CONSERVATION STRATEGY
FOR
INTERIOR REDBAND
(*Oncorhynchus mykiss subsp.*)

in the States of
California, Idaho, Montana, Nevada, Oregon and Washington

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Acknowledgments

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Conservation Strategy for Interior Redband Trout (*Oncorhynchus mykiss subsp.*)

I. Introduction

This Conservation Strategy (Strategy) was developed by state fish and wildlife agencies in California, Idaho, Montana, Nevada, Oregon, and Washington, federal agencies, Indian Tribes, and Trout Unlimited, to provide a framework for long-term conservation of Interior Redband (Redband; *Oncorhynchus mykiss* subspecies *gairdneri, newberryi*, and *stonei*). Most were signatories to the Range-wide Conservation Agreement for the Conservation and Management of Interior Redband completed in 2014 (Agreement). Implementation of the Strategy is intended to be a collaborative and cooperative effort among signatories and other interested parties to support long-term conservation and management of the species throughout its range. Full implementation of the Strategy is expected to significantly reduce or eliminate threats to Redband populations and their ecosystems. This will substantially reduce the likelihood of its future listing under the Endangered Species Act of 1974, as amended (ESA), and implementation of the Strategy will also provide additional measures to enhance Redband populations and habitats that would not be required under the ESA. This document was designed to meet the requirements of a conservation strategy as specified in the USFWS policy for the evaluation of conservation efforts (68 FR 15100, 3/28/2003). These criteria are designed to ensure the certainty that the conservation effort will be implemented, and, when implemented, the conservation efforts will be effective. To ensure Policy for Evaluation of Conservation Efforts (PECE) compliance, USFWS cooperators contributed extensively during the development of the plan by serving on the Interior Redband Conservation Team. The Strategy has been reviewed by USFWS offices with the range of Redband.

This document provides goals and objectives for Redband conservation across its range, and specific stepwise goals, objectives and actions for each of the eight Redband Geographic Management Units (GMUs). When implemented, these measures significantly address the needed conservation efforts described above. As described in some of the GMU sections of this document, before specific conservation actions can be prescribed, additional sampling is needed to characterize the genetic status of these populations.

II. Background

The native freshwater *O. mykiss* populations occurring west of the Cascade and Sierra Nevada Mountains along the Pacific Coast are often referred to as coastal Rainbow Trout, whereas "interior" *O. mykiss* occurring east of the Cascade Crest are often referred to as Redband. Studies have shown genetic differences between coastal and interior *O. mykiss*, and in many cases interior populations are managed separately from coastal *O. mykiss*. Earlier work by Behnke (1992) identified three nominal subspecies of interior *O. mykiss*; Columbia River Redband *O. mykiss gairdneri*, (occurring east of the Cascades in the Columbia/Snake and Fraser rivers), northern Great Basin and Upper Klamath Lake Redband *O. mykiss newberryi*, and Sacramento Redband *O. mykiss stonei* (broadly applied to the diverse groups of Redband of the Pit and McCloud rivers). Recent evolutionary analysis by Currens et al. (2009) found that most genetic divergence among Redband groups has occurred between three major river systems (Columbia,

Klamath, upper Sacramento) resulting in three major interior genetic groups that align generally with the nominal subspecies proposed by Behnke. In the closed basins of southeast Oregon, some Redband populations were aligned with *O. mykiss gairdneri*, while others have an unclear taxonomic association with these other groups (Currens et al. 2009).

For this strategy, interior Redband are defined geographically as populations above anthropogenic or natural barriers where the maintenance of an anadromous migratory trait is not currently possible. As such, these populations are spatially separated (allopatric) from populations of con-specific steelhead or other anadromous salmonids. An example of con-specific separation is the Hells Canyon hydroelectric complex on the Snake River, above which anadromous forms have been extirpated. There is some evidence of sympatry between resident and anadromous forms of *O. mykiss* and, while the level of reproductive isolation or interaction between these forms is likely under some environmental control, the mechanisms are not clear (Zimmerman and Reeves 2002, Kendall et al. 2015). However, this Strategy focuses on Redband subspecies that are considered allopatric to steelhead, occupying non-anadromous portions of catchments, watersheds, and sub-basins, or wholly contained within interior basins having no natural hydrologic outlet to the Pacific Ocean. Redband populations occupy non-anadromous reaches within five major hydrologic basins in six western U. S. states and Canada: Upper Columbia and Fraser Rivers, the Snake River, Sacramento River, Klamath River, and the Closed Basins of southeast Oregon (**Error! Reference source not found.**).[1]

III. Species Description

Redband occupy a variety of freshwater habitats, from small streams to large rivers and lakes. Stream-dwelling forms live in a variety of vegetative and elevational biomes, ranging from high-desert streams in arid landscapes to forested montane streams. Their adaptation to such a wide range of environmental conditions may help explain why Redband remain the most widely distributed native salmonid in the Columbia River Basin (Thurow et al. 1997). However, many populations have declined in occurrence and abundance (Thurow et al. 1997), due largely to hybridization and competition with nonnative salmonids, and to land use that has resulted in habitat fragmentation, flow alteration, and degraded stream and riparian habitat.

In the interior Columbia River Basin, numerous studies have been conducted at several spatial scales on the habitat preferences of Redband and Rainbow Trout in streams. In vegetated montane streams, the presence of Redband has been positively related to the abundance of pools and negatively related to stream gradient (Muhlfeld et al. 2001), whereas in lowland desert streams, Redband presence has been associated more closely with shaded reaches of stream that block solar radiation and contain cooler stream temperatures (Li et al. 1994; Zoellick 1999, 2004).

Redband populations exhibit broad phenotypic diversity, including variable age-at-maturity, frequency and timing of spawning, seasonal timing and patterns of migration, longevity, habitat selection, temperature tolerance, and a host of other characteristics (Thurow et al. 2007). Life history traits of Redband are variable. At least three basic life history strategies have been described, based on how Redband use their available hydrologic network during their life cycle. Redband that migrate from lentic

[1] There are known isolated populations of Redband above barriers in subbasins that also support anadromous *O. mykiss. F*or example, the White River population in the lower Deschutes. The most appropriate GMU team will address how these cases are applied to the strategy.

waters to tributaries, mostly as a reproductive strategy, can express an adfluvial strategy. An example is the Kamloops Rainbow Trout that were historically present in Canadian lakes, Crescent Lake, Washington, and several isolated lake basins within the Northern Great Basin in Oregon (Moyle et al. 1989; Behnke 1992). Where Redband utilize both relatively larger streams and rivers and lower-order tributaries, they can be characterized as using a fluvial strategy. Redband with more restricted movements within stream networks are considered resident fish. Movement among habitats and populations may be an important mechanism for maintenance of genetic variability in populations (Leary et al. 1992) and for their persistence in variable environments (Rieman and Clayton 1997; Rieman and Dunham 2000). Local adaptation and selection for unique alleles resulting from isolation may also contribute to total genetic variability in the species (e.g. Lesica and Allendorf 1995; Gamperl et al. 2002). Introgressed forms of Redband, through hybridization with introduced Cutthroat Trout (*O. clarkia)* or coastal Rainbow Trout, have replaced native Redband in some areas today (Currens et al. 1997; Neville et al. 2009).

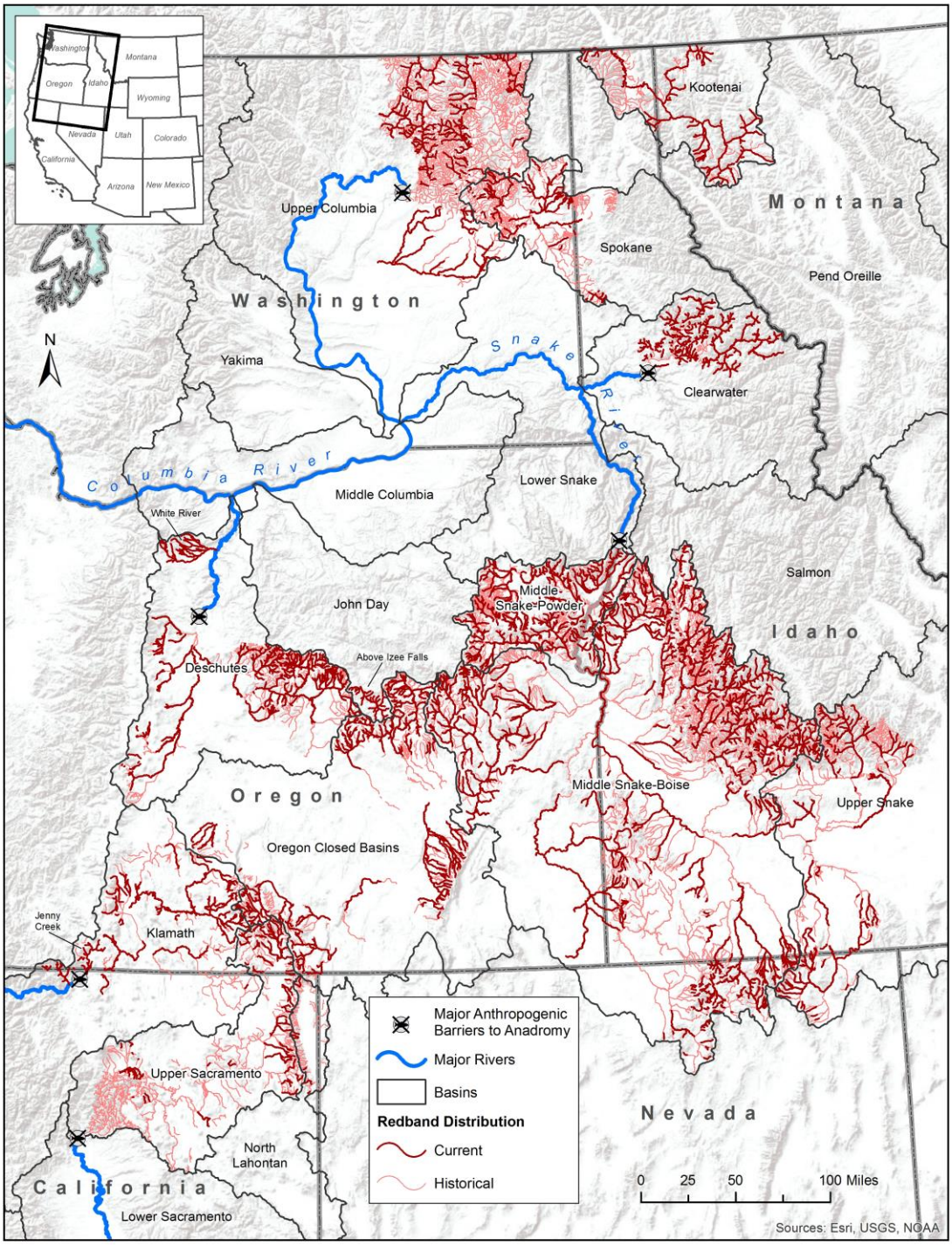

Figure 1. Distribution of interior Redband in the United States as applied to this Strategy. Map shows current Redband distribution (red lines) overlaid on estimated historical Redband distribution (light lines). Data are based mostly on the status assessment workshop in 2012, but in Oregon also includes distributions of known Redband populations that are isolated above barriers within drainages that have anadromous salmonids. Basin outlines and names are Hydraulic Unit Code (HUC) 6-digit nomenclature.

IV. Distribution and Status

Historical and Current Distribution

Although the distribution (occupancy) of Redband within its range is not completely known, estimates of historical and current distribution for drainages in the United States were developed as part of a range-wide status assessment in 2012, and reported in Muhlfeld et al. (2015). Estimates that follow are from those documents. At the HUC 8-digit scale (sub-basin), sixty nine sub-basins were identified as being historically occupied, and it is estimated that all of them currently support populations of Redband.[2] In total, an estimated 60,295 km (37,465 miles) of stream habitat were historically occupied (circa 1800), and of those 25,417 km (42%) are currently occupied (Table 4 in Muhlfeld et al. 2015). For lake habitats, an estimated 152 lakes were identified as being historically occupied compared to the current estimate of 124 lakes and/or reservoirs (184,504 hectares).

Based on the estimates provided by Muhlfeld et al. (2015), the estimated amount of habitat for each state is summarized in Table 1. A very minor amount of habitat (less than 1%) was estimated in portions of Canada that drain into the western United States (approximately 23 km historical, 21 km current).

Table 1. Estimates of amount of stream habitat occupied by Redband in the western United States (from Muhlfeld et al. 2015).

State	Historical (km)	% of Total	Current (km)	% of Total
Idaho	21,556	36%	8,928	35%
Oregon	19,839	33%	11,016	43%
Washington	10,598	18%	2,828	11%
California	4,606	7%	535	2%
Nevada	2,606	4%	1,301	5%
Montana	1,067	2%	788	3%

There were 286 historical barriers identified in the assessment (Muhlfeld et al. 2012). Nearly all of the historical barriers were associated with either waterfalls or high gradient cascades that limited upstream movement. In some instances, these barriers precluded Redband movement into otherwise suitable habitats.

Genetics—Muhlfeld et al. (2015) presented results as of 2012 from genetic testing conducted across 450 stream sites. They used these sites to infer genetic status for an estimated 4,473 km (18%) of occupied stream habitats. No evidence of introgression was found from samples associated with 1,930 km (8% of current stream habitat). Introgression (of at least 1%) was detected in samples from 2,543 km (10%) of currently occupied stream habitat. Sites tested and found to support genetically pure Redband co-existing with introgressed Redband amounted to 134 km of stream habitat. The majority of Redband populations in 20,944 km of stream habitats had not been genetically tested. To predict the probable genetic make-up of Redband in these untested stream habitats, the authors assigned suspected genetic status based on two factors: 1) stocking records of potentially hybridizing species and 2) the current presence of hybridizing species co-existing with Redband in untested stream habitats. Based on that

[2] The GMU section of this strategy has tables that break down these estimates at the HUC 8-digit scale.

review, it was estimated that 11,179 km (44% of occupied) of stream would likely contain introgressed Redband populations. The remaining 9,765 km were suspected to be genetically unaltered because there were no records of stocking or presence of non-native species. Combining the tested and estimated stream lengths, a total of 11,695 km (46% of occupied) of stream habitat supported genetically unaltered Redband, which represented only 19% of the historical range.

