline, not just the symptoms, and be implemented at the scale of entire watersheds (Williams et al. 1997). Monitoring and adaptive management is the final necessary strategy that will ensure that we continue to learn and adapt to the uncertainties of a growing human population and changing climate.

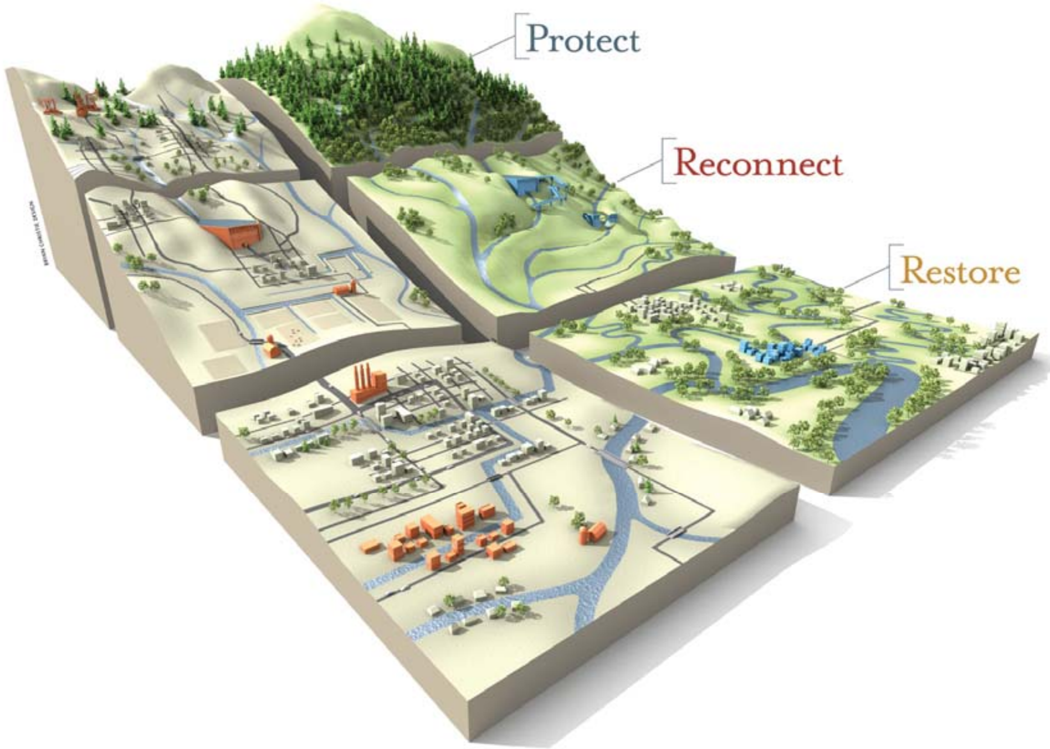

Figure 1. The Protect-Reconnect-Restore approach to building resistance and resilience to climate change in watersheds supporting trout and salmon. Graphic courtesy Trout Unlimited and Bryan Christie Design.

In the Sacramento, Snake, and Klamath river systems, the best remaining habitats occur at higher elevation public lands, where protection is the most logical strategy although some lands certainly would benefit from restoration efforts as well. The most degraded fishery habitats occur along the valley bottom and mainstem river corridors where land has been converted from wildlands to agriculture, hydropower, industry and urban development. While these mainstem corridors are the most altered, they also provide the most important opportunities for reconnection and restoration. In fact, it is because they are the most altered that the fundamental causes of their declines must be adequately addressed.

We cannot solve the problems of salmon through reliance on artificial measures that not only fail to address the root causes of declines but create a new suite of problems in and of themselves. That is what has happened on the Columbia and Snake systems with our reliance on barging to move juvenile salmon around dams. The long-standing consensus within the scientific community has been to breach the lower four Snake River dams as the single most important step needed to restore Snake and Salmon River salmon and steelhead populations. A similar situation exists in the Klamath River where passage for anadromous fishes must be provided around dams on the river and access to historical habitat is necessary to restore Klamath River salmon and steelhead. Many dams provide vital human services and must be retained. But dams are not designed to be permanent structures. As they age and deteriorate, the economic and ecological costs and benefits must be carefully weighed to determine their most appropriate future. In the instances of the lower Snake River and Klamath, dam breaching or removal is likely the only solution that provides needed ecological benefits.

In summary, however, something more is needed to address the current West Coast salmon fishery failure than a focus on just one variable, or one of the 4-Hs. This something more must go beyond the status quo. It starts with employing sound science for management decisions, but it goes further.

Bold action is needed. Building broad alliances and unique coalitions of unlikely partners for salmon and steelhead restoration must become the norm. We must focus on supporting remaining healthy Pacific salmon ecosystems, such as through the North American Salmon Stronghold Partnership. We must think bigger about salmon and steelhead restoration and protection than we ever have before, like on the Klamath River where a collection of disparate voices and interests are proposing a brighter future based on restoration. And, we must pursue landscape changing events like removal of the lower four Snake River dams. But we must also push for real and lasting solutions with individuals and local communities. Such solutions will prove to be the most durable and effective in the long run for ensuring place-based models to protect, reconnect, and restore our western rivers and watersheds, and in the process, recover our remarkable salmon and steelhead. Today’s salmon crisis is a shared crisis. Now we need shared solutions.

On behalf of Trout Unlimited, I would like to thank you for the invitation to submit testimony and participate in today’s hearing, and for your time in consideration of these issues.

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