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Imperiled Western Trout and the Importance of Roadless Areas

A Report by the Western Native Trout Campaign

November 2001

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Executive Summary

This report examines the distribution of healthier remaining populations of eight native trout species in the West. It is the most comprehensive and extensive analysis of its kind.

The report demonstrates that all eight species have experienced severe declines. For all eight, the strongest remaining populations occupy only tiny portions of their former ranges — averaging less than 5%. Three of the eight species have stronger populations in less than 1% of their historic range. Even the strongest remaining populations commonly have experienced local declines and/or occupy partially degraded habitats. Nevertheless, the remaining stronger populations of all eight species were associated with roadless areas. For five of the eight, the *majority* of their strongholds were in roadless areas.

The analysis clearly indicates that western native trout species are highly imperiled, and complete protection of roadless areas is essential to their persistence. There is a very high risk of continuing loss of stronger populations due to their precarious population status, widespread habitat degradation, and continuing intrusion into roadless areas.

The decline of native trout is caused primarily by habitat damage (much of it associated with roads), and the effects of introduced, non-native fish. Two native trout species are already extinct. Many are listed under the Endangered Species Act.

The Bureau of Land Management (BLM) and Forest Service (USFS) have not protected roadless areas: more than 2.8 million acres of inventoried roadless areas have been lost over the last two decades on USFS lands alone. Millions more acres have been lost on BLM lands. Most remaining roadless areas are not protected from roads, from oil and gas exploration, and other associated degradation.

The report's results corroborate previous assessments and scientific literature, which have consistently concluded that roadless areas and other high quality habitats are essential components of native trout conservation. Similarly, scientific literature has consistently shown that roads and associated activities are one of the most severe sources of trout habitat damage. This report summarizes this information.

The report is based on computerized Geographic Information Systems (GIS) analysis of trout distributions and roadless areas using data from government and academic sources. The eight native trout species that were analyzed have distributions that cover much of the West and provide a geographically robust indication of the importance of roadless areas for native trout.

In sum, this analysis, the scientific literature, and pertinent government assessments indicates that in the face of the severe declines of these native trout and their dependence on high quality habitat frequently associated with roadless areas, the full protection of all roadless public land, including uninventoried areas greater than 1000 acres, is essential to the restoration and protection of native trout in the West. While such protection is essential, it is not enough. Ensuring even the long term persistence of sensitive trout species will require the widespread protection of depressed and scattered populations, and the recovery and restoration of much habitat. Full recovery of western trout will require proportionately more action yet.

Imperiled Western Trout
and the Importance of Roadless Areas

A Report by the Western Native Trout Campaign

November 2001

Introduction

Native trout populations in the western United States have declined precipitously because of habitat damage and the combined effects of introduced, non-native species. As a result, an important part of the west's natural heritage is in danger of disappearing forever. At least two distinct trout subspecies, the Alvord cutthroat trout of the Great Basin and the yellowfin cutthroat of the southern Rocky Mountains, are already extinct. Many others are now restricted to less than 10% of their historical range. The Western Native Trout Campaign, a coalition of national, regional, and local conservation and sportsman's groups, has recently formed to conserve and recover the remaining native trout in the west (http://www.westerntrout.org/trout/).

As part of the efforts to protect native trout and their habitat, the Campaign evaluated the relationship between public land roadless areas and existing native trout populations. Roads are a significant cause of trout habitat damage and water quality degradation. Roads also facilitate stocking of non-native trout and other fish, access by domestic livestock, overfishing, and disease transmission. Unfortunately, like native trout, roadless areas are a diminishing resource on the public lands. In many instances, roadless areas outside of wilderness and national parks have not been protected from on-going development. Further, absent congressional protection, public land management agencies such as the Bureau of Land Management (BLM) and U.S. Forest Service (USFS) have failed to protect undeveloped areas from degradation caused by roads, logging, mining, and grazing.

Despite the ecological importance of roadless areas, millions of acres of public land roadless areas have been lost to development (such as logging roads) in the past 50 years—commercial logging of federal lands was almost negligible until the 1950s. The loss of roadless areas has been especially severe over the past 25 years. In an unprecedented orgy of road-building, about 2.8 million acres of inventoried roadless lands have been lost in the last two decades on USFS lands alone (66 Federal Register, 2001). This probably underestimates the amount of roadless area lost, because the USFS does not track uninventoried roadless areas and those that are less than 5,000 acres in area. Their total miles of roads on USFS lands are now greater than the total miles of the U.S. Interstate Highway system.

Still more area is at risk. Road construction is allowed in 34.3 million acres of the 58.5 million acres of inventoried roadless areas considered in the USFS's recent Roadless Conservation Rule (66 Federal Register, 2001). Again, this underestimates the area of ecologically important roadless area at risk because it does not include uninventoried roadless areas or those areas less than 5,000 acres in area. Roadless areas greater than 1,000 acres are ecologically important for trout conservation (Henjum et al., 1994; Rhodes et al., 1994; Espinosa et al., 1997). Most of these areas are not protected from road-building.

Millions of acres of BLM roadless lands have been lost as well, but even a ballpark total acreage figure is not available because BLM has not undertaken a comprehensive inventory since the half-hearted efforts of the late 1980s.