Of the 184,504 hectares of lake habitat currently occupied by Redband, 35,030 ha (19%) were considered genetically unaltered (Muhlfeld et al. 2015). Another 8,779 ha (5%) had introgression levels ranging from 1% to over 20%. Lake habitats tested and found to support genetically unaltered Redband co-existing with genetically altered Redband amounted to 36,628 ha (20%). Redband in approximately 104,067 ha (56% of total lake hectares) of lake habitat had not been genetically tested. The probable genetic status of the untested Redband populations in these lake habitats was suspected to be 60,376 ha (33%) with some level of introgression, while 43,691 ha (24%) were likely to support core conservation populations of Redband.

Status--State and federal agencies have various designations for Redband, including species of concern, sensitive species, and sport fish. Redband in the Kootenai River Basin, the Snake River between Brownlee Reservoir and Shoshone Falls, and the Great Basin were separately petitioned for listing under the Endangered Species Act in the early to mid-1990s. The U.S. Fish and Wildlife Service determined there was insufficient information for listing Redband in the Kootenai River Basin and determined it "not warranted" for listing in the Snake River and Great Basin (US Fish and Wildlife Service 2000).

The 2012 range-wide Redband assessment found even though the species occur in only 42% its estimated historical range, it was not viewed as being at imminent risk of extinction (Muhlfeld et al. 2015). The assessment suggested Redband are still widely distributed, many populations are isolated from the threat of hybridization/introgression, and conservation activities are being implemented throughout their range. However, the long-term persistence of the species is dependent upon continued and strategic conservation efforts.

Muhlfeld et al. (2015) estimated there were 210 populations of Redband considered to be conservation populations, and 49 of these were identified as core conservation populations (defined below). The 210 conservation populations occupied approximately 15,252 km of stream habitat (60% of the currently occupied stream habitat) and 95,158 hectares of lake habitats (approximately 52% of the currently occupied lake habitat). One core conservation population occupied only lakehabitat. Several occupied both stream and lake habitats. Most occupied only stream habitats. Conservation populations were found in 56 of the 69 sub-basins that supported the current distribution of Redband. The number of conservation populations within each sub-basin ranged from 1 to 16 populations.

V. Definitions

3R Analysis--The 3R Framework (Haak and Williams. 2012) was used to inform the development of the rangewide conservation strategy through maps and summaries. The 3R Framework seeks to quantify the 3Rs (Representation, Resiliency, and Redundancy) in a spatially explicit manner in order to support comparisons of population diversity over space and time. The quantification process creates a highly transparent and replicable framework that can be consistently applied to different regions over different time frames by different practitioners. In order to accomplish this, the 3R Framework is based on a series

of quantitative rule sets that are applied to population scale data. Although the rule sets are grounded in the relevant scientific literature, there may still be debate over the criteria as applied to different species. However, if the methodology is intended to be replicable, it is important that the rule sets be consistently applied across a species' range. Therefore, appropriate rule sets based on the literature and expert knowledge of the species should be defined prior to the application of the 3R Framework.

Geographic Management Unit (GMU) – For coordination and reporting purposes, the Redband range-wide distribution was divided into seven Geographic Management Units (GMUs) providing a more feasible structure for collaboration on conservation and restoration activities. The GMUs represent major river basins (HUC 6-digit) and each contains several HUC 8-digit sub-basins. However, they do not necessarily reflect important differences in genetic, biological, or ecological variability in Redband based on adaptations to specific environments. State boundaries were not considered when GMUs were identified, since they should not necessarily influence Redband conservation efforts. Experience with other interior salmonid conservation programs indicated that GMUs represent a more feasible, practical, and meaningful structure to organize and implement conservation throughout the distribution of Redband.

Historical Distribution – The historical range is based primarily on historical fisheries data, fisheries reports, and published historical accounts, augmented with personal knowledge of the areas, known anecdotal information, known habitat restrictions, and known barriers of historical significance. Barriers of historical significance are those that would have precluded Redband from occupying habitat segments at any time prior to 1800. These barrier determinations, by necessity, will be based primarily on professional judgment.

Current Distribution – Habitat segments currently occupied by Redband.

Genetic Introgression – Genetic introgression is the repeated backcrossing of hybrid descendants with a parental line, population, or species, resulting in the incorporation of genes from one gene pool into another (Hallerman 2003). For Redband, most cases of genetic introgression are the result of intraspecific crosses with hatchery strains of Rainbow Trout. However, Redband hybridization with Cutthroat Trout has also been documented, but at a lesser frequency. Some introgressed populations may offer genetic, ecological, or behavioral attributes valuable to conservation efforts for the subspecies. As part of classifying Redband populations during the range-wide status assessment (Muhlfeld et al. 2015), participants used the Interior Cutthroat Trout Protocol (May and Shepard 2007) to designate known or suspected conservation populations. The protocol adheres to the recommendations of a multi-state position paper on genetic considerations concerning Cutthroat Trout management (UDWR 2000). This method provides a defensible and agreeable approach to the classification of and ultimately to the protection and conservation of genetically pure populations of Redband.

Phenotype – Physical, physiological, or behavioral traits expressed by an organism that are due to the interaction of the organism's genetic makeup with its environment or the physical manifestation of a genotype (e.g., coloration pattern; Hallerman 2003).

Redband Conservation Team – A team of Redband conservationists consisting of representatives of agencies and organizations that were signatories of the Redband Conservation Agreement. Their overall goal is the protection and recovery of Redband throughout its range.

Conservation, Core, and Sportfish Populations – In 1996, the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration proposed a policy on the treatment of intercrosses and intercross progeny (the issue of hybridization; 50 CFR Part 424, 61 FR 26). This policy was intended to clarify the role that hybridized populations should play in status determinations and conservation strategies. However, the proposed policy was never finalized. In the absence of a federal policy, the states developed their own guidelines that are consistent with the proposed federal policy. Those guidelines are reflected in a position paper on genetic considerations associated with Cutthroat Trout management (UDWR 2000). The Redband Conservation Team adopted that paper to guide genetic considerations for Redband conservation and management. Federal Court decisions on Endangered Species Act listing determinations for Westslope Cutthroat Trout upheld the Fish and Wildlife Service's criteria used to determine genetic status. The criteria adopted by the Redband Conservation Team are more conservative and are described below.

Core Conservation Population – The Redband Conservation Team defined a core conservation population as a conservation population that contains 100% Redband (0% introgression) based on accepted genetic testing protocols or no historical stocking record or presence of non- native hybridizing species. These populations serve as the primary source of gametes for assisted colonization and re-introductions through transplants, for improving genetic status of existing hybridized populations, and for broodstock development. These populations should not receive genetic material from other population sources unless there is evidence that loss of fitness, reduced reproduction, or reduced survival has put the population in jeopardy.

Conservation Population – A conservation population is a naturally reproducing population of native Redband that is managed to preserve the historical genome and/or unique genetic, ecological, and/or behavioral characteristics. In some circumstances, conservation populations may be managed through periodic supplementation for the purpose of maintaining genetic refugia, or when "genetic swamping" is being attempted to increase the purity level of the population. In situations where supplementation is used as a conservation tool, the most appropriate genetic strain (i.e., nearest neighbor) should be determined through genetic testing. As a general criterion, a conservation population should be at least 90% Redband (<10% introgression from other salmonid species or subspecies), but may be lower depending on circumstances (such as a rare population that is more representative of the closest GMU than distantly located designated conservation populations). Conservation populations retain all of the phenotypic attributes associated with the species/subspecies. This definition includes situations where genetically pure individuals coexist with introgressed or other non-native individuals or they occur as "hybrid swarms". Conservation populations (other than Core populations, defined above) typically would not be used to develop broodstock for conservation purposes, but may be considered as sources for introductions or reintroductions when the objective is to foster unique ecological, genetic, or behavioral attributes. Since it is important to preserve as much Redband genetic diversity as possible, it may be necessary to accept a small amount of hybrid influence in order to preserve a larger amount of Redband diversity, ultimately a management decision by state and tribal fishery managers.

Sportfish Population – A sportfish population is a wild or hatchery-sustained Redband population that is managed primarily for the benefit of recreational fisheries. However, populations classified as sportfish populations, especially extant wild populations, may have conservation value, but their conservation value is uncertain or of lower priority than the core or conservation populations.

VI. Species Threats

As with other interior salmonid species, the distribution and abundance of Redband has declined due to anthropogenic influences. The introduction of non-native salmonids and non-salmonids (e.g., Smallmouth Bass) has led to competition, hybridization, disease, and predation, and are considered to be key factors in declines of Redband. In addition, Redband habitat has been lost, degraded and fragmented within a significant portion of its historical range. Causes include land and water use practices (e.g., agricultural and grazing practices, dam construction, water diversions, logging, road building, etc.). Non-point source pollution, sediment and runoff associated from urban development, reduced stream flows, altered thermal regimes due to drought and/or climate change, and habitat disturbance due to uncharacteristically large forest fires are growing concerns. The following categories, organized by Endangered Species Act listing criteria, present more in-depth discussions of threats that have contributed to the decline of Redband.

A. Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range

Anthropogenic factors have influenced Redband status and distribution (Thurow et al. 2007). In forested, higher-elevation areas the status of Redband was negatively associated with increasing road density (Lee et al. 1997). Work at finer scales has also described the result of habitat degradation. Redband habitats have been altered by a host of land use practices (Williams et al. 1989). Water diversions for irrigation affect many Redband populations in the southern portion of the range, through dewatering of stream reaches, loss of fish in unscreened diversions, blockage of migration corridors, and alteration of stream channels. The loss or conversion of riparian cover has been caused by livestock grazing, timber harvest, mining, urbanization, and agriculture (Meehan 1991). Although removal of canopy by fire may benefit production in colder, high elevation streams (Rieman et al. 1997), the loss of riparian cover has been associated with excessive temperature and reduced abundance and production in warmer and drier environments (Li et al. 1994, Tait et al. 1994). Floodplain development and alteration (roads, diking, etc.) has led to loss of channel complexity (Bottom et al. 1985) and changes in nutrient pathways (Schlosser 1982), invertebrate production (Benke et al. 1985), and fish production. In Idaho, unaltered stream reaches supported 8 to 10 times the densities of Redband observed in altered channels (Thurow 1988). Habitat alterations may reduce the resilience and stability of the entire aquatic assemblage (Pearsons et al. 1992). Declines of fluvial forms, in particular, have been most common in larger low-elevation streams that have historically been the focus of agricultural, residential, and other forms of development.

A portion of populations presently defined as interior Redband are located within the historical range of anadromous conspecifics and are artificially isolated due to the presence of impassable anthropogenic barriers, in contrast to interior Redband populations isolated by geologic events (Currens et al. 2009; Muhlfeld et al. 2015). Despite isolation from anadromy, Redband still maintain a diversity of life history patterns. For example, physiological indicators of smoltification have been documented among adfluvial *O.mykiss* individuals in the Snake River GMU, though it is unclear the extent to which this documentation may be influenced by stocking practices (Holecek et al. 2012, Holecek and Scarnecchia 2013). The extirpation of anadromous *O. mykiss* may affect the resilience of some GMUs to environmental variation (Pascual et al. 2001, Thrower and Joyce 2004, Courter et al. 2013, Weigel et al. 2013, Weigel et al. 2014). Genetic diversity among interior Redband populations, an important component of species representation, may be supported by the restoration of connectivity and expression of migratory life history forms historically present (Currens et al. 2009, Haak and Williams 2012). Loss of anadromy may

constitute a long-term threat to interior Redband, but reestablishing the anadromous life history is beyond the scope of this document. The putative metapopulation effects of lost anadromy could be evaluated for pertinent GMUs for meeting the management framework presented in this document.

B. Overutilization

Although overharvest by anglers may have historically affected Redband populations, it is currently not considered a threat. Fishing rules, including seasonal harvest and gear restrictions, have effectively decreased risk associated with Redband fisheries. Many Redband populations occur in remote drainages with difficult access, naturally limiting angling impacts. Schill et al. (2007) found average exploitation of 0.6-0.9% annually in remote desert Redband streams of southwest Idaho. Granted, this is much lower than other more accessible montane streams for which data are also available but not readily published. They concluded that Redband residing in streams within southern Idaho are virtually unexploited and that angler harvest is well below levels observed on other Idaho Redband fisheries in more accessible montane environments.

Monitoring Redband populations is an ongoing process in all six states within the conservation strategy area. Scientific collections of Redband are carefully regulated by state agencies across the range of the subspecies, to prevent issues of overuse. Commercial harvest is not allowed anywhere across the range of Redband. Based on ongoing monitoring programs, overuse does not impact the current status of the species.

C. Disease

May et al. (2012) summarized the risk to Redband populations from disease in an update to the rangewide status assessment. The number of Redband trout conservation populations determined to be at limited risk from serious diseases was 137 populations (65% of total populations). It should be noted that there were no populations identified as being at high risk as a result of co-existing with known diseased fish. The diseases of concern are ones that could have severe negative effects on population health, including (but not limited to) whirling disease, furunculosis, and infectious pancreatic necrosis. As with the risk of hybridization, the risk of disease depends primarily on the distance to sources of disease and the existence of barriers to transmission (Muhlfield et al. 2015).

Information is lacking on the factors influencing the spread of diseases from fish introductions. Whirling disease (caused by *Myxobolus cerebralis*) has emerged as an issue of controversy and concern for its potential effects on wild Redband populations in the western U.S. (Hulbert 1996). Although several ecological factors appear to influence disease epidemics, these relationships are not clearly defined. Nehring and Walker (1996) suggest with the lack of a disease sampling protocol, whirling disease effects can be masked by other factors, including harvest or natural mortality. Thurow et al. (2007) suggest rainbow Trout are among the most susceptible salmonids to mortality caused by whirling disease.

