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Mr. Chairman, Members of the Committee, I appreciate the opportunity to appear before you today to provide Trout Unlimited's perspective on the impacts of climate change on our nation's water supply, related impacts to trout and salmon populations, as well as strategies that we believe can be important in responding to the very serious threat that climate change poses to these valuable resources.

Trout Unlimited (TU) is the nation's largest coldwater fisheries conservation organization dedicated to the protection and restoration of our nation's trout and salmon, and the watersheds that sustain them. Our goal is to restore robust populations of native and wild coldwater fishes so that future generations can enjoy these resources. TU has more than 160,000 members organized into 450 chapters across the country. Our members generally are trout and salmon anglers who give back to the resources they love by voluntarily contributing substantial amounts of their personal time and energy to fisheries habitat protection and restoration on public and private lands. 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.

Trout Unlimited is very concerned about the impacts of climate change on our water and fisheries resources. During the past year, a team of TU scientists and geographic information specialists have modeled the impacts of climate change on coldwater fishes, reviewed available scientific literature, and prepared articles on the impacts of climate change for our members. In addition, TU has polled hunters and anglers across the country to determine their level of interest and concerns about how

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climate change is likely to impact their recreational pursuits. Furthermore, we have developed a series of strategies, that if implemented, we believe will substantially increase the resistance and resilience to climate change impacts in our nation's salmon and trout streams.

I would like to briefly describe the impacts from climate change on our trout and salmon resources and their habitats and then proceed to describe our strategies to increase resistance and resilience to these impacts.

Impacts to Trout and Salmon Resources

There is a clear scientific consensus that climate change will have major and negative implications to our nation's hydrology and river systems. Numerous peer-reviewed studies have predicted broad declines in trout and salmon populations as well. U.S. Forest Service scientists have predicted that between 53 and 97% of wild trout populations are likely to be eliminated from the Appalachian Mountains because of warming climate. Losses of western trout populations may be as high as 64%. Most studies of Pacific Coast salmon predict losses of 20-40% by the year 2050. The bad news about the salmon models is that they may actually be optimistic predictions because they focus on freshwater conditions and do not consider the complexity and uncertainty of changing ocean environments.

Although some regions will fare better than others and the timing and severity of impacts is somewhat uncertain, the overall need for concern should be clear. Based on review of the relevant literature and research, the following impacts from climate change are likely to occur: increased stream temperatures, increased evaporation rates, earlier spring runoff, reduced snowpack, higher winter flows and lower summer flows in most streams, greater storm intensity and increased frequency of floods, drought and wildfires, and rising sea levels. Erosion rates will increase as will polluted runoff from our cities and agricultural areas. One of the most significant bottom lines for fisheries and other water users is that stream flows are likely to be even lower during future summers than they have been in the past.

While some consequences of climate change are highly predictable others are not. Beginning in 2002, a "dead zone" of very low dissolved oxygen has appeared each year off the Oregon coast. Unlike other oceanic dead zones, this one is not attributable to pollution or other human impact that has been identified. Rather, it is caused by changes in ocean currents and upwelling that is in turn, controlled by weather patterns. In 2006, the dead zone covered 1,235 square miles, an area the size of Rhode Island. According to Oregon State University Professor Jane Lubchenco, "we are beginning to think there has been some sort of fundamental change in ocean conditions off the West Coast." The changes appear consistent with wind patterns modified by climate change.

The Oregon coast changes bring up another important concern: climate change is not just a problem of the future, but is a growing concern of the present. Our climate already is rapidly changing and we currently are seeing impacts to our stream systems and aquatic communities. For instance, because of warmer stream flows and earlier peak runoff, mayflies and other aquatic insects are emerging earlier in Rocky Mountain streams. Earlier emergence of aquatic insects means that females are smaller in body size and produce fewer eggs than would insects that emerge later. Such changes may seem minor but could have cascading implications to fish populations that depend on mayflies, caddisflies, stoneflies and other aquatic insects as their primary food supplies.

At TU we have modeled impacts of climate change on Colorado River cutthroat trout in Utah, Wyoming and Colorado; Bonneville cutthroat trout in Idaho, Utah, Wyoming and Nevada; and westslope cutthroat trout in Idaho, Montana, Oregon and Washington. In 5 of the 8 major river drainages where Colorado River cutthroat trout occur, most populations already are below adequate habitat thresholds and will be further stressed by climate change impacts. The same situation is true for 2 of 4 geographic management areas of Bonneville cutthroat trout. Most remaining populations of both subspecies are restricted to small, headwater streams, which will feel the brunt of climate change impacts due to declining snowpacks, drought and wildfire. Westslope cutthroat trout fare somewhat better because of existing strongholds in National Forest wilderness areas. Nonetheless, populations of westslope cutthroat continue to be invaded by non-native rainbow trout that hybridize with the cutthroat and eliminate the native gene pool.

Depending on the climate model used, most salmon populations in the Pacific Northwest are expected to decline by 20 to 40% by the year 2050. In California, where temperatures already pose a significant source of stress for fisheries, greater declines are likely.

Unless immediate action is taken to restore resistance and resiliency to climate change impacts, stream conditions will degrade and many more of our native trout and salmon may soon warrant the protection of the Endangered Species Act. Let me outline what can be done to alleviate at least some of the adverse impacts of climate change on the nation's trout and salmon populations.