We examined the association of native trout with roadless areas in order to disclose the importance of roadless areas on federal public lands to the continued persistence of native trout. Notably, our analysis accomplishes what the Interior Columbia Basin Ecosystem Management Project (ICBEMP) did not over the course of more than eight years and a budget of more than $50 million. Although the ICBEMP purported to assess the effects of land management conditions on native trout populations, it failed to explicitly disclose the association of individual trout populations with roadless areas. Our analysis rectified this deficiency. While we updated and expanded the interior Columbia analysis with more recent roadless area and fish status information, we expanded the analysis by including all eight native trout species across the interior of the western United States for which digital distribution data were available (Figure 1). This provides a reasonable cross-section of trout species native to the West and indication of the importance of roadless areas across the west to these species.

We also examined the overall status of these eight trout, with respect to the amount of the historic range still occupied by conservation or strong populations. This analysis provides an important context for assessing the importance of remaining native trout populations and roadless areas. This report presents the results of our analyses.

Native Trout are in Trouble

Today, all trout native to the West are in trouble. Virtually all of these fish are either listed or being considered for listing under the federal Endangered Species Act (ESA). About half are already listed as either Threatened or Endangered under the ESA: the Lahontan cutthroat trout, Paiute cutthroat trout, Little Kern golden trout, California golden trout, greenback cutthroat, Apache trout, bull trout, several strains of steelhead trout, and the Gila trout. The other half have been petitioned for listing in recent years and are now the subject of greatly heightened interest by fisheries managers: the Bonneville cutthroat, Colorado River cutthroat, westslope cutthroat, coastal cutthroat, Yellowstone cutthroat, Rio Grande cutthroat, and several strains of redband trout. Nearly all native trout are considered "sensitive species" or "species of special concern" by the American Fisheries Society, U.S. Fish and Wildlife Service (USFWS), and/or USFS. The ecologically perilous condition of these populations is worsened by habitat conditions. Much of the historically occupied habitats are widely degraded.

Greatly Reduced Distribution, Abundance, and Vigor

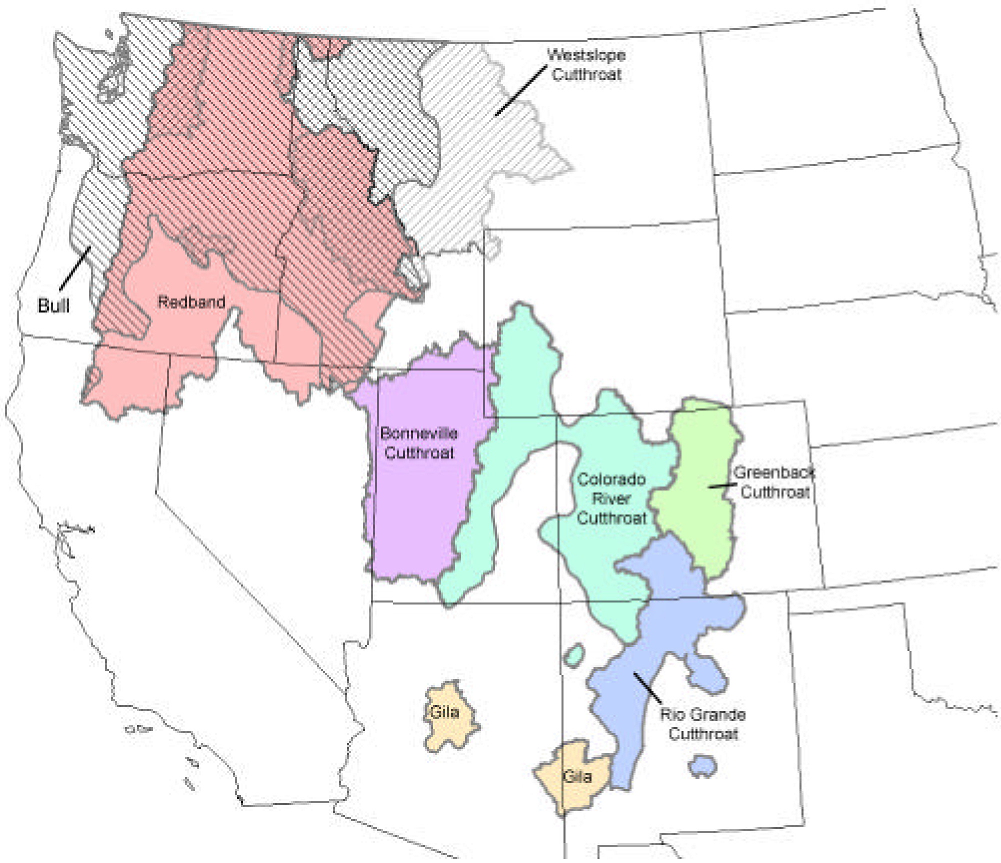
While two native trout are now extinct, all remaining native trout species have experienced severe reductions in distribution, abundance, genetic integrity, or other important measures of biological health. This is especially true of the 14 recognized subspecies of cutthroats, nearly all of which “have been reduced to a small portion of their historical range, nearly all less than 5%” (Harig, et al., 2000).

To provide an updated ecological context for our analysis, we used the digital data, available literature, and Geographic Information System (GIS) to assess the overall status of the eight native trout in terms of the amount of their historic range still occupied by strong or conservation populations. The results, displayed in Figure 2 and Table 1, clearly indicate that all of the eight native trout populations have radically reduced ranges and are extremely fragmented. Three of the eight species have conservation or strong populations in only 1% of their historic range and all but one have such populations in less than 6% of their historic range. This situation puts all of these species at extreme risk of extinction. This is especially true because even “strong” or conservation populations may have already had declines in numbers. Many occupy degraded habitats that make additional population declines likely.