Trout and salmon that are indigenous to areas with *Ceratonova shasta* have resistance to the parasite that causes ceratomyxosis (Bartholomew et al. 1989, 1992). Currens et al. (1997) examined the susceptibility of Redband from the Metolius River (tributary of the Deschutes River, Oregon) to genetic introgression and ceratomyxosis as a result of stocking nonnative hatchery Rainbow Trout. They concluded that because of a long history of stocking nonnative Rainbow Trout, wild Rainbow Trout became increasingly susceptible to ceratomyxosis due to introgression with the nonresistant strains of

hatchery Rainbow Trout. Across the range of Redband, state fish and wildlife agencies have stocked various strains of hatchery Rainbow Trout.

D. Inadequacy of Existing Regulatory Mechanisms

There are numerous federal and state regulatory mechanisms in place that, if appropriately and adequately administered, funded, and implemented, provide a high degree of protection to Redband and their habitats throughout its range. Federal land management agencies such as the USDA Forest Service and Bureau of Land Management adhere to federal laws (e.g., National Environmental Policy Act, Clean Water Act, Endangered Species Act, etc.), regulations, rules, and policies. As part of implementing or allowing and implementing management actions on public lands, federal agencies must routinely consult with federal fish and wildlife regulatory agencies regarding potential impacts on federally listed fish and fish habitat.

Western states within the current Redband range have statutes, rules, or regulations addressing forest practices, stream channel and wetlands protection, water quality, water rights, instream flows, habitat mitigation, live transport of fish, private fish ponds, fishing rules, and scientific fish collection permits. State fish and wildlife agencies and Tribes also generally have statewide or species-specific fish management plans. These plans tend to be comprehensive and generally describe how an agency to protects, conserves, and manages native species and sport fisheries. State and Tribal agencies establish fishing regulations to further conserve the species. Appendix B summarizes how state and Tribal fish and wildlife agencies approach Redband and other native trout conservation and management through their statutory authority, establish fishing rules to protect Redband populations.

Although existing regulations and policies that benefit Redband exist for Federal, State, and Tribal agencies, challenges remain for consistent and effective management of the species. Challenges include consistency between and within agencies within the immense range of the species, limited funding and personnel available for proactive management of fish and their habitat, and remaining impacts upon Redband populations as a result of other management emphases such as hatchery augmentation of popular fisheries or land uses in stream corridors impacting riparian areas. Full implementation of this conservation strategy will help resolve these inconsistencies.

E. Introduced Species

The introduction and subsequent spread of nonnative trout and other fishes are a significant long-term threat to Redband. Across the range of Redband, Brook Trout, Rainbow Trout, Brown Trout, Cutthroat Trout, Smallmouth Bass, Common Carp, and other non-native fish species have become established following intentional stocking or invasion. These non-native fishes present a wide range of threats to Redband including competition, hybridization/introgression, and predation. Non-native fish, represented by one or more species, co-exist with Redband in 13,490 km (53%) of stream habitat (Muhlfeld et al. 2015). Climate change is anticipated to warm stream temperatures in some locations within the range of Redband, potentially expanding habitat for warm water predators and expanding their range into habitats previously too cold for them to inhabit (Sharma et al. 2007). Higher bio-energetic demands on predators may cause increased consumption of native salmonids (Petersen and Kitchell 2001) which may further reduce the distribution of Redband beyond any reduction that warmer water temperature may directly cause.

Genetic introgression with introduced strains of Rainbow Trout and Cutthroat Trout is a significant risk to the long-term persistence of Redband and is discussed in the genetics section of this document.

The impacts of introduced non-native trout species or stocks on Redband populations are still a major conservation concern, although primarily from a legacy perspective. The six states and Tribes have promulgated rules, regulations, and policies to address native trout populations and habitat, disease control, and fishing rules. Stocking non-native trout in ponds by private parties is regulated in all states to protect native trout populations. However, detecting illegal stocking and enforcing applicable regulations can be difficult. Decreasing the illegal stocking by private landowners will require a targeted outreach campaign to educate landowners of the negative impacts of stocking on native fish populations.

A growing issue facing fishery and habitat managers is the increasing threat of aquatic invasive species (AIS). Preventing the introduction or establishment of AIS is the most efficient and economical method of controlling these undesirable species due to the cost of removal and low potential of a successful treatment. Proactive AIS management programs exist in State, Federal, and Tribal entities. Approaches include outreach, inventory/monitoring, and protection. Protection includes boat inspection stations, fishing and boating protocols, and equipment and vehicle washing. Most of the states within the range of Redband maintain inspection stations in an interstate coordinated effort.

VII. Goals and Objectives

Implementation of the Strategy will be based on the following goals and objectives, which were adapted from the Conservation Agreement.

Goal 1 – Identify and manage Redband conservation populations to achieve conservation objectives and provide recreational and subsistence opportunities.

Objectives

1.1 Continue to identify Redband conservation populations within the historical range and identify data needs to direct conservation efforts for those populations.
- Collect information on population-level parameters (abundance, spatial distribution, diversity, etc.). Utilize this information to develop comprehensive population-specific management and maintenance and/or monitoring programs.
- Collect information on genetic introgression of Redband populations through time to inform restoration and conservation efforts. Prioritize sampling for those populations thought to be genetically pure.
- Collect information on habitat conditions and the potential for enhancement or protection, in the context of prioritizing habitat actions across and within GMUs.
- Develop a system for managing data collected. Maintain population-specific data in a GIS format (geo-referenced) so they can be accessed and updated by GMU teams (see Goal 5 below).
- Include GMU-scale monitoring variables of climate change that could influence achieving conservation goals within GMUs (as determined by GMU teams), but also pose risks to the range-wide status and distribution of Redband.

- Consider developing an interagency within-GMU drought strategy establishing a protocol for agencies to implement to protect vulnerable populations during extreme drought conditions.

1.2 Maintain and enhance, where possible, the abundance and spatial distribution of all core conservation (first priority) and conservation populations (secondary priority) of Redband throughout their historical range.

- Maintain, protect, and/or improve aquatic and riparian habitat and species assemblages associated with Redband populations through efforts to enhance aquatic habitats and connectivity between good habitat, and improve land use practices that currently constrain ecosystem functionality (hydrologic regime, temperature buffering, sediment processing).
- Manage the impacts of angling through fishing regulations and their enforcement.
- Evaluate biotic interactions (genetic, ecological) that pose a threat to Redband populations, including non-native fish interactions. Develop population-specific efforts to minimize and/or eliminate exposure or sensitivity to these threats.

Goal 2 – Manage the genetic integrity of core and conservation populations of Redband, with targets and strategies developed by GMU teams.

Objectives

2.1 Protect the genetic integrity of existing Redband populations. For most populations the strategy will be to promote local adaptation. For others, the strategy will be to protect a genetic legacy.

2.2 Continue to sample for and identify core conservation populations.

Goal 3 – Apply decision tools to identify priority information gaps for the management and conservation of Redband.

Objective

3.1 Assess biological and environmental vulnerabilities from GMU-level projections of climate change. Use vulnerability assessments to identify best places to implement actions. For example, use relative climate change vulnerabilities to identify best places to implement different kinds of climate adaption actions.

Goal 4 – Expand Redband distribution within GMUs and across the historical range through expansion of some populations and restoration and/or reintroduction of other populations.

Objective

4.1 Where necessary and feasible to secure local, regional, and range-wide genetic diversity, and to increase the overall distribution of Redband, increase the number of conservation populations (population replication strategy).

- Establish local adaptation in other areas by reintroducing fish to extirpated drainages (reintroduction within the range (assisted colonization). Prior to re-introduction, the factors that led to extirpation will be addressed first. For assisted colonization, GMU teams will work within the interpretations of adopted translocation policies.
- Source populations used for establishing new conservation populations should be

genetically pure Redband ideally from healthy populations in the same sub-basin (HUC 10-digit). Development of captive conservation broodstock programs will be coordinated with the Conservation Team.

Goal 5 – Develop and maintain a Redband database and web portal to meet the following objective.

Objective

5.1 Use a geo-referenced database easily accessed and updated in a consistent format that allows integrated data summaries and comparisons between and among GMUs. The database should be designed to allow a standardized approach to Redband enhancement efforts.

- Look for opportunities to collaborate with existing web-based outreach such as WNTI, NWPCC, and USFWS.
- Maintain and share population-specific information (e.g., historical, current distribution, migration barriers, expansion potential, and conservation population genetic data).
- Use the database to summarize and share existing information on watershed condition, ecosystem restoration, and land conservation accomplishments.
- The Conservation Team, including the GMU Leaders, will meet to determine the frequency and forum for individual GMU and rangewide database updates.
- Maintain data standards that are compatible with existing agency distribution databases to facilitate data exchange.

Goal 6 – Initiate an administrative framework that improves cooperation and coordination between agencies and entities involved in the conservation of Redband.

Objectives

6.1 A range-wide Conservation Team consisting of members that are signatory to the Conservation Agreement has been established.

6.2 The Conservation Team will hold annual coordination meetings at agreed upon locations (ongoing).

- Minutes of the annual Conservation Team meeting will be distributed to all members of the Conservation Team and other interested parties upon request (ongoing).
- The Conservation Agreement and Strategy shall be reviewed annually by the Conservation Team.
- Other parties are encouraged to become members of the Conservation Team and can also become signatories to the Conservation Agreement in the future.

6.3 The GMU teams will facilitate focused conservation planning, implementation, and monitoring (started and ongoing) specific to their GMU.

- The GMU Team leaders will direct and schedule annual coordination meetings with GMU participants to discuss conservation planning and implementation, and to evaluate conservation effectiveness.
- At the annual coordination meeting, a summary report will be provided by the GMU team to the Conservation Team.

VIII. 3Rs: Representation, Resiliency, and Redundancy Analysis

The Interagency Redband Conservation Team met in Boise June 22-23, 2015, to review a Representation, Resiliency, and Redundancy (3R) Analysis for Redband. They used data collected during the Redband status assessment and were led through the process by Amy Haak of Trout Unlimited (TU).

The 3R Framework is a conservation planning tool that can organize range-wide conservation strategies through development of conservation portfolios. While the 3R Framework concept has been in the conservation biology literature for well over a decade (Shafer and Stein 2000), TU quantifies the 3Rs in a spatially explicit manner from which spatio-temporal comparisons can be made of population diversity. To achieve this, the 3R Framework uses a series of quantitative rule sets that are applied to population scale data. The process creates a highly transparent and replicable framework that can be consistently applied by practitioners across different regions and over different time frames. For trout species the 3R Framework developed by TU was originally applied to framing the conservation status of Cutthroat Trout subspecies (Haak and Williams 2012). The rule sets are based on published studies primarily related to Cutthroat Trout and the metrics chosen utilize data that are typically available in the spatial databases developed for the Cutthroat Trout range-wide status assessments.

The Conservation Team worked with TU to develop Redband rules for three conservation attributes: representation, resilience, and redundancy. The criteria are listed below, followed by the Redband results in Tables 2-4 for hydrologic basins. For spatial reference, the 3R results are also displayed as maps in Appendix A.

Representation

- Genetic Integrity: 99% unaltered
- Life History: population supports a migratory form (fluvial or adfluvial)
- Geographic: populations have evolutionary history of isolation

Resilience

- Tier 1 Stronghold: 27.8 km **or** 10,000 ha patch size
- Tier 2 Stronghold: 27.8 km **and** 10,000 ha patch size
- Metapopulation: 50 km, 25,000 ha patch size and migratory life history form present

Redundancy

- Less than 10% hybridized (includes populations classified as ‘mixed’ or ‘co-existence’)
- Satisfies persistence criteria based on a combination of occupied stream or lake habitat, population density and abundance, and patch size. A classification of ‘Unknown’ for population density was assigned to the lowest density class (i.e. 0-35 fish/km) and abundance was calculated based on the mid-point value for each density range weighted by occupied stream length. Minimum thresholds for metrics used were 9.3 km stream habitat, 5,000 ha patch size, and 1250 population abundance. The presence of lacustrine habitat and data confidence levels (e.g. major or minor sampling) for population density was taken into account when making a persistence determination.

The 3R analysis results help inform GMU-specific conservation actions, which are described in Section X. Specifically, GMU teams organized their strategies as opportunities to improve some attributes of the 3Rs. Accordingly, conservation strategies are nested under 3R opportunities in the GMU section of this document. These 3R-specific strategies are to be developed by the respective GMU teams.

Table 2. Results of 3R analysis for Redband conservation populations in hydrologic basins.

Basin Name	Total Number of Pops.	Occupied Habitat		Representation			Resiliency			Redundancy
							Strongholds		Meta-pop. (pops.)	Persistent and <= 10% Introgressed
		Stream (km)	Lake (ha)	Genetic Integrity (pops.)	Life Hist. Diversity (pops.)	Geographic Diversity (pops.)	Tier 1	Tier 2		
Clearwater	1	1,279	6,622	0	1	0	0	0	1	1
Deschutes	14	2,224	12,135	4	12	0	2	3	6	10
Klamath	10	940	84	9	10	0	0	1	6	9
Kootenai	9	1,000	121	4	6	0	0	2	3	6
Middle Snake -Boise	36	3,626	1,911	27	11	0	2	8	8	22
Middle Snake – Powder	3	196	0	2	3	0	1	1	1	3
North Lahontan	6	57	114	3	3	0	0	0	0	2
Oregon Closed Basins – East	16	1,782	547	11	3	1	0	5	2	6
Oregon Closed Basins – West	12	687	17	7	4	11	2	3	2	8
Spokane	29	720	2,148	14	10	0	4	3	2	10
Upper Columbia	34	1,752	31,641	18	6	0	2	4	5	8
Upper Sacramento	35	807	39,819	13	4	0	0	6	1	7
Upper Snake	5	183	0	5	2	0	0	1	1	4
Total	210	15,252	95,158	117	75	12	13	37	38	96

Table 3. Results of 3R analysis for Redband non-conservation populations in hydrologic basins.