Strategies to Increase the Resistance and Resilience to Climate Change Impacts

Trout Unlimited works primarily to implement what we refer to as the Protect-Reconnect-Restore model of fishery sustainability. This process emphasizes protection of our best remaining habitats and populations, reconnecting stream systems by removing instream barriers and reestablishing flows, and restoring vital lower-elevation rivers. I will describe six strategies for dealing with a rapidly changing climate that fit this model. These strategies are consistent with the best available science and have been proven to be effective in on-the-ground application. Our primary goal in suggesting these strategies is to increase the resistance to climate change impacts in our natural systems and to enable fish populations and their habitats to rebound more completely once they are disturbed by flood, drought and wildfire that will accompany a warming environment.

Furthermore, it is important to realize that these actions must be implemented strategically to achieve success. That is, for each evolutionarily significant unit of salmon, or each large river basin with trout, we need to identify the best subset of opportunities for protection, reconnection, and restoration. We must carefully choose those areas for restoration where we can make the most immediate and lasting impact.

Strategy 1: Protect remaining core habitat areas. It is vital that remaining salmon and trout strongholds as well as watersheds that produce reliable supplies of cold water be protected from additional disturbance. Watersheds that currently support large and robust populations of native fisheries should be protected from new dam and road development. Simply stated, it is more biologically sound and cost effective to protect existing population strongholds than attempt to restore them once they have been disturbed.

Strategy 2: Maintain genetic and life history diversity. Higher levels of genetic diversity enable populations to better adapt to future environmental change. For example, scientists at the University of Washington have demonstrated that large numbers of separate spawning populations of sockeye salmon in Alaska's Bristol Bay have been the key to maintaining that robust fishery in the face of changing freshwater and marine conditions. Under certain conditions, one set of stocks will be favored and produce abundant offspring; when conditions shift, a different group of populations will be favored. It is simply a matter of maintaining all the genetic pieces to maximize adaptability.

Life history diversity also is critical. In western cutthroat trout, for example, most populations are resident stream forms that are restricted to single tributaries. But, restoring migratory populations expands habitat options, produces bigger fish, and allows remaining individuals more opportunities to find suitable habitats as stream conditions and flows change.

Strategy 3: Increase size and extent of existing populations. Currently, many populations of native trout in the West have been pushed into upper elevation streams as non-native species have been introduced downstream. We know that at least 5 miles of continuous high quality habitat are necessary to ensure the likelihood that each trout population will persist for many generations. The populations already are being squeezed from downstream reaches. Climate change will squeeze them from upstream as snowpacks diminish and precipitation patterns change. The options for these fish are to expand into remaining downstream habitat or perish. But for downstream expansion to be possible, non-native fishes must be removed and habitats restored.

Strategy 4: Minimize outside stressors. In many ways, the impacts of climate change will bring additional stress to stream systems and watersheds that already have been pushed to their ecological limits. We may not be able to slow the immediate impacts of a changing climate, but we can identify and remove or mitigate existing sources of stress. Too many roads, poorly constructed culverts, and poor livestock practices are a few examples of existing stressors that can be fixed. Watersheds that are in a healthy condition will be better able to withstand the stress of climate-imposed impacts and rebound from disturbances.

We know basic improvements in water quality, restoration of riparian habitats, and restoration of stream channel complexity will improve habitats and create refuges from warm water by forming deeper and more shaded pools of cool water. This appears just as true for small mountain streams in New Mexico or Montana as it does for larger river systems in coastal areas of Oregon and Washington.

Strategy 5: Manage at watershed scales to reconnect stream systems. Many existing stream systems have been disconnected by construction of dams, water diversions, and other dewatering processes. We should identify and reconnect the hydrology in those areas that are most likely to provide for long-term survival of trout and salmon. In some cases, this may be as easy as replacing poorly designed culverts with small bridges that allow upstream and downstream movement of fish and spawning gravels.

Strategy 6: Monitor, evaluate and employ adaptive management. As noted earlier, our ecosystems are complex and some impacts of climate change are difficult to predict with certainty. Therefore, it is important to adequately fund monitoring programs and maintain the ability to modify our management approach in the face of changing conditions and new information. We must listen to what the land is telling us as climate shifts.

Conclusion

In conclusion, we find that climate change poses a serious and imminent threat to our nation's water and stream resources and to the trout and salmon populations they support. Further, we believe that the impacts of a rapidly changing climate are already manifesting themselves through changes in precipitation regimes and snowmelt patterns, warmer weather and increasing drought, reduced snowpacks and earlier stream runoff, reduced stream flows in the summer, and a greater threat from disturbance processes such as drought, flood and wildfire.

Despite these significant challenges posed by a rapidly changing climate, we believe there are many reasonable and proven actions, such as the strategies described herein, that can be taken immediately to reduce the threats to our coldwater fishery resources. We strongly believe that our actions must be based on the principles of conservation biology and restoration ecology.

The long-term health of our rivers and watersheds must have priority over any quick fixes. We are highly skeptical of any attempts to channelize streams or dam headwaters in an effort to control flows and floods. Rather, we advocate healthy streams and floodplains that are more able to absorb higher energies associated with floods and also are more likely to slowly release water and maintain flows during summer and autumn.

Many of our existing trout and salmon face an increased risk of extinction. It is important to make investments in protection and restoration of our streams, riparian areas and watersheds during the current and coming years while the debates and discussions concerning our energy policies and carbon footprint move forward. By making such basic investments in the health of our watersheds, we will insure the persistence of our most valuable salmon and trout populations and buy the time needed to deal with the larger problem of reducing our carbon footprint.

Thank you again for the opportunity to testify today. I look forward to answering any questions that you may have.