Table 1. Percent of historically occupied range currently occupied by conservation/strong populations for eight native trout species in the West, based on analysis of digital distribution data and literature

Trout Species/Subspecies	% of Historically Occupied Range Still Occupied by Conservation or Strong Populations	Comments
Colorado River cutthroat trout	**0.3%**	Conservation population definition from Young, et al. (1996) as cited in Duff, (1996).
bull trout	**3.8%**	Includes only populations and historical range within ICBEMP analysis area.
greenback cutthroat	**0.7%**	
Gila trout	**0.7%**	Conservation populations based on D.L. Propst (N. Mex. Dept of Game and Fish, pers. comm., Oct. 2001).
Rio Grande cutthroat	**2.7%**	
Bonneville cutthroat	**4.3%**	Includes only populations and historical range in Utah.
westslope cutthroat	**15.2%**	Includes only populations and historical range within ICBEMP analysis area.
Redband	**5.3%**	Includes only populations and historical range within ICBEMP analysis area.

Figure 1. Historic distributions for the eight native trout species with digital distribution data analyzed in this report. In some cases, distribution data were only available for a portion of these historic ranges. For example, bull trout data for strong populations were only available for the interior Columbia River Basin portion of the historic range for these trout. See text for details and discussion of data coverage and analysis.



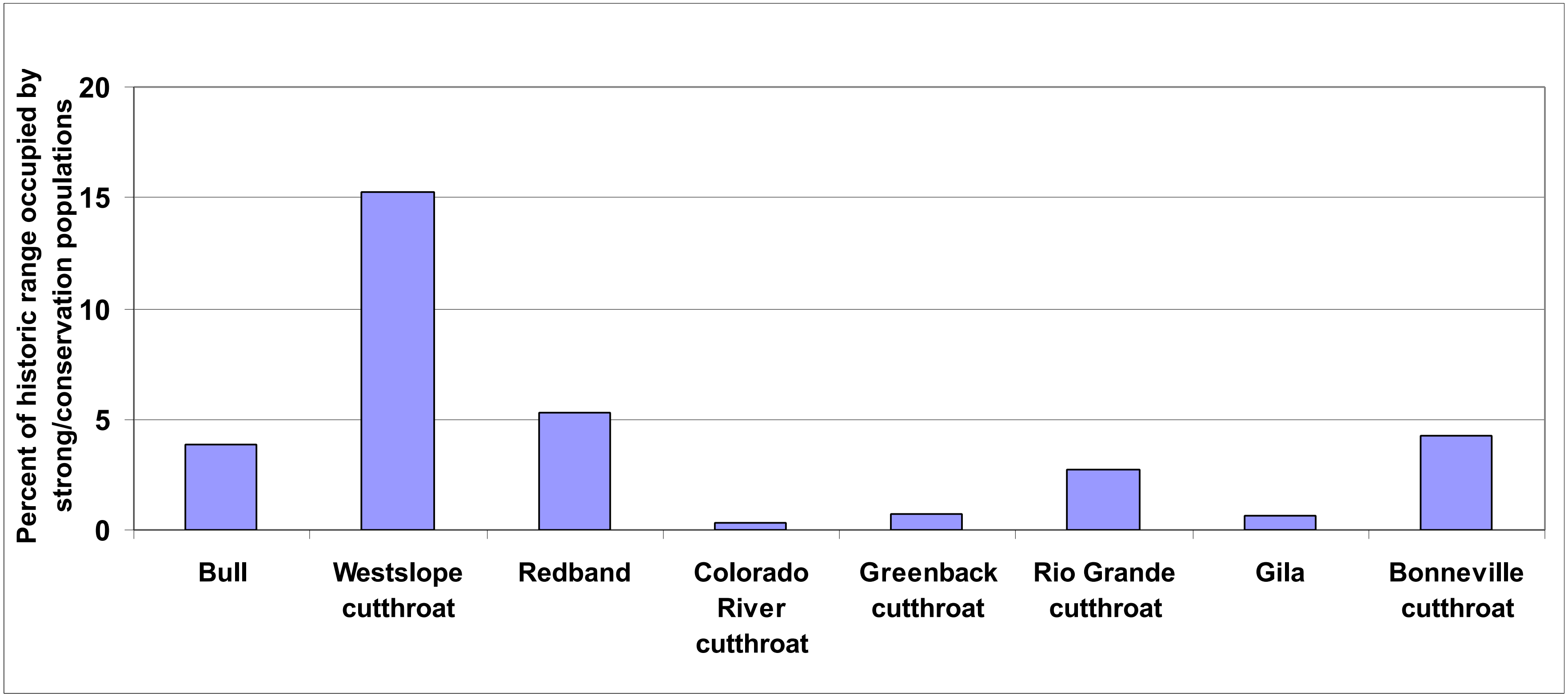


Figure 2. The percent area of historic range occupied by remaining strong/conservation populations for all eight species with digital distribution data. See also Table 1, Figure 1, and text for additional details.

These results are consistent with the literature, which clearly shows that native trout species have seriously reduced range, abundance, and genetic integrity. For example:

- Despite recent conservation efforts, the greenback cutthroat trout are currently restricted to a mere 19 conservation populations in less than 100 miles of stream. These trout once occupied hundreds of miles of streams in the mountains and foothills of the South Platte and Arkansas River drainages in Colorado.