Basin Name	Total Number of Pops.	Occupied Habitat		Representation			Resiliency			Redundancy
							Strongholds		Meta-pop. (pops.)	
		Stream (km)	Lake (ha)	Genetic Integrity (pops.)	Life Hist. Diversity (pops.)	Geographic Diversity (pops.)	Tier 1	Tier 2		Persistent and <= 10% Introgressed
Deschutes	14	82	38	7	4	0	0	0	0	3
Klamath	12	122	36,460	9	2	0	2	1	0	1
Kootenai	4	18	441	1	1	0	0	0	0	0
Middle Snake -Boise	209	5,650	22,110	116	47	0	3	11	21	41
Middle Snake – Powder	25	2,341	7,330	9	10	0	1	0	6	3
Oregon Closed Basins – East	3	15	102	1	2	0	0	0	0	0
Oregon Closed Basins – West	30	130	17,885	19	2	30	3	0	0	4
Spokane	8	32	58	6	1	0	0	0	0	1
Upper Columbia	13	381	77	1	2	0	1	2	1	1
Upper Sacramento	7	36	84	4	1	0	0	0	0	0
Upper Snake	43	1,355	3,348	10	11	0	3	3	6	4
Total	368	10,163	87,935	183	83	30	13	17	34	58

* Populations defined based on connectivity of current distribution (exclusive of conservation populations) using barrier data to define breaks between populations.

Table 4. Basin-level summary of 3R results for conservation populations of Redband.

Basin Name	Portfolio Summary	Conservation Opportunity
Clearwater	Resilience and life history diversity: large fluvial and adfluvial populations with mixed genetics	Habitat protection and control of non-natives where possible. Habitat restoration that favors Redband over introduced trout can help to secure population.
Deschutes	Resilience and life history diversity: well-connected fluvial and adfluvial populations above and below reservoirs with mixed genetics. Some genetically unaltered populations present in small stream segments	Expansion of small genetically unaltered populations and control of non-natives in larger populations. Lakes and reservoirs particularly problematic – all are greater than 10% hybridized. Habitat restoration and flow management from reservoirs that favor Redband over introduced trout can help to secure populations.
Klamath	Genetics, life history, and resilience: well-connected migratory populations that are genetically unaltered; representation of *newberryi* subspecies.	High priority for protection of genetics and migratory life history. Klamath Lake and Klamath River below the lake are also unaltered but not included as conservation populations.
Kootenai	Resilience and life history diversity: large fluvial populations but hybridization is a significant issue. Mainstem below Callahan Creek is >10% hybridized.	Protection of headwaters of Yaak which supports only unaltered migratory population in GMU. Increase genetics representation by reestablishing populations in historical habitat above existing barriers to lower main stem Kootenai River.
Middle Snake-Boise	Genetics, life history, and resilience: includes 5 metapopulations that are unaltered and another one with mixed genetics.	Large GMU that supports 24% of habitat occupied by conservation populations. However, this is less than 18% of historical habitat in GMU. 12 of 23 sub-basins do not contribute to redundancy. 116 non- conservation populations in GMU occupy 1325 km of stream habitat and may provide opportunities to increase representation and redundancy within GMU where limiting factors can be addressed.
Middle Snake-Powder	Genetics, life history, and resilience: all 3 populations are resilient and migratory and two are unaltered while the third and largest has mixed genetics.	Limited distribution in GMU – less than 4% of historical habitat. All populations are located within 1 sub-basin. Non-conservation populations in Pine Creek (unaltered) and Eagle Creek and Powder River (mixed genetics) may provide opportunities to increase representation and redundancy in GMU.
North Lahontan	Genetics: very limited distribution with unaltered populations occupying only 15 km of stream habitat and 6.5 ha of lake habitat. Important for	Establishing new populations in historical habitat will help to increase redundancy and preserve genetics.
Oregon Closed Basins East	Unique geographic diversity in Rock Creek but population is hybridized. Large populations in northeast provide resilience. Populations to south in Skull and Home creek provide representation for	Protection of large populations in Silvies River and Donner und Blitzen River.

Table 4. Continued.

Basin Name	Portfolio Summary	Conservation Opportunity
Oregon Closed Basins West	Geographic diversity: unique populations with evolutionary history of isolation. 7 populations genetically unaltered and 3 are mixed genetically.	Control of non-natives in order to maintain unique genetics.
Spokane	Genetics and redundancy: half of the populations are unaltered but they are small and occur in just 22% of stream habitat occupied by conservation populations. All sub-basins support populations that contribute to redundancy.	Potential opportunities to expand and reconnect populations in headwaters of Hangman Creek which supports some unaltered populations and mixed genetics. Little Spokane River supports large migratory population with mixed genetics. Habitat restoration that favors Redband over introduced trout can help to secure population as well as potential reconnection to tributaries that could support unaltered populations if non-natives can be controlled.
Upper Columbia	Genetics and life history: multiple fluvial and adfluvial populations with pure and mixed genetics present throughout the GMU.	Protection of the Sanpoil River adfluvial (spring and fall runs) and fluvial populations in Crab Creek provides best opportunity for maintaining representation within GMU. Habitat protection, harvest regulations and the control of non-native species will conserve current population diversity.
Upper Sacramento	Important for representation of *stonei* subspecies. Goose Lake population provides resilience with migratory life history and mixed genetics.	Control of non-natives as possible and protection of habitat supporting Goose Lake population.
Upper Snake	Genetics and life history: all 5 populations are unaltered and two are migratory. 4 populations are located within the same sub-basin.	Limited distribution in GMU – less than 4% of historical habitat concentrated primarily in one sub-basin. Unaltered non-conservation populations in upper tributaries to Salmon Falls Creek may provide opportunities to reconnect and expand conservation population in drainage. Increasing representation in other sub-basins will require control of non-natives.

IX. Interior Redband GMUs

Due to its locally based specificity, this chapter is considered the backbone of the conservation strategy. The significance and strength of the specific GMU sections are steeped in the overall strength of the Redband Conservation Team, consisting not only of regional fisheries biologists, but also local fisheries biologists stationed in and responsible for the management of those GMUs. It is the locally based biologists that were instrumental in preparing each GMU section, adding GMU-specific knowledge and locally-based credibility to those sections.

The interagency Redband conservation strategy team organized GMU teams to develop species recovery actions specific to their GMUs. In their respective subchapter, each GMU section displays Goals, Objectives, and Action Items required to address the 3 Rs described in Section VIII (Representation, Resiliency, and Redundancy). This adds strength to the conservation strategy because each GMU section presents similarly organized, locally based, science-based, specific action items to achieve meaningful Redband conservation.

The GMUs represent major river basins (HUC 6-digit) and each contains several HUC 8-digit sub-basins where Redband are present. The data on current occupation of Redband habitat across their range was gathered from a range-wide status assessment (Muhlfeld et al. 2015), and reflects the best scientific information currently available on the interior forms of the species.

Upper Columbia-Spokane GMU

The Upper Columbia-Spokane GMU (UC-S GMU) includes two HUC 6-basins. The Upper Columbia basin contains five HUC 8-digit sub-basins and at least 36 Redband conservation populations. The Spokane basin contains four HUC 8-digit sub-basins and at least 37 Redband conservation populations (Table 5; Figure 2). The UC-S GMU area, below natural barriers, was historically occupied by both resident and anadromous REDBAND, with the exception of the Upper Crab Creek watershed. Anadromy to this GMU was permanently blocked by Grand Coulee Dam in 1945 on the Columbia River.

Upper Columbia Basin – The Upper Columbia basin contains Franklin D. Roosevelt Lake (Lake Roosevelt), the reservoir behind Grand Coulee Dam, three additional major sub-basins that drain into the reservoir (Kettle, Colville and Sanpoil rivers), and the Upper Crab Creek watershed. Recent genetic information suggested the Upper Columbia basin likely contains more Redband conservation populations than were previously identified by technical staff at the workshop in 2011, including unique characteristics such as a fall run in the Sanpoil River (Small et al. 2014, 2015, 2016a, 2016b).

Crab Creek, a closed sub-basin, is one of the few perennial streams in the Columbia Basin of central Washington. Very little information has been collected in the Upper Crab Creek drainage; however limited genetic work indicated the presence of Redband (Bettles 2004).

Spokane Basin – The Spokane basin contains the Upper and Lower Spokane River, Little Spokane River, and Hangman (Latah) Creek sub-basins. Post Falls, on the main-stem Spokane River, was a natural barrier for anadromous and resident fish. Post Falls Dam is currently the upper extend of Redband

distribution. Much of the known genetics information for the Upper Spokane, Little Spokane, and Hangman Creek was summarized in Small et al. (2007), which indicated minor hybridization with coastal Rainbow Trout and Cutthroat Trout. The Lower Spokane also has limited hybridization and supports a variety of Redband populations in multiple reservoirs (Small et al. 2016a).

The UC-S GMU partners that developed this section included: Coeur d' Alene Tribe (CDA), Colville Confederated Tribes (CCT), National Park Service (NPS), Spokane Tribe of Indians (STI), U.S Forest Service (USFS), and Washington Department of Fish and Wildlife (WDFW). Reviewing partners included: Avista Utilities, Idaho Fish and Game, and Trout Unlimited (Spokane Falls Chapter).

Table 5. Summary statistics for the Upper Columbia-Spokane Redband GMU.

HUC 8-digit Code	Sub-basin Name	Number of Conservation Populations	Historical		Current	
			Length (km)	Area (ha)	Stream Length (km)	Lake Area (ha)
Columbia Basin						
17020001	Lake Roosevelt _Columbia	120	3,360	89	688	29,955
17020002	Kettle	119	1,179	0	363	0
17020003	Colville	114	1,160	1480	36	439
17020004	Sanpoil	131	1,529	0	568	0
17020013	Crab Creek Upper	3	458	458	458	213
	Totals	487	7,686	2,027	2,113	30,607
Spokane Basin						
17010305	Spokane_Upper	54	568	779	81	0
17010306	Hangman (Latah)	37	579	0	74	0
17010307	Spokane_Lower	212	150	30	315	4650
17010308	Spokane_Little	917	653	858	303	106
	Totals	1,220	1,950	1,667	773	4,756

*Historical and current distribution were summarized during a workshop in 2011 and do not reflect recent data additions and minor corrections to historical distribution.

Columbia Basin

Lake Roosevelt: 20 populations (from south to north)

Westside Tributaries: 12 conservation populations

1. Qui Qui Creek: need to survey
2. Niles Creek: need to survey
3. Whitestone Creek: need to survey
4. George Creek: need to survey
5. **Three Mile Creek: conservation**
6. **Six Mile Creek: conservation**
7. Little Nine Mile: need to survey
8. Nine Mile Creek: above water fall; need to survey
9. **Wilmont Creek, below waterfall: conservation**
10. **Wilmont Creek, above waterfall: conservation**

11. Little Wilmont: need to survey
12. Monaghan Creek: next to Coyote; need to survey
13. Coyote Creek: next to Nez Perce; need to survey
14. Falls Creek: next to Nez Perce
15. **Nez Perce Creek, below waterfall: conservation**
16. **Nez Perce Creek, above waterfall: conservation**
17. **Stranger Creek: below waterfall/Twin Lakes: conservation**
18. Stranger Creek above Twin Lakes: need to survey
19. **Hall Creek: conservation**
20. Little Jim: need to survey
21. **Barnaby Creek: conservation**
22. La Fleur Creek: need to survey
23. Roper Creek: need survey
24. **Sherman Creek, below waterfall: conservation**
25. **Sherman Creek, above waterfall: conservation**
26. Nancy Creek: need to survey
27. Lodgepole Creek: need to survey
28. Fifteen Mile Creek: need to survey
29. Flat Creek: need to survey
30. Crown Creek: need to survey
31. Rattlesnake Creek: need to survey
32. **Big Sheep Creek (below water fall): conservation**
33. Big Sheep Creek (above water fall?): need to survey
34. Goodeve Creek: need to survey

Eastside Tributaries 8 conservation populations (south to north)

35. Welsh Creek: above waterfall: need to survey
36. **Hawk Creek, below waterfall: conservation**
37. **Hawk Creek, above waterfall: conservation**
38. Castle Rock Creek: Non-conservation. Last survey was in 2000; No fish found in surveys with notes of steep gradient (C. Flanagan STI)
39. **Oh-Ra-Pak-En Creek: conservation** below the falls; no RBT found above waterfall (C. Flanagan STI)
40. **Alder Creek below waterfall: conservation**
41. Alder Creek above waterfall: non-conservation. Last watershed survey done in 2007; no RBT found above waterfall (C. Flanagan STI)
42. **Hunters Creek: conservation**
43. Harvey Creek: non conservation. Last surveyed in 2010; no RBT found in watershed (C. Flanagan STI)
44. Deer Creek: need to survey
45. East Stranger Creek: need to survey
46. Magee Creek: need to survey
47. Cheweka Creek: need to survey
48. Quillisascut Creek: need to survey
49. Rickey Creek: need to survey
50. Hallam Creek: need to survey
51. Mingo Creek: need to survey

52. Pingston Creek: need to survey
53. China Creek: need to survey
54. Ryan Creek: need to survey
55. **Onion Creek below waterfall: conservation**
56. Onion Creek above waterfall: need to survey
57. **Deep Creek below waterfall: conservation**
58. Deep Creek above waterfall: need to survey
59. Mathews Creek: need to survey
60. Tom Bush Creek: need to survey
61. **Mainstem Columbia River above Northport: conservation**

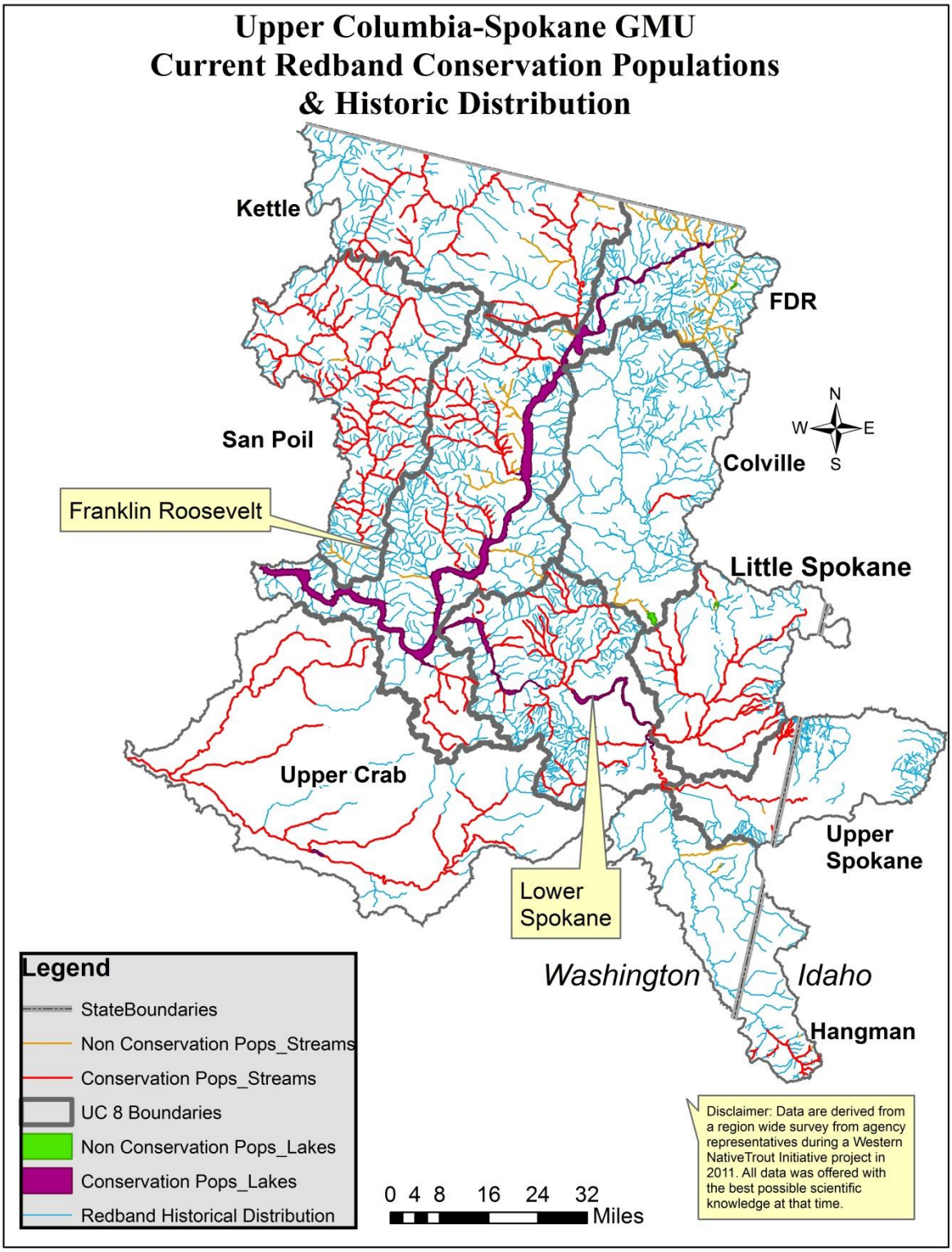

Figure 2. Upper Columbia and Spokane GMU Interior Redband distribution map.

Representation:

Today, Redband in the UC-S GMU contain genetically pure, partially introgressed (>80% pure), and introgressed populations (<80% pure) with multiple life histories represented (fluvial, adfluvial, lacustrine adfluvial, and fall lacustrine adfluvial).

Goal: Conserve, enhance, and restore Redband populations and genetic integrity in the UC-S GMU.

Objective: Identify and fill data gaps to conserve, enhance, and restore Redband populations.

- Action Item: Coordinate with partners within the UC-S GMU to identify Redband population data gaps.
- Action Item: Identify and address Redband distribution/life history discrepancies within the current dataset.
- Action Item: Prioritize Redband population data gaps that are required to address conservation needs.
- Action Item: Coordinate to pool funding and secure new funding to implement research studies.
- Action Item: Compile historical stocking records for each sub-basin.
- Action Item: Review historical genetic information (mitochondrial/microsatellite methods) and determine if samples need to be re-analyzed with the current SNP's method to support conservation needs.
- Action Item: Develop and implement stock assessment plans for each sub-basin, similar to the Lake Roosevelt Stock Assessment Plan (Lee and McLellan 2011).
- Action Item: Implement long-term status and trend monitoring on core conservation populations.
- Action Item: Update records in the range-wide Redband database with more recent distribution and life history data as it becomes available.
- Action Item: Convene meetings to coordinate fish sampling efforts, review existing data, and share newly collected data.
- Action Item: Verify and identify core conservation populations through genetic testing.

Objective: Promote educational outreach to increase public awareness and support for Redband.

- Action Item: Develop the use of social media to educate the public and to update current work aimed at conserving Redband.
- Action Item: Organize, attend, and present Redband results at annual meetings and conferences.
- Action Item: Create and attend educational programs to increase public awareness and support for the conservation of Redband.

Objective: Where appropriate, provide opportunities for both recreational sport fishing harvest and Tribal subsistence harvest.

- Action Item: Utilize stock assessment data to evaluate harvest management alternatives intended to support conservation, enhancement, and restoration of select Redband stocks.

Objective: Minimize impacts of hatchery Rainbow Trout stocking on wild stocks of Redband.

Action Item: Continue to use best management practices such as stocking triploid hatchery fish and encourage anglers to harvest hatchery trout.

Resilience:

The primary factors affecting Redband in the UC-S GMU include connectivity to historical habitats, fish passage, screening at diversions, loss of natural geomorphic processes, degraded habitats, poor water quality, low stream flows, and the presence of non-native species.

Goal: Healthy and harvestable Redband populations facilitated through rehabilitations of stream habitat and restoration of ecological function in the riparian corridor of streams in the UC-S GMU.

Objective: Inventory existing stream and riparian habitat condition.

- Action Item: Inventory and evaluate fish passage barriers (natural and anthropogenic) and diversions using standardized protocols.
- Action Item: Create, share, and update fish passage regional databases and GIS layers.
- Action Item: Inventory and evaluate aquatic and riparian habitat condition using standard protocols.
- Action Item: Develop aquatic and riparian habitat restoration and protection plan that includes a prioritization and action strategy.

Objective: Maintain and restore healthy ecosystems and watersheds that preserve functional links among ecosystem elements (floodplains, side channels, riparian zones, alluvial fans) to ensure the continued persistence, health, and genetic diversity of Redband.

- Action Item: Implement habitat restoration plans that include geomorphic and hydrologic function, habitat conditions/complexity, and the enhancement of beaver populations, including Hangman Creek Restoration Plan (CDAT) and Sanpoil Restoration Plan (CCT).
- Action Item: Identify and pursue opportunities to work with the USDA Forest Service, Tribal permittees, and land owners to adjust grazing strategies for pastures and allotments to improve riparian and stream channel conditions.
- Action Item: Develop and maintain inter-governmental relationships to facilitate habitat restoration.
- Action Item: Monitor water quality parameters to assist with identifying limiting factors.
- Action Item: Monitor the impacts on the genetic integrity of isolated populations post-removal of migration barriers.
- Action Item: Coordinate with regional stakeholders to promote best management practices.

Redundancy:

Redundancy can be enhanced by limiting the negative impacts of non-native species, improving habitat condition, reducing the impacts of climate change, and expanding the range of Redband populations.

Goal: Native populations of Redband persist within the UC-S GMU in perpetuity.

Objective: Ensure Redband populations receive the proper protections to ensure continued

persistence.

Action Item: Using the stock assessment data, categorize populations using the redundancy criteria (five populations per sub-basin and 500 spawning pairs).

Action Item: Develop reintroduction plans to expand distribution.

Action Item: Identify the threats of climate change and implement strategies to offset impacts.

Objective: Understand and address the impacts to Redband from non-native species.

Action Item: Determine if non-native species (Walleye, Smallmouth Bass, Northern Pike, Brook Trout, Cutthroat Trout, hatchery Rainbow Trout) are limiting the success of Redband.

Action Item: Develop watershed specific non-native species management plans.

Action Item: Implement non-native suppression/eradication where necessary.

Action Item: Develop criteria for the potential removal of hybridized trout populations and the re-establishment of Redband populations.

Action item: Develop outreach programs detailing the negative impacts of non-native species and the consequences of illegal introductions.

Kootenai GMU

The Kootenai basin contains one GMU with Redband populations in five of the HUC 8-digit sub-basins (Table 6). Four of the sub-basins are definitively occupied by conservation populations of Redband. Trout.

Table 6. Summary statistics for the Kootenai Redband GMU. Summary includes the number of core conservation, conservation, and sportfish Redband populations by sub basin. Assessment of Redband population presence was based on best available data. Data may not identify all populations.

HUC 8-digit Code	Sub-basin Name	Number of Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
17010101	Upper Kootenai	17	326	0	268	0
17010102	Fisher	43	485	210	348	185
17010103	Yaak	17	270	23	200	25
17010104	Lower Kootenai	3	823	123	198	0
17010105	Moyie	0	3	0	3	0
Totals			**1,907**	**356**	**1,017**	**211**

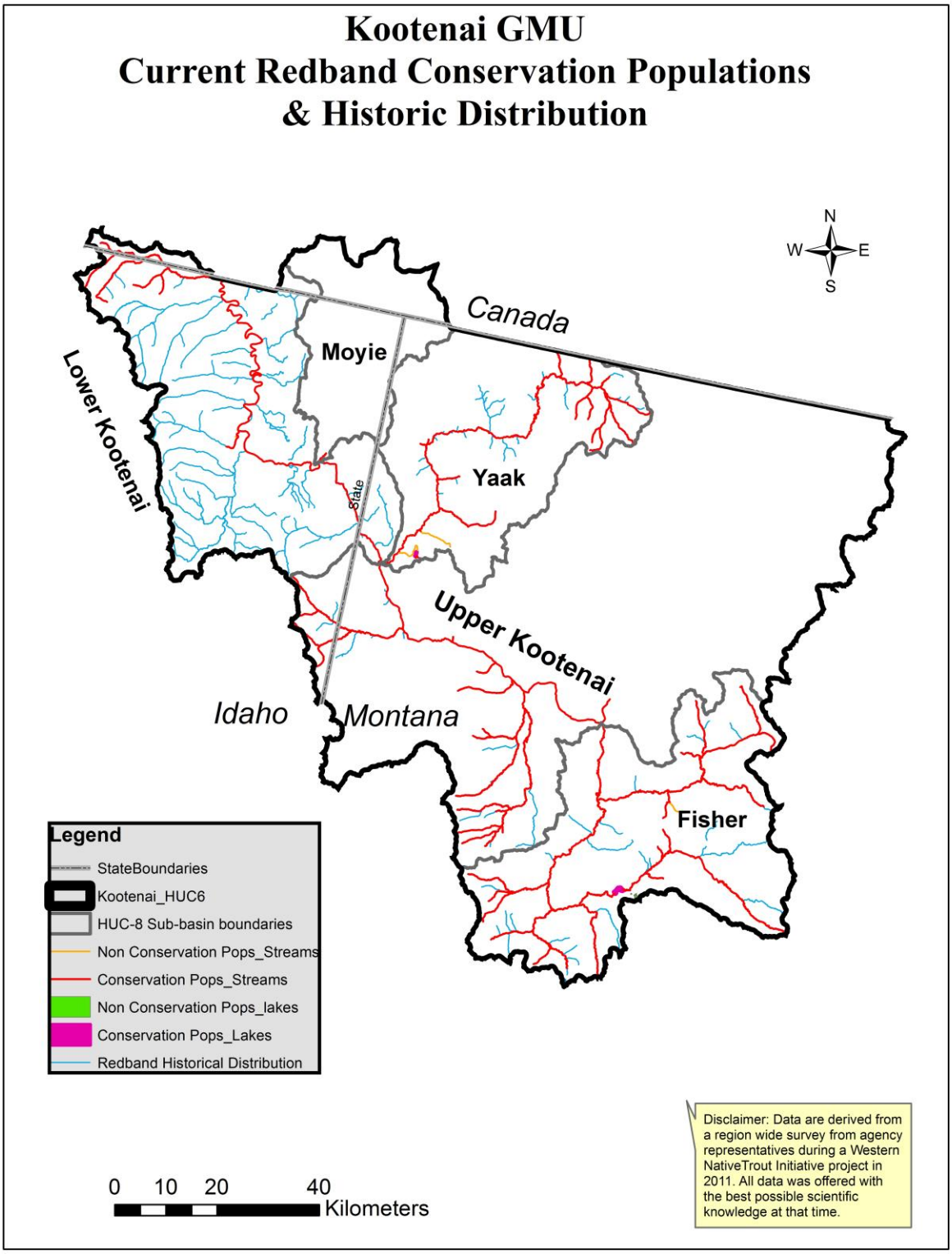

Figure 3. Kootenai River GMU Redband distribution based on 2011 Western Native Trout Initiative

Representation

Goal: Protect and improve the genetic integrity of Redband within the Kootenai GMU

Objective: Evaluate current genetic distribution data for accuracy and data gaps

- Action Item: Identify and/or verify populations where the genetic integrity is unknown (GMU Team; begin 2016)
- Action Item: If unknown, collaboratively develop and implement biological sampling to collect genetic material for these populations (GMU Team; TBD)
- Action Item: Identify cost requirements and secure funding for genetic analysis and reporting (GMU Team; as needed)
- Action Item: Update distributions within range-wide database (WDFW/GMU Team; TBD)

Objective: Minimize the impacts of sport fish stocking within the current distribution of Redband in the Kootenai basin

- Action Item: Review past and current stocking practices (IDFG/MFWP; Ongoing)
- Action Item: Modify stocking practices as appropriate (IDFG/MFWP; Ongoing)
- Action Item: Evaluate the feasibility of culturing Redband for conservation (IDFG/MFWP; Ongoing)
- Action Item: Continue stocking only sterile triploid Rainbow Trout within the current distribution of Redband (IDFG; Ongoing)

Goal: Protect and improve the existing life history diversity of Redband populations within the Kootenai GMU

Objective: Determine where migratory populations with diverse life histories exist in the GMU to help prioritize conservation actions

- Action Item: Identify populations where life history diversity is unknown (GMU Team; 2022)
- Action Item: Develop sampling strategy and protocol to monitor Redband (GMU Team; 2020)
- Action Item: Implement biological sampling and barrier surveys to collect the most appropriate life history information for target populations (GMU Team; begin 2016)
- Action Item: Identify cost requirements and secure funding for sampling and reporting (GMU Team; TBD)

Objective: Review existing life history distribution data (from the 2012 Status Assessment documentation) for accuracy/consistency.