- The Lahontan cutthroat trout previously occupied about 3,600 miles of streams and 334,000 acres of lakes in Nevada and California. As of 1995, it occupied only about 0.4% of former lake habitat and only 10.7% of former stream habitat (USFWS, 1994).

- In 1996, it was estimated that genetically pure Colorado River cutthroat trout existed in only 20 of 318 waters without the presence of non-native species and a functional natural or man-made barrier to prevent a non-native invasion (Duff, 1996). Data updated by the Campaign show that only 38 populations in 119 miles of streams meet these criteria, out of approximately 23,000 miles of historically occupied streams (Center for Biological Diversity et al., 2000). This amounts to "conservation populations" in far less than 1% of historic stream mileage, consistent with our analysis of the area of the currently occupied historic range (Table 1 and Figure 2). Even if these estimates are off by a factor of 4, they paint a very bleak picture for these trout.

- In the interior Columbia River Basin, our re-analysis of the ICBEMP data indicate that only 15.2% of the area of historically occupied range of westslope cutthroat trout still harbors "strong" populations (Table 1 and Figure 2). Outside the interior Columbia River Basin, east of the Continental Divide in Montana, these native cutthroat trout occupy less than 5% of their historic range (Shepard et al., 1997).

- Apache trout in Arizona have been reduced to only 20% of their previously occupied habitat (Ruiz, et al., 2000).

- In the interior Columbia River Basin, strong populations of bull trout occupy only about 3.8% area of the historically occupied range, based on our re-analysis of ICBEMP data. Only 10.5% of the watersheds that still contain bull trout populations have existing *populations* that are considered "strong" (USFS and BLM, 1997a).

- Redband trout have been reduced by 41-45% from historic levels (USFWS, 2000; USFS and BLM, 1997a). In the Columbia River Basin, only 8.4% of the watersheds that still have redband trout have populations that are considered strong (USFS and BLM, 1997a). Our re-analysis of the ICBEMP data indicate that strong populations occupy only about 5.3% of their historic range within the Columbia River Basin (Table 1 and Figure 1). Life history diversity has been severely reduced, with many high-desert lake adfluvial and larger stream fluvial redband numbers greatly reduced.

These results clearly illustrate that native trout are in an ecologically precarious condition. All remaining populations and habitats are critical to conserve and restore, if these populations are to persist. Additional losses in trout abundance and range or habitat degradation will increase the already high risk of extinction.

Native Trout Are Primarily Found In Roadless Areas

We analyzed the association of the eight native trout with roadless areas via GIS. The results are clear, as shown in Table 2 and Figure 3. Of the eight native trout investigated, five have the majority of their strong populations in roadless and other undeveloped areas (over 60% of the conservation or strong populations), while the remaining three have an ecologically significant percentage of their important populations in roadless areas. The results clearly indicate that roadless areas, including those in wilderness, wilderness study areas, and national parks*, are extraordinarily important to the remaining native trout populations*.

Table 2. Association of remaining strong and conservation populations of eight native trout with roadless areas. See also Figure 3.

Trout Species/Subspecies	**Percent Area of Conservation or Strong Populations Watersheds in Roadless Area, Wilderness Study Area, Wilderness, or National Park**	**Comments**
Colorado River cutthroat trout	**62%**	Conservation population definition from Young, et al. (1996) as cited in Duff, (1996).
bull trout	**76%**	Includes only populations in ICBEMP analysis area.
greenback cutthroat	**75%**	
Gila trout	**99%**	Conservation populations based on D.L. Propst (N. Mex. Dept of Game and Fish, pers. comm., Oct. 2001).
Rio Grande cutthroat	**39%**	
Bonneville cutthroat	**32%**	Includes only populations in Utah.
westslope cutthroat	**71%** by watershed area in interior Columbia River Basin. In Montana, including populations east of the Continental Divide, **60%** of stream miles have watersheds partially or wholly within roadless/wilderness/parks.	
redband	**17%** of watershed area within interior Columbia River Basin. Within Great Basin, from 50% to 0% of populations pass through roadless/wilderness/parks, depending on basin, amount of forested, and other factors.	Average for all basins within the Great Basin was 23%.