- Action Item: Address apparent discrepancies in life history classifications within watersheds across state boundaries.
- Action Item: Update records in the range-wide Redband database with more recent distribution and life history data as it becomes available.
- Action Item: Convene annual GMU meetings to review existing data and share newly collected data.
- Action Item: Coordinate fish sampling efforts annually between Redband partners to address data gaps.

Resilience

Goal: Improve the quantity and quality of Redband habitat in the Kootenai GMU

Objective: Restore and protect aquatic, riparian, and wetland habitat in the Kootenai GMU
- Action Item: Identify high priority aquatic restoration projects (GMU Team; ongoing)
- Action Item: Identify cost requirements and secure funding for implementation (GMU Team; ongoing)
- Action Item: Implement identified aquatic restoration projects (GMU Team; ongoing)
- Action Item: Monitor Redband response to aquatic restoration projects (IDFG, MFWP, USFS; TBD)

Objective: Maintain quality and quantity of Redband habitat in the Kootenai GMU
- Action Item: Review proposed land and water use activities, policies, or programs that could result in significant loss or degradation of fish habitat or populations (IDFG, MFWP, USFS; ongoing)
- Action Item: Identify alternatives and make recommendations that minimize or avoid impacts from proposed land and water use activities, policies, or programs (IDFG, MFWP, USFS; ongoing)

Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Objective: Identify core conservation populations and verify previously identified populations.
- Action Item: Use genetic testing and inspection of past stocking records to identify core conservation populations within the GMU.

Objective: Protect the integrity of core conservation populations
- Action Item: Insure stocking programs are managed to protect conservation populations
- Action Item: Use public outreach, including signage and user group presentations, where needed to protect core populations from illegal introductions of fish with the potential of affecting core population genetics.

Objective: If currently designated core population genetics are found not to be pure, consider management actions to improve genetics.
- Action Item: Address incoming source of genes affecting population genetics, if it has not previously been addressed.
- Action Item: Consider swamping gene pool with regular introduction of pure Redband genes.

Redundancy

Goal: Protect and improve the genetic integrity of Redband within the Kootenai GMU

Objective: Evaluate current genetic distribution data for accuracy and data gaps (see Representation section objectives)

Goal: Maintain or enhance Redundancy throughout the Kootenai GMU

Objective: Maintain Redband populations throughout the Kootenai GMU

- Action Item: Identify opportunities to reduce population sinks (i.e. unscreened diversions, culverts) (GMU Team; ongoing)
- Action Item: Identify fish passage barriers and determine their influence on the degree of isolation (GMU Team; ongoing)
- Action Item: Maintain or remove fish passage barriers and/or install fish screens based on conservation value (GMU Team; ongoing)
- Action Item: Periodically monitor Redband fishing harvest rates and modify fishing regulations as needed to maintain persistence of Redband populations (IDFG/MFWP; ongoing)
- Action Item: Evaluate the potential for removing non-native fishes from Redband habitat (GMU Team; ongoing)

Objective: Maintain Cascade Creek conservation population

- Action Item: Replace existing diversion with a screened diversion to reduce or eliminate the population sink (FWS; 2017)
- Action Item: Sample upstream of the lower waterfall to verify distribution of Redband in Cascade Creek (FWS/Kootenai Tribe; 2016)
- Action Item: Assess feasibility of expanding the distribution of Cascade Creek Redband into upper watershed (FWS, USFS, IDFG, Kootenai Tribe; 2018)

Objective: Maintain Libby Creek conservation population

- Action Item: Assess feasibility of expanding the distribution of Redband in Howard, Granite, Leigh, Double, and Wishbone lakes (MFWP, USFS; 2021)
- Action Item: If feasible and approved through a public MEPA process, implement removal of non-native fish species (MFWP/USFS; 2025)
- Action Item: Expand the populations using appropriate donor sources (MFWP; 2025)

Objective: Maintain Parmenter Creek conservation population

- Action Item: Assess feasibility of expanding the distribution of Redband in Minor Lake (MFWP, USFS; 2021)
- Action Item: If feasible and approved through a public MEPA process, implement removal of non-endemic fish species (MFWP/USFS; 2025)
- Action Item: Expand the populations using appropriate donor sources (MFWP; 2025)

Objective: Maintain Cedar Creek conservation population

- Action Item: Assess feasibility of expanding the distribution of Redband in Cedar Lakes (MFWP, USFS; 2021)
- Action Item: If feasible and approved through a public MEPA process, implement removal of non-endemic fish species (MFWP/USFS; 2025)
- Action Item: Expand the populations using appropriate donor sources (MFWP; 2025)

Objective: Maintain Yaak River conservation population

- Action Item: Assess feasibility of expanding the distribution of REDBAND in Okaga, Fish, Vinal, Kilbrennan, and Wee lakes (MFWP, USFS; 2021)

Action Item: If feasible and approved through a public MEPA process, implement removal of non-endemic fish species (MFWP/USFS) 2025

Action Item: Expand the populations using appropriate donor sources (MFWP) 2025

Objective: Maintain isolated populations in the Boundary Creek Watershed

Action Item: Coordinate on sampling protocols (USFS/IDFG) ongoing

Action Item: Identify current distribution of Redband, and assess the influence of passage barriers (culverts) (IDFG/USFS; 2020)

Action Item: Consider genetic information as made available to remove or replace barriers as appropriate (USFS; TBD)

Goal: Improve public perception about conservation of Redband

Objective: Develop and promote sport fisheries for Redband in the Kootenai GMU

Action Item: Evaluate the feasibility of utilizing rearing space at Twin Rivers Hatchery for the production of Redband (Kootenai Tribe; 2016)

Action Item: Where appropriate, use hatchery origin Redband to supplement fisheries (MFWP; ongoing)

Action Item: Inform/Educate public about conservation of Redband (IDFG, MFWP; ongoing)

Action Item: Provide harvest opportunities as appropriate (IDFG, MFWP; ongoing)

Action Item: Where appropriate, use hatchery origin Gerrard Redband to establish sport fisheries (MFWP; ongoing)

Clearwater River Geographic Management Unit (GMU)

History and background

Within the Clearwater River basin, only the North Fork Clearwater River upstream of Dworshak Dam is considered to have Redband populations. The North Fork Clearwater River begins in the headwaters of the Bitterroot Mountain Range near the Idaho/Montana border and flows about 127 km until it enters into Dworshak Reservoir. Dworshak Dam was constructed on the North Fork Clearwater River 3.1 km upstream of its mouth. The dam was completed in 1973 and now impounds 83 km of the North Fork Clearwater River. During full pool, Dworshak Reservoir has a surface area of 6,670 Hectares. Dworshak Dam, operated by the US Army Corps of Engineers, controls water levels and outflow from Dworshak Reservoir. Major tributaries of the North Fork Clearwater River include Kelly Creek, Weitas Creek, and the Little North Fork Clearwater River. The North Fork Clearwater watershed has an area of over 6,300 km^2. Stream Flow for the North Fork Clearwater River entering Dworshak Reservoir ranges from typical lows in September of around 25 m^3/s (900 cfs) to peaks that typically occur in May and June and often exceed 570 m^3/s (20,000 cfs). Annual outflow from Dworshak Dam is largely dictated by flood control and ESA listed fish reasons, but annually averages 142-170 m^3/s (5,000-6,000 cfs) and typically varies from 14 m^3/s to 566 m^3/s (500 to 20,000 cfs). Elevations in the North Fork Clearwater River watershed range from a low of 302 m at the mouth up to over 2130 m in the peaks of the Kelly Creek drainage. The majority of the watershed surrounding Dworshak Reservoir is less than 900 m making this area subject to rain-on-snow events. Upstream of Dworshak Reservoir, much or the drainage area is greater than 1,200 m. Consequently, winter precipitation falls mainly as snow, although lower elevation canyons along mainstem tributaries may be susceptible to rain-on-snow events. Topography of the North Fork

Clearwater River watershed is predominantly mountainous, with side slopes commonly exceeding 60%. The land cover in this watershed is almost entirely forested.

Currently, the North Fork Clearwater River watershed supports native populations of Westslope Cutthroat Trout, Bull Trout, Rainbow Trout and Redband, and Mountain Whitefish. Historically, anadromous runs of steelhead, Chinook Salmon, and Pacific Lamprey also ascended the North Fork Clearwater River and spawned and reared in many of its tributaries. Construction of Dworshak Dam blocked all upstream fish passage and ended these anadromous fish runs. After construction of the dam, Redband abundance declined by about 90% (Pettit 1976). Based on periodic snorkel surveys in the mainstem North Fork Clearwater River and its major tributaries, Redband abundance has been stable or increasing since the construction of Dworshak Dam. Because this population of Redband no longer exhibits a full anadromous life history, they are considered to be Interior Redband (Redband) in this exercise. The Redband in this drainage appear to have a short life span (4-6 years) and typically don't exceed 300 mm. The Redband occur throughout the North Fork Clearwater watershed and resident, fluvial and adfluvial life history strategies all appear to exist.

Historically, hatchery Rainbow Trout (many strains) were stocked in the North Fork Clearwater River, and many tributaries. By 1975, almost all stocking ended in flowing waters in this drainage except for near a few towns. Currently, no stocking occurs in any flowing waters upstream of Dworshak Dam. Rainbow Trout have been stocked into Dworshak Reservoir since its construction. Starting in 2000, all stocked Rainbow Trout have been sterile fish. Cutthroat Trout X Rainbow Trout hybrids are known to occur in the North Fork Clearwater River basin (Weigel et al. 2003), but it is not known if these hybrids were from stocked Rainbow Trout or native Redband. No genetic assessments have occurred to evaluate if and/or to what degree introgression between native and non-native strains of Rainbow Trout have occurred.

Brook Trout are located in many of the lower elevation streams and high mountain lakes in this watershed. Brook Trout are rarely observed in the main-stem North Fork Clearwater River. Smallmouth Bass and kokanee have been stocked into Dworshak Reservoir and provide popular fisheries. Kokanee migrate upstream from the reservoir as far as 85 km to spawn. Smallmouth Bass have been observed over 50 km upstream of Dworshak Reservoir.

The purpose of this analysis is to set broad goals and strategies that will lead to a range-wide strategy towards the conservation of Redband. Within the Clearwater GMU, there are two HUC 8-digit sub-basins that occur within it that are considered to have Redband. Both sub-basins are considered to be occupied by conservation populations of Redband. Many other HUC 8-digit sub-basins within the Clearwater GMU have Redband in them, but are not included in this exercise as they have steelhead life history forms.

Table 7. Summary statistics for the Clearwater Redband GMU.

HUC 8-digit Code	Sub-basin Name	Number of Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
17060307	Upper North Fork Clearwater	3	568		81	0
17060308	Lower North Fork Clearwater	2	579	779	74	0
Totals		**1,528**	**779**	**1,279**		**6,622**

Representation

Goal: Maintain/improve genetic integrity of Redband within the North Fork Clearwater basin

Objective: Reduce opportunities for hybridization

Action Item: When stocking Rainbow Trout, continue using sterile triploid varieties to prevent interbreeding with Redband populations.

Objective: Increase our knowledge of Redband genetics in the North Fork Clearwater basin.

Action Item: Improve our understanding of Redband population genetics.

Action Item: Investigate funding opportunities to conduct genetic analysis.

Resiliency:

Goal: Maintain/Improve Redband abundance

Objective: Maintain/improve connectivity to promote all life history characteristics

Action Item: On Federal lands, all stream crossing barriers have been identified and are being prioritized for improvement.

Action Item: On state lands managed by Idaho Department of Lands (IDL), all stream crossing barriers have been identify and are being prioritized for improvement.

Action Item: Efforts should be made to assess fish passage at steam crossings that occur on private lands. Identified barriers should be prioritized for improvement where there is private landowner support.

Action Item: Seek funding to improve stream crossing that pose issues with fish passage.

Action Item: Follow IDL/IDWR/IDFG/Federal fish passage guidelines to ensure new stream crossing don't impact movement/connectivity of Redband.