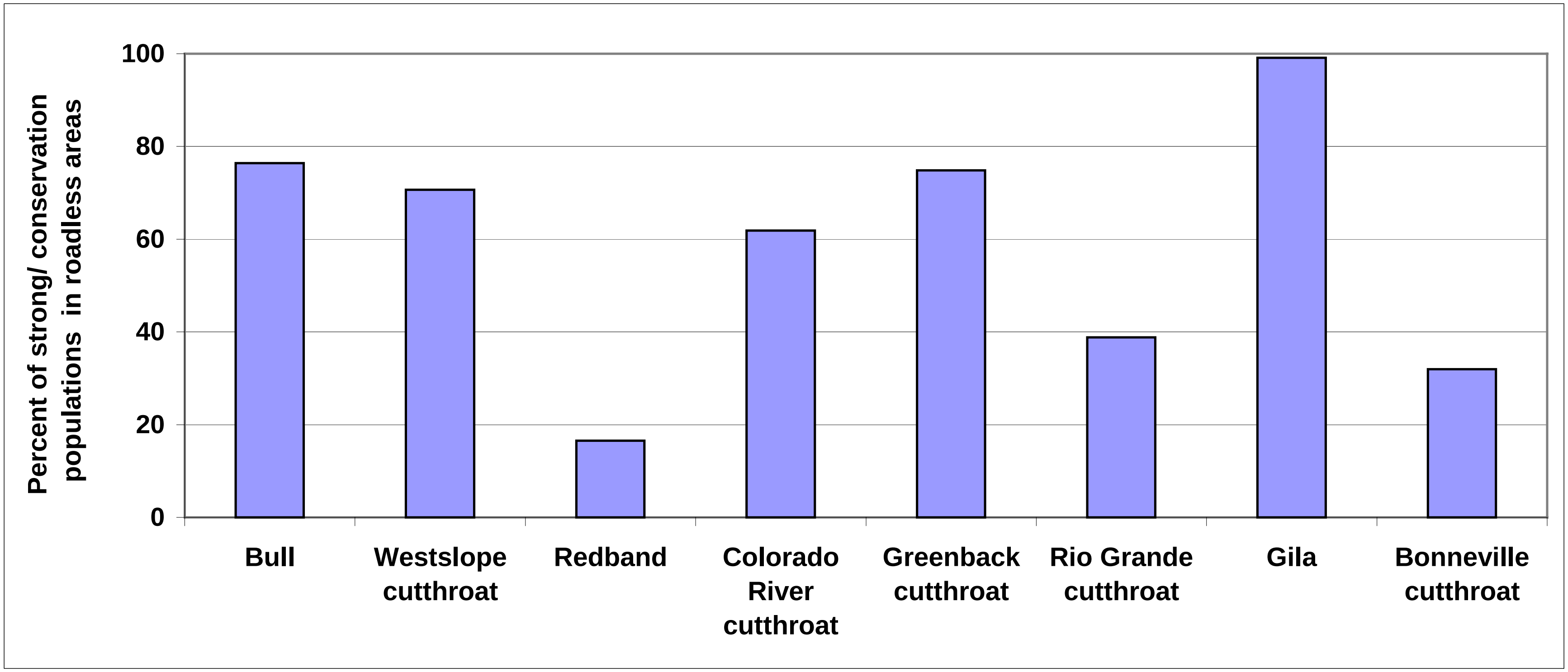


Figure 3. The percent area of remaining strong/conservation populations found in roadless areas for all eight species with GIS analysis of digital distribution data. See also Table 2 and text for additional details.

It is likely that our analysis underestimates the association of native trout with roadless areas because available data underestimate the amount of roadless areas. First, the analysis only includes roadless areas greater than 5,000 acres in size on public lands. In a regional study of conditions on USFS lands in eastern Oregon and Washington, Henjum et al. (1994) documented that a majority (85%) of the remaining roadless areas were in patches smaller than 5,000 acres. Second, most of the roadless area data were for inventoried roadless areas from the USFS and BLM. Comprehensive analyses have shown that these inventories are far from complete and fail to include all roadless areas greater than 5,000 acres (Henjum et al., 1994; Wyoming Wilderness Coalition, 2001). For these reasons, our results probably underestimate the association of remaining trout populations with roadless areas.

This underestimation of roadless area may partially explain the relatively low, but still significant, association of redband trout with roadless areas in our analysis (Table 2 and Figure 3). Roadless areas on USFS lands within much of the redband trout's historic range are limited, highly fragmented and largely relegated to higher elevations (Henjum et al., 1994). However, redband are extensively and intensively affected by water withdrawals and grazing impacts throughout their range. Most roadless public lands within the range of redband trout are extensively grazed. These impacts may not be captured by our analysis and likely confound the effect of roadless areas on the distribution of remaining strong populations of redband trout.

The results of our GIS analysis of the association of native trout with roadless areas are entirely consistent with existing literature and recent government reports. These assessments have repeatedly concluded that roadless areas are essential to the conservation of native trout. A few examples are presented here.

An assessment of the condition of seven native salmonid populations in the entire interior Columbia River Basin found that 58% of the population strongholds on public lands occurred in unroaded subwatersheds. (USFS and BLM, 1997a). This analysis lumped seven salmonid species, including anadromous fish, together and failed to specifically disclose the association of individual trout populations with roadless areas (USFS and BLM, 1997a). For this report, we analyzed this association for each of three native trout species (bull, redband, and westslope cutthroat) on an individual basis.

Several other assessments made at various geographic scales have concluded that remaining roadless areas are critical to the persistence of trout and other salmonids (Anderson, et al., 1993; Forest Ecosystem Management Assessment Team, 1993; Henjum, et al. 1994; Rhodes, et al. 1994; NMFS, 1995). USFWS (1999) found that many "strongholds" for westslope cutthroat trout were found in roadless areas and wilderness, although they did not present a quantitative estimate of this association.

Several other western native trout are known to have a very strong association with roadless areas and wilderness. For example, pure California golden trout and Little Kern River golden trout exist only in the Golden Trout Wilderness, an area jointly managed by the Inyo and Sequoia National Forests in the southern portion of the Sierra Nevada Mountain Range.

The literature and our results indicate that the extent and number of strong and conservation populations have been greatly diminished. The relatively few remaining are significantly associated with roadless areas. Notably, it cannot be assumed that strong and conservation populations are numerically healthy or secure from additional habitat degradation or population declines. In aggregate, our results indicate that full protection of roadless areas is an essential part of conserving and restoring native trout populations.

While our analysis and the literature clearly indicate that the protection of all remaining high quality habitats and all conservation or strong populations is an essential step for trout conservation, it also indicates that the protection and restoration of many degraded habitats and weak populations will also be critical for ensuring the persistence of trout populations.