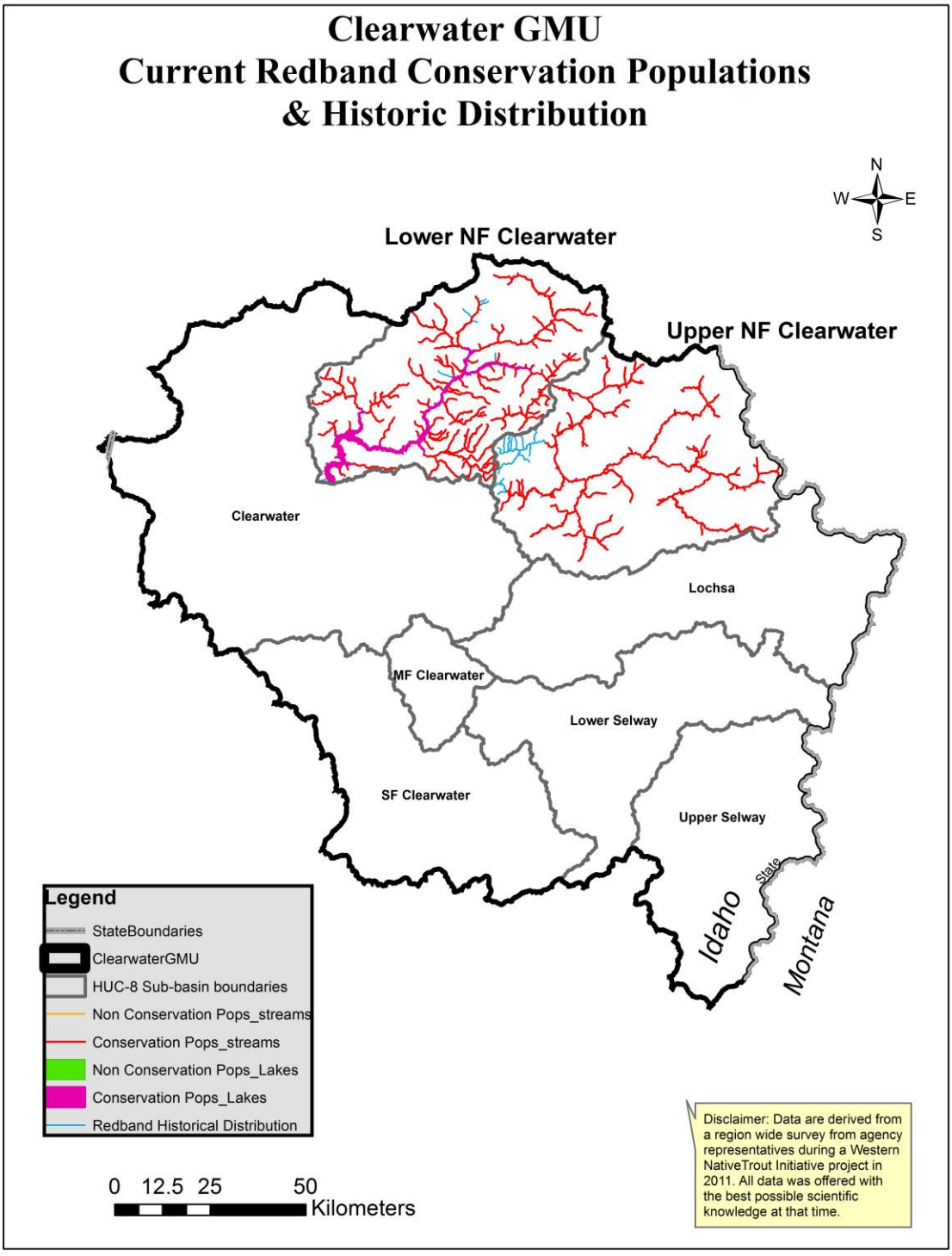

Figure 4. Clearwater River GMU Redband distribution based on 2011 Western Native Trout Initiative.

Objective**:** Maintain quality Redband habitat into the future

Action Item: On Federal lands (CORPS, BLM, USFS), ensure activities that can potentially impact Redband habitat (grazing, mining, timber management, etc.) follow rules/directions/plans developed by each agency to maintain quality habitat.

Action Item: Continue to assess the potential impacts of suction dredging on aquatic habitat.

Action Item: Ensure the rules of the Idaho Forest Practices Act are followed when timber management practices occur on non-Federal lands.

Action Item: On state land managed by IDL, ensure grazing leases include terms that will protect Redband habitat.

Objectives: Increase "Resilience" by identifying areas for habitat improvement and develop/implement projects.

Action Item: Utilize IDL's Cumulative Watershed Effects process to identify streams on non-federal timberlands that are potentially degraded. Develop plans/strategies on how improve these degraded habitats.

Action Item: Utilized the Idaho Department of Water Quality's TMDL process to identify and restore streams that are not meeting beneficial uses.

Action Item: For lands managed by the USFS, implement the Watershed Condition Framework to identify and prioritize watersheds for protection and restoration of impaired hydrologic function and stream habitat.

Action Item: Better understand how water level management of Dworshak Reservoir influences Redband populations.

Action Item: Assess how the nutrient restoration program on Dworshak Reservoir is/has influenced Redband populations.

Action Item: Develop a programmatic permit that will make it easier for private landowners to participate in habitat restoration projects.

Objective: Reduce/control competition and/or predation from introduced species

Action Item: Develop a better understanding of the effects of introduced species on Redband and manage accordingly.

Action Item: Assess the distribution of Smallmouth Bass in the mainstem North Fork Clearwater River

Objective: Manage recreational fishing harvest to insure sustainable Redband populations.

Action Item: Periodically monitor Redband fishing harvest rates to maintain persistence of Redband populations.

Objective: Increase our knowledge of Redband in the North Fork Clearwater basin.

Action Item: Monitor Redband abundance and distribution throughout the drainage.

Action Item: Better understand life history characteristics of Redband populations located throughout the North Fork Clearwater basin.

Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Objective: Identify core conservation populations and verify previously identified populations.

Action Item: Use genetic testing and inspection of past stocking records to identify core conservation populations within the GMU.

Objective: Protect the integrity of core conservation populations

Action Item: Adjust stocking programs as necessary to protect conservation populations

Action Item: Use public outreach, including signage and user group presentations, where needed to protect core populations from illegal introductions of fish with the potential of affecting core population genetics.

Objective: If currently designated core population genetics are found not to be pure, consider management actions to improve genetics.

Action Item: Address incoming source of genes affecting population genetics, if it has not previously been addressed.

Action Item: Consider swamping gene pool with regular introduction of pure Redband genes.

Redundancy:

Goal: Maintain/restore abundance, connectivity, and genetic diversity in multiple watersheds dispersed across the North Fork Clearwater watershed

Objective: Improve "Redundancy". Ensure actions to maintain/improve "Representation" and "Resiliency" occur in multiple populations within the North Fork Clearwater River watershed.

Action Item: Five areas have been identified that cover the entire North Fork Clearwater drainage and likely contain distinct Redband populations. They include: 1) Dworshak Reservoir and all tributaries that flow directly into it; 2) the Little North Fork and Breakfast Creek watersheds; 3) the North Fork Clearwater River and tributaries between the Dworshak slack water interface and Kelly Creek; 4) the North Fork Clearwater River and tributaries upstream of Kelly Creek; and 5) the Kelly Creek watershed. All the conservation action items listed above under "Representation" and "Resiliency" will occur in each of these five areas where appropriate.

Action Item: Determine if introducing Redband populations to new watersheds would be beneficial to long term persistence. If determined beneficial, implement projects.

Snake River GMU

The Snake River GMU is a large GMU that supports 24% of habitat occupied by conservation populations. However, this is less than 18% of historical habitat within this GMU. Twelve of 23 sub-basins do not contribute to redundancy. Non-conservation populations (116 populations) in the Snake River GMU occupy 1,325 km of stream habitat and may provide opportunities to increase representation and redundancy within GMU where limiting factors can be addressed.

The Upper Snake and Middle Snake basins are grouped as one GMU with Redband populations in 31 of the HUC 8-digit sub-basins (Table 8). The Snake River GMU is so large and includes such a diversity of watersheds and habitat types that conservation strategies are broken up into two major sections.

General Strategies will focus on broad scale efforts, while the Sub-Basin Strategies will list conservation strategies at the finer sub-basin scale

Table 8. Summary statistics for the Snake River Redband GMU.

HUC 8-digit Code	Sub-basin Name	Number of Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
Upper Snake River Basin						
17040212	Upper Snake-Rock	Unknown	531	0	163	0
17040213	Salmon Falls	Unknown	1,181	0	628	1,452
17040219	Big Wood	Unknown	1,309	0	424	1,422
17040220	Camas	Unknown	413	0	72	141
17040221	Little Wood	Unknown	885	0	267	333
Totals			**4,319**	**0**	**1,554**	**3,349**
Middle Snake-Boise Basin						
17050101	C.J. Strike Reservoir	Unknown	501	0	223	2,543
17050102	Bruneau	Unknown	1,806	0	981	1
17050103	Middle Snake-Succor	Unknown	1,133	0	435	78
17050104	Upper Owyhee	Unknown	1,427	0	292	0
17050105	South Fork Owyhee	Unknown	800	0	188	38
17050107	Middle Owyhee	Unknown	518	0	387	0
17050108	Jordan	Unknown	716	0	299	0
17050109	Crooked-Rattlesnake	Unknown	4	0	4	0
17050110	Lower Owyhee	Unknown	278	0	151	0
17050111	North and Middle Forks Boise	Unknown	1,236	0	604	0
17050112	Boise-Mores	Unknown	1,151	0	266	2,043
17050113	South Fork Boise	Unknown	1,604	0	795	1,877
17050114	Lower Boise	Unknown	636	0	138	0

Table 8. Continued.

HUC 8-digit Code	Sub-basin Name	Number of Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
17050115	Middle Snake-Payette	Unknown	118	0	68	0
17050116	Upper Malheur	Unknown	1,891	0	1,327	2,529
17050117	Lower Malheur	Unknown	332	0	162	0
17050118	Bully	Unknown	500	0	232	13
17050119	Willow	Unknown	456	0	105	130
17050120	South Fork Payette	Unknown	7,345	0	558	1,198
17050121	Middle Fork Payette	Unknown	714	1	274	0
17050122	Payette	Unknown	944	0	217	96
17050123	North Fork Payette	Unknown	1,366	0	578	13,107
17050124	Weiser	Unknown	1,541	0	959	395
Totals			**27,017**	**1**	**9,243**	**24,047**
Middle Snake-Powder Basin						
17050201	Brownlee Reservoir		995	0	679	5,538
17050202	Burnt		1,544	0	759	373
17050203	Powder		2,341	0	1,120	1,956
Totals			**4,880**	**0**	**2,558**	**7,867**

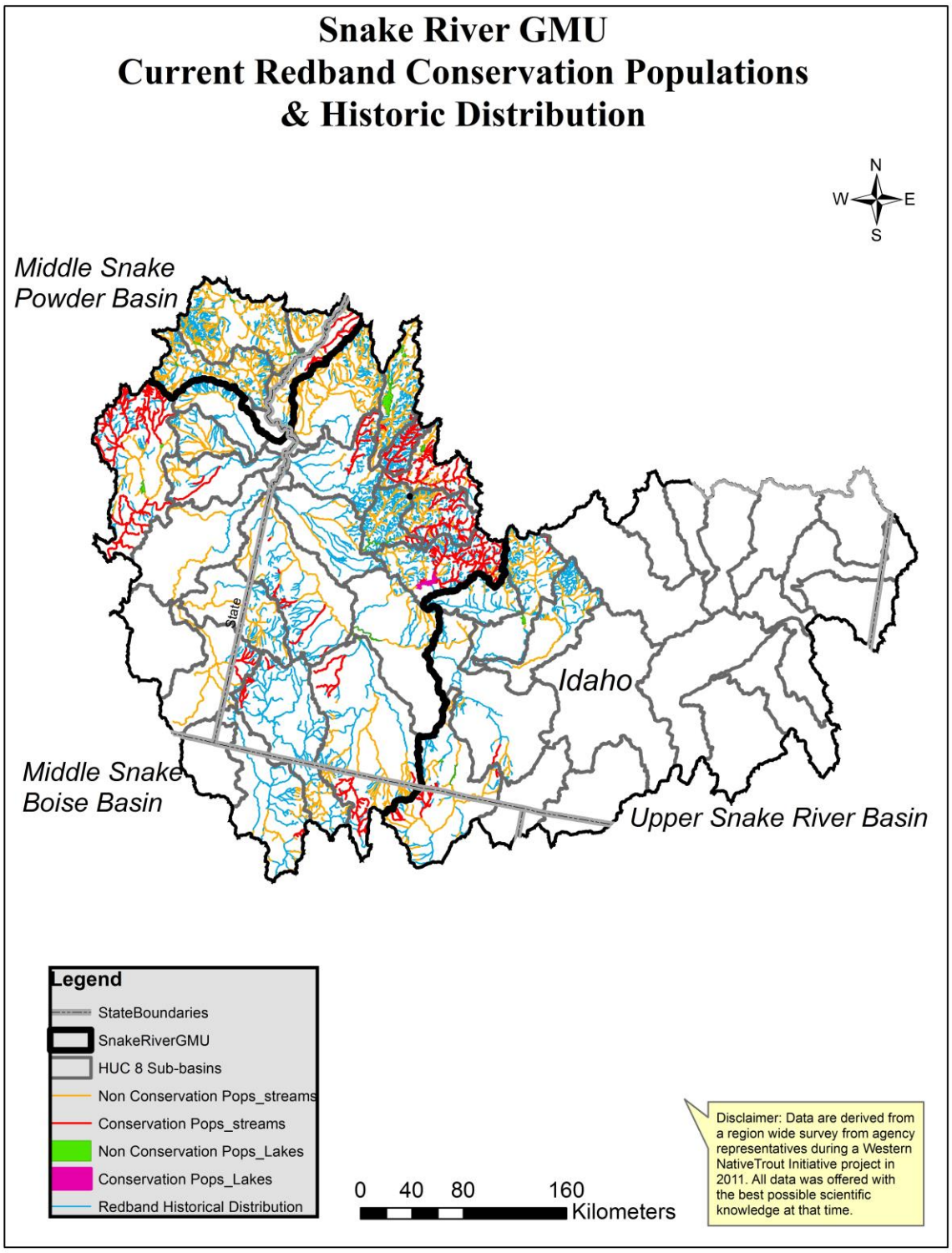

Figure 5. Clearwater River GMU Redband distribution based on 2011 Western Native Trout Initiative.

General Strategies

Snake River GMU team members identified the following general goals and objectives within the 3R framework. These are intended to be broadly applicable to the entire Snake River GMU.

Representation*:*

Goal: Protect and improve the genetic integrity of Redband within the Snake River GMU.