The protection of degraded trout habitats outside of roadless areas is a critical need because many of the historically most productive habitats are outside of roadless areas, as indicated by regional studies in Idaho (Huntington, 1998; Rhodes et al., 1994), Oregon, and Washington (Henjum et al., 1994; Rhodes et al., 1994). These lower elevation habitats are essential if population fragmentation is to be reduced because they provide the sole avenues for re-establishing population connectivity (Henjum et al., 1994; Rhodes et al., 1994). Recent studies have also shown that the majority of isolated cutthroat trout populations do not have adequate space for their long-term persistence (Hilderbrand, 1998). As a result, these populations face a high risk of extinction from habitat degradation.

For the eight trout we analyzed, all remaining strong or conservations are essential to protect and restore, because the status of all of these trout is so precarious (Figure 2). While most of these eight trout had a majority of their healthiest populations in roadless areas, a significant fraction of strong/conservation populations of all eight species analyzed are in roaded landscapes. Three of the populations we analyzed (Bonneville and Rio Grande cutthroat trout and redband trout) have the majority of their remaining strong or conservation populations in roaded and somewhat degraded habitats. Therefore, it is clear that while protecting the roadless areas and best remaining habitats is an absolutely necessary step, it is insufficient to protect all remaining conservation or strong populations of trout or to assure trout persistence, as other have noted in regional assessments of populations and habitats (Rhodes et al., 1994; Henjum et al., 1994).

Further, because the status of trout are so depleted with respect to genetic integrity, numerical strength, range and connectivity, weak populations are also important to protect and conserve. While our analysis focused on strong and conservation populations, for most of the species we analyzed, the vast bulk of remaining populations are weak. For instance, the vast majority (greater than 85%) of the remaining watershed-scale populations of bull, redband, and westslope cutthroat trout in the Columbia River basin are not considered strong (USFS and USBLM, 1997a). This population context makes it critical to protect these weaker trout populations and their habitats. As weaker populations are lost, fragmentation increases.

Analysis Methods

The Western Native Trout Campaign attempted to gather all available digital data on the distribution and status of populations for all trout species native to the interior west. There were eight native trout species that had digital distribution data that were adequate for analysis. For all eight of these species, we analyzed their status and association with roadless areas via GIS. For inland trout species that lacked data adequate for GIS analysis, we searched the scientific literature and government and agency reports on population locations and biological condition. We did not attempt to analyze the association of anadromous fish or those in coastal rivers with roadless areas but do report some previous findings from the literature.

While data availability determined the species analyzed, the eight species with digital distribution data represent a reasonable cross-section of native populations across the West. In aggregate, these species have historical ranges that cover a large part of the inland West and include a wide array of ecosystems (Figure 1). The results are, therefore, geographically and environmentally robust.

Data for the various trout populations' distribution and status came from researchers, academia, conservation professionals, and state wildlife and land managers. Sources include: ICBEMP; state wildlife agencies in Montana, Utah, and Oregon; the Natural Heritage Programs in Wyoming and Utah; and several key researchers at various institutions and organizations. Data sources are listed at the end of this report in the "Digital Data Sources" section.

When possible, we used only "conservation" and "strong" populations in our analysis. Conservation populations are those deemed to have high genetic purity, secure from non-native fish, and/or high conservation status ranking by federal or state agencies. We used data for "strong" populations for bull, redband, and westslope cutthroat trout from ICBEMP (USFS and BLM, 1997a). These populations were designated on the basis of numerical population criteria (USFS and BLM, 1997a). Notably, both conservation and strong populations are neither necessarily healthy nor secure. They may have already declined considerably and may still be at risk of further declines due to habitat degradation and fragmentation.

We collected digital data for inventoried roadless and wilderness on USFS and BLM from those agencies and various multi-agency data repositories such as ICBEMP. As previously discussed, it is likely these data underestimate the extent of roadless areas greater than 1,000 acres. National park data were obtained from the National Park Service. For Utah and Colorado, we also used roadless area data on BLM lands mapped by conservation groups, if, and only if, these data were based on intensive on-the-ground surveys.

We used ICBEMP digital data for the historic range for bull, redband, and westslope cutthroat trout. For other five species analyzed, we digitized historic range information collected from the literature. Since we did not have complete data for all these species across all of their historic and current ranges, we analyzed their status and distribution over the major portions of their ranges for which data were available, as noted in Table 1 and Table 2.

The distribution data were in two forms for the eight species analyzed. The ICBEMP sources (bull, redband, and westlope) provided areal data at the subwatershed scale. The non-ICBEMP sources (Bonneville, Colorado River, Rio Grande, Gila, and greenback cutthroat trout) provided data on individual stream reaches that were converted into units of area, in order to allow consistent comparisons across species and areas. This was done using the work of Hack (1957) whose approximation of drainage basin area from stream length holds remarkably well for watersheds of all sizes (Dunne and Leopold, 1972). The Gila trout distribution information was taken directly from information in Probst and Stefferud (1997).

GIS analysis was also used to determine the association of strong/conservation populations with roadless areas including wilderness, wilderness study areas, and national park lands. Among the eight species analyzed, the distribution data were in a variety of forms, including areal, point, and lineal data. We converted all of our results into units of area, in order to allow consistent comparisons across species and areas. For the species with conservation population status delineated at the subwatershed scale, this simply involved an intersection with the roadless area coverage. For the species with conservation population status delineated on a a stream reach basis, the size of the calculated conservation watersheds were multiplied by the ratio of the length of conservation streams within roadless areas to those outside of roadless areas.

Roads Harm Trout and Trout Habitat

One of the reasons that native trout are so strongly associated with roadless areas is that roads are one of the greatest single causes of trout habitat damage (USFS et al., 1993; Henjum et al., 1994; Rhodes et al., 1994; NMFS 1995; USFS and BLM, 1997a; b). Habitat damage and water quality degradation is an unavoidable consequence of road construction (Rhodes et al., 1994; Henjum et al., 1994; NMFS 1995; USFS and BLM, 1997,a,b). This damage is persistent and cannot be quickly reversed (Furniss et al., 1991; Rhodes et al., 1994; NMFS 1995; Espinosa et al., 1997). Reductions in effects and extent of road networks are essential to protecting and restoring trout habitats (Henjum et al., 1994; Rhodes et al., 1994; USFS and BLM, 1997a).

In 1970, the USFS identified road construction as perhaps the most serious source of damage from man's activities (Duff, 1996). Sediment contribution per unit area from roads can be greater than from all other land management activities combined (Furniss et al., 1991).

USFS and BLM (1997a) found that roads had strong negative effect on native trout within the Columbia River Basin. "Our results clearly show that increasing road densities and their attendant effects are associated with declines in the status of four non-anadromous salmonid species [including bull trout, westslope cutthroat, and redband]. They are less likely to use highly roaded areas for spawning and rearing, and if found are less likely to be at strong population levels. This is a consistent and unmistakable pattern based on empirical analysis of 3,327 combinations of known species' status and subwatershed conditions, limited primarily to forested lands administered by the USFS and BLM" (USFS and BLM. 1997a). Agency scientists concluded that "designated wilderness and potentially unroaded areas are important anchors for strongholds throughout the Basin" (USFS and BLM. 1997a).

Bull trout are exceptionally sensitive to direct, indirect, and cumulative road effects. In western Montana, Hitt and Frissell (1999) found that bull trout strongholds occur in areas with road density less than about 0.4 miles per square mile of land area. Bull trout were not found in areas with road density greater than about 1.7 miles per square mile, indicating that roads have strong negative effects on bull trout (Hitt and Frissell, 1999).

In many habitats, trout survival and production are more affected by habitat condition than by food (Behnke, 1992; Rhodes et al., 1994; May, 2000). Trout require four habitat types during their life history: spawning habitat, rearing habitat, adult habitat, and over-wintering habitat. Road construction negatively affects all of these habitats (Furniss et al., 1991; Duff, 1996; Espinosa et al., 1997). Though road construction effects can be many and complex, some of the more serious impacts are increased sediment loads, damaged riparian areas, increased water temperatures, and changes in peak flow timing and magnitude. When fish spawn, they lay eggs in the gravel in the stream bottom. Fine sediment from roads can completely cover the stream bottom, smothering eggs. Sediment also reduces available habitat by filling in pools, reducing their number or frequency. Pools are vital to trout survival and production.

Habitat damage favors introduced species at the expense of native trout (Duff, 1996). Increased stream sediment loads from roads provide non-native trout with a competitive advantage (Behnke, 1992). Road construction effects can increase water temperatures (Meehan, 1991). Even temporary increases in water temperature help brook trout permanently replace native cutthroat trout (Behnke, 1992). In streams where cutthroat share habitat with other non-native salmonids, any habitat degradation is likely to shift the balance to dominance by non-native salmonids (Duff, 1996). Once non-native trout displace native trout, the situation is almost impossible to reverse (Behnke, 1992)

Roads have many other indirect impacts detrimental to native trout. They provide increased access for overfishing, increased livestock damage to streams, and for stocking of non-native fish; they also provide pathways for pathogens like whirling disease and an increased likelihood of toxic spills (Allan and Flecker, 1993; Rhodes, et al., 1994; USFS and BLM, 1997a; Brooks, et al., 2000; Trombulak and Frissell, 2000).

Roadless Areas and Wilderness Are Essential to Protect and Restore Native Trout

Complete roadless area protection is essential to native trout protection and restoration populations for many reasons. First, roadless areas and wilderness (and some national parks) provide key habitat for a number of native trout species, as documented by our GIS analysis and available literature. Roadless areas provide some of the best remaining trout habitat (USFS et al., 1993; Henjum et al., 1994; Wissmar et al., 1994; Rhodes et al., 1994; Huntington, 1998; Rhodes and Huntington, 2000). This is probably one of the primary reasons that major portions of existing populations of native trout are found within the undisturbed environment of roadless areas and wilderness. This, alone, is a compelling reason for protecting all remaining roadless areas and other undeveloped regions of the public lands.

Virtually every credible and independent assessment of salmonid population and habitat condition has concluded that roadless areas are essential to persistence and rebuilding of native salmonid populations. Such studies include work by independent scientists (Henjum et al., 1994; Wissmar et al., 1994; Espinosa et al. 1997; Huntington; 1998), tribal government scientists (Rhodes et al, 1994), inter-agency science groups (Anderson et al., 1993), and the federal government (USFS et al., 1993; NMFS, 1995; USFS and BLM, 1997a; USFS, 2000). Credible plans for protection and rebuilding of salmonid populations have repeatedly called for complete protection of all roadless areas greater than 1,000 acres (Henjum et al., 1994; Rhodes et al., 1994; Espinosa et al., 1997). Even assessments that failed to require roadless area protection acknowledged that the road building and logging in these areas was likely to undermine efforts to conserve and rebuild salmonid populations (USFS et al., 1993; NMFS, 1995; USFS and BLM, 1997a).

While roadless areas also typically maintain high quality habitat, the legacy of logging, roads, and/or grazing continues to degrade habitats in other areas. For instance, in a study of storm and flood effects on habitats of bull trout, westslope cutthroat trout, and steelhead trout in Idaho, habitats in a heavily roaded watershed underwent severe degradation by landsliding from roads and clearcuts, while habitats in an adjacent, but roadless, watershed experienced neither landslides nor habitat degradation (Rhodes and Huntington, 2000). Extensive surveys in bull trout, steelhead, and westslope cutthroat habitats in northern Idaho showed that streams in unroaded areas had higher quality habitat with significantly lower levels of fine sediment than those in roaded landscapes (Huntington, 1998). These differences were most pronounced in low gradient channels that are typically the most important for trout production (Huntington, 1998). Despite the relatively recent history of catastrophic wildfires in many unroaded watersheds, the higher quality habitat in unroaded areas tended to support more diverse and abundant populations of native trout (Huntington, 1998).

In a regional study of pools, a vital attribute of trout habitat, McIntosh et al. (2000) found that pool losses over a 50-year period had been severe in heavily roaded and logged watersheds throughout the interior Columbia River Basin, while pools either increased or remained unchanged in roadless areas during the same period.

Even when roadless areas do not encompass trout habitats, they help to maintain habitat quality downstream (Anderson et al., 1993; USFS et al., 1993; Rhodes et al., 1994; Henjum et al., 1994). Roadless areas provide a source of high water quality essential to trout and their habitats. These high quality intact roadless areas provide important havens for native trout populations that can help recolonize restored areas in the future (Anderson et al., 1993; USFS et al., 1993; Henjum et al., 1994; Rhodes et al., 1994; NMFS, 1995; May, 2000). This is important because, due to precarious condition of trout populations and the scale of habitat degradation, many trout populations need large-scale habitat restoration to avoid extinction (USFS and BLM, 1997a; b).

The majority of remaining roadless areas are extremely fragile and vulnerable to disturbance from logging and roading (USFS et al. 1993; Henjum et al., 1994; Rhodes et al., 1994; NMFS, 1995). While logging and roads always contribute to trout habitat damage, the physical setting and climate of most roadless areas makes it impossible to develop these areas via road construction or logging without causing persistent and severe negative effects on trout habitats and populations (Henjum et al., 1994; Rhodes et al., 1994).

Whether considering biology, cost, or logistics, it is also much more effective to avoid damaging aquatic habitat than attempting to restore damaged conditions (Reeves et al., 1991; Rhodes et al., 1994; Kauffman et al., 1997). In most cases, water quality and trout habitat damage from roads cannot be rapidly or fully arrested and reversed, even with costly intervention (Rhodes et al., 1994; Espinosa et al, 1997).

Many trout populations, like bull trout and most cutthroat trout populations, are severely fragmented and depressed. Much historic habitat is degraded, rendering all remaining habitat critical to native trout persistence (USFS and BLM, 1997a). Any further degradation increases the likelihood of trout extirpation (USFS and BLM, 1997a). These conditions make roadless area protection essential to protecting and restoring trout.

Recent studies have shown that the majority of isolated trout populations do not have adequate space for their long-term persistence (Hilderbrand, 1998). Scientists have estimated that the long-term maintenance of cutthroat populations requires two to twelve miles of occupied stream habitat (Hilderbrand, 1998). Few of the remaining populations have this amount of habitat. As a result, existing populations face a high risk of extinction from habitat degradation caused by roads, logging, grazing, mining, toxic spills, fire, as well as, non-native fish stocking.

High quality habitat for most trout populations is rare. High quality habitats in roadless areas are like islands in an ocean of degraded habitat (Henjum et al., 1994; Rhodes et al., 1994, NMFS, 1995). Most salmonid habitats in roaded and logged watersheds are significantly degraded (Henjum et al., 1994; Rhodes et al., 1994; NMFS, 1995; Espinosa et al., 1997; Huntington, 1998).

In a study of the role of designated wilderness in conserving aquatic biological integrity and sensitive species, researchers found that watersheds containing wilderness scored higher for aquatic biological integrity indicators (Hitt and Frissell, 1999). The study found that wilderness areas are important areas of biological integrity in western Montana and given their importance and rarity, unprotected areas with good aquatic biological integrity merit permanent protection (Hitt and Frissell, 1999). Densities of adult Colorado River cutthroat and juvenile lengths and weights are significantly higher in Uinta mountain wilderness reaches than in non-wilderness reaches (Kershner et al., 1997). Trout habitat quality was significantly higher in wilderness reaches (Kershner et al., 1997).

Finally, the USFS is now unable to adequately maintain the forest road system, which is the largest in the world (USFS, 2000). The current backlog of maintenance is several billion dollars. Additional road construction adds to the currently insurmountable and severe backlog in road maintenance (USFS, 2000). Lack of road maintenance increases damage to trout habitat, water quality, and watersheds (USFS, 2000). These findings also generally hold for BLM lands. In aggregate, the road network has also wracked up a currently insurmountable ecological debt. Road construction inexorably adds to that debt.

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