Objective: Evaluate current genetic distribution data for accuracy and address existing data gaps.
- Action Item: Identify and/or verify populations where the genetic integrity is unknown
- Action Item: Develop geodatabase of genetic samples to spatially display existing samples and identify data gaps to prioritize future genetic sampling.
- Action Item: Collaboratively develop and implement biological sampling to collect genetic data for populations with limited or unknown genetic data.
- Action Item: Secure funding for genetic sample analysis, reporting and archiving.
- Action Item: Update genetic sampling data records within the range-wide Redband database.

Objective: Minimize the impacts of sport fish stocking within the current distribution of Redband in the Snake River basin.
- Action Item: Review past and current stocking practices and modify them as needed to minimize impacts to Redband.
- Action Item: When needed, continue stocking sterile triploid Rainbow Trout within the current distribution of Redband (IDFG/ODFW; Ongoing)

Goal: Protect and improve the existing life history diversity of Redband populations within the Snake River GMU.

Objective: Review existing life history distribution data (from the 2012 Status Assessment documentation) for accuracy/consistency.
- Action Item: Address apparent discrepancies in life history classifications within watersheds across state boundaries.
- Action Item: Update records in the range-wide Redband database with more recent distribution and life history data as it becomes available.
- Action Item: Convene annual GMU meetings to review existing data and share newly collected data.
- Action Item: Coordinate fish sampling efforts annually between Redband partners to address data gaps.

Resilience:

Goal: Improve the quantity and quality of Redband habitat in the Snake River GMU

Objective: Identify and alleviate fish migration barriers to improve population connectivity.
- Action Item: Maintain Redband database with spatial distribution of current fish

barrier/migration information.

Action Item: Address apparent discrepancies in life history classifications (from the 2012 Status Assessment documentation) within watersheds crossing state boundaries.

Action Item: Promote education and outreach to increase public awareness and support for conserving Redband.

Objective: Protect Redband habitat for existing populations and restore additional aquatic, riparian, and wetland habitat in the Snake River GMU.

Action Item: Identify and implement high priority aquatic restoration projects for protecting core conservation populations.

Action Item: Coordinate State, Federal, and Tribal partners to evaluate riparian condition, identify problems, and prioritize enhancements.

Action Item: Review proposed land and water use activities, policies, or programs that could result in a significant loss or degradation of fish habitat or populations and make recommendations that minimize or avoid impacts from proposed land and water use activities, policies, or programs.

Action Item: Acquire conservation easements with private landowners to secure long term habitat and water protection and enhancements.

Action Item: Encourage partnerships with resource agencies, water users, private landowners, Indian Tribes and non-governmental organizations to reduce human-caused impacts to Redband, improve fish passage, reduce entrainment and provide suitable flows where necessary.

Action Item: Develop cooperative agreements with land-owners to eliminate or reduce impacts to Redband.

Action Item: Avoid or mitigate potential threats and impacts from energy development.

Action Item: Develop an Idaho Department of Water Resources (IDWR) water diversion information/spatial layer to add to existing geodatabases available to Redband partners.

Goal: Increase the abundance and/or patch size of Redband populations contributing to Resilience within the Snake River GMU.

Objective: Identify watersheds with opportunities to increase the number of Tier 1/Tier 2/Metapopulation stronghold populations.

Action Item: Increase occupied stream habitat by addressing stream habitat connectivity issues. Work with State, Federal, Tribal partners, NGO's and private land owners to evaluate fish passage barriers, identify problems, and prioritize enhancements.

Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Objective: Identify core conservation populations and verify previously identified populations.

Action Item: Use genetic testing and inspection of past stocking records to identify core conservation populations within the GMU.

Objective: Protect the integrity of core conservation populations

Action Item: Manage stocking programs to protect conservation populations

Action Item: Use public outreach, including signage and user group presentations, where needed to protect core populations from illegal introductions of fish with the potential of affecting core population genetics.

Objective: If currently designated core population genetics are found not to be pure, consider management actions to improve genetics.

Action Item: Address incoming source of genes affecting population genetics, if it has not previously been addressed.

Action Item: Consider swamping gene pool with regular introduction of pure Redband genes.

Redundancy:

Goal: Improve Redundancy by increasing the number of Redband populations throughout the Snake River GMU.

Objective: Maintain or increase the number of core and conservation populations throughout the Snake River GMU.

Action Item: Identify opportunities to reduce population sinks (i.e. unscreened diversions, culverts).

Action Item: Monitor Redband fishing harvest rates to insure fishing regulations support sustainable Redband populations.

Action Item: Evaluate the potential for removing non-native fishes from Redband habitat.

Action Item: Establish new or reestablish historical core conservation populations by translocating Redband to suitable habitats.

Sub-Basin Specific Strategies

Snake River GMU team members identified the following sub-basin goals and objections strategies within the 3R framework. These strategies are intended to be specific to individual sub-basin scale watersheds with more detail than General Strategies above.

Upper Snake River GMU:

Upper Snake-Rock, Salmon Falls, Big Wood, Camas, Little Wood

Representation

Goal: Protect and improve the genetic integrity of Redband within the Upper Snake River sub-basin watersheds.

Objective: Evaluate current genetic distribution data to address existing data gaps for the Big Wood, Little Wood and Camas Creek drainages.

Action Item: Collect needed genetic samples from the Big Wood, Little Wood and Camas Creek drainages to confirm whether Redband are in fact native to Big Wood, Little Wood and Camas Creek drainages.

Action Item: Evaluate current genetic composition of Rock Creek watershed Redband population.

Action Item: Improve understanding of distribution and genetic integrity in tributaries with little information.

Resilience

Goal: Improve the quantity and quality of Redband habitat in the Upper Snake River sub-basin watersheds.

Objective: Protect Redband habitat for existing populations and restore additional aquatic, riparian, and wetland habitat in the Upper Snake River Basin.

Action Item: Reduce sediment yield from roads or trails.

Action Item: Improve riparian condition. Work with State and Federal partners, NGO's and private landowners to evaluate riparian condition, identify problems, and prioritize enhancements.

Redundancy

Goal: Improve Redundancy by maintaining or increasing the number of core and conservation populations throughout the Upper Snake River Basin.

Objective: Maintain or improve Redband populations in the Upper Snake-Rock, Salmon Falls, Big Wood, Camas and Little Wood sub-basins.

Action Item: If feasible, remove of non-native stocks of trout in the SF Boise sub-basin.

Action Item: Continue long-term abundance and trend monitoring.

Middle Snake River GMU:

CJ Strike Reservoir, Bruneau, Middle Snake – Succor, Upper Owyhee, South Fork Owyhee, Middle Owyhee, Jordan, Crooked-Rattlesnake, Lower Owyhee, North and Middle Forks Boise, Boise-Mores, South Fork Boise, Middle Snake-Payette, Upper Malheur, Lower Malheur, Bully, Willow, South Fork Payette, Middle Fork Payette, Payette, North Fork Payette, Weiser

Representation

Goal: Protect and improve the genetic integrity of Redband within the Middle Snake River sub-basin watersheds.

Objective: Evaluate current genetic distribution data for accuracy and address existing data gaps.

Action Item: Analyze Duck Valley Reservation fin clip genetic samples from EF Owyhee River.

Action Item: In the Lower Boise sub-basin, improve understanding of distribution and genetic

integrity in tributaries (especially small drains and tributaries in the Boise foothills) with little information.

Action Item: Improve understanding of distribution and genetic integrity in SF Payette sub-basin tributaries with little information (especially Alder, Big Pine, and Goat creeks).

Objective: Minimize the impacts of sport fish stocking within the current distribution of Redband in the Middle Snake River sub-basin watersheds.

Action Item: Limit the potential for further introgression by continuing to use sterile trout in all Redband watersheds where hatchery stocking continues (with the exception of Lake Cascade).

Goal: Protect and improve the existing life history diversity of Redband populations within the Middle Snake River sub-basin watersheds.

Objective: Develop a current accurate understanding and record of life history distribution data

Action Item: Review existing life history and distribution data (from the 2012 Status Assessment documentation) for accuracy/consistency.

Action Item: Update records in the range-wide Redband database with Duck Valley Reservation survey data for the EF Owyhee River.

Action Item: Address and update the Weiser River Redband population status, given current data.

Action Item: Update records in the range-wide Redband database to include missing data points from the Jarbidge Foothills, Bruneau, and Owyhee surveys (primarily in NV).

Action Item: Update records in the range-wide Redband database to include missing data points from Pine Creek survey 2012 distribution maps (3 sites higher in the drainage).

Action Item: Improve understanding of distribution and genetic integrity in tributaries with limited information.

Goal: Empirically evaluate the effect of extirpated or functionally reduced life history trait of anadromy among O. mykiss populations in the Malheur River.

Objective: Experimentally investigate the potential occurrence of anadromous smoltification among putative interior Redband populations.

Action: Using physiological indicators, investigate whether anadromous smoltification is occurring among O. mykiss populations downstream of Beulah and Warm Springs Dams.

Action: Using physiological indicators, investigate the relative contributions of hatchery versus native origin individuals to the expression of migratory behavior and/or smoltification.

Action: Identify environmental factors that may support life history diversity among O.mykiss populations.

Action: Identify opportunities to Integrate results into agency actions where applicable.

Resilience

Goal: Improve the quantity and quality of Redband habitat in the Middle Snake River sub-basin watersheds.

Objective: Protect Redband habitat for existing populations and restore additional aquatic, riparian, and wetland habitat in the CJ Strike Reservoir, Bruneau, Middle Snake-Succor, Middle Owyhee, SF Owyhee, Jordan, Crooked-Rattlesnake, Lower Owyhee, sub-basins.

- Action Item: Address legacy mercury contamination (historical mining) in the Jordan Creek drainage and mitigate impacts where appropriate.
- Action Item: Address legacy habitat impacts from historical mining in Idaho City (Grimes, Mores Creeks) and restore floodplains and stream channels.
- Action Item: Address legacy habitat impact from historical mining to MF Boise in Atlanta (tailings), and NF Boise River (Banner Mine, water quality).
- Action Item: Establish minimum stream flows and minimum reservoir (conservation) pools below reservoirs in the Malheur River drainage.
- Action Item: Investigate impacts/threats (if any) relative to altered temperature regimes associated with reservoir tailwater streams in the Deadwood River and NF Payette River.
- Action Item: Reduce sediment yield from roads or trails.
- Action Item: Improve riparian condition in tributaries capable of supporting Redband
- Action Item: Re-introduce beaver (if necessary) in drainages with adequate riparian vegetation, or consider installing beaver dam analogs, to increase water retention, improve riparian conditions, reduce stream temperatures, and improve late season flows.
- Action Item: Reduce juniper encroachment to improve water yields and reduce erosion. See the Oregon Watershed Enhancement Board (OWEB) site: https://www.oregon.gov/OWEB/MONITOR/pages/monitor_juniper.aspx showing benefits of juniper management through citations of multiple studies that can be accessed from this link.
- Action Item: Improve riparian condition in small tributaries of the Boise foothills in the Lower Boise sub-basin.

Redundancy

Goal: Improve Redundancy by maintaining or increasing the number of core and conservation populations throughout the Middle Snake River sub-basin watersheds.

Objective: Maintain or improve Redband populations in the CJ Strike Reservoir, Bruneau, Middle Snake-Succor, Middle Owyhee, SF Owyhee, Jordan, Crooked-Rattlesnake, Lower Owyhee, Boise-Mores , SF Boise sub-basins.

- Action Item: Assess distribution of non-native species (especially smallmouth bass) in the CJ Strike sub-basin and determine if adequate barrier(s) exist to prevent colonization; install additional barriers to prevent non-native species expansion as necessary.
- Action Item: Monitor the integrity of the existing sloped-velocity barrier (Bruneau River near CJ Strike) to prevent establishment of non-native fishes in the upper drainage

Action Item: In the Middle Snake-Succor sub-basin, determine if related impacts from the Soda Fire of 2015 extirpated populations in small isolate tributaries. Re-establish any extirpated Redband through translocation if necessary.

Action Item: If feasible, remove of non-endemic stocks of trout in the SF Boise sub-basin.

Action Item: In the SF Boise sub-basin, determine if related impacts from the Pony/Elk Fire of 2013 extirpated populations in small isolated tributaries; re-establish through translocation if necessary

Action Item: Assess harvest rates of wild Redband in the mainstem MF Payette River.

Action Item: Identify unscreened diversions in the Payette sub-basin, especially in upper Squaw Creek and install fish screens to reduce entrainment.

Action Item: Assess genetic integrity and harvest rates of wild Redband upstream of Sage Hen Dam in the Payette sub-basin.

Action Item: Investigate the feasibility of introducing Redband to the Tripod Reservoir fishery in the NF Payette sub-basin.

Action Item: Confirm the extent of Redband distribution in the East Fork Weiser River upstream from the confluence with the West Fork Weiser River as a conservation populations.

Action Item: Confirm the extent of Redband distribution in the Hornet Creek to confluence with the Weiser River as a conservation population.

Middle Snake – Powder Basin:

Brownlee Reservoir, Burnt, Powder

Representation

Goal: Protect and improve the genetic integrity of Redband within the Middle Snake – Powder sub-basin watersheds.

Objective: Minimize the impacts of sport fish stocking within the current distribution of Redband in the Middle Snake – Powder sub-basin watersheds.

Action Item: Limit the potential for further introgression by ensuring hatchery stocking programs utilize sterile trout in all Redband watersheds where hatchery stocking continues.

Objective: Emulate metapopulation dynamics across disconnected populations.

Action Item: Facilitate gene flow between disconnected populations by translocating Redband among streams to maintain robust genetic structure.

Resilience

Goal: Improve the quantity and quality of Redband habitat in the Middle Snake – Powder River sub-basin watersheds.

Objective: Protect Redband habitat for existing populations and restore additional aquatic, riparian, and wetland habitat in the Brownlee Reservoir, Burnt, and Powder river watersheds.

Objective: Identify and alleviate fish migration barriers to improve population connectivity.

Action Item: Identify barriers that should be prioritized for removal or for improving fish passage.

Action Item: Identify barriers that should remain in place if they provide a conservation benefit.

Redundancy

Goal: Improve Redundancy by increasing the number of core and conservation populations throughout the Middle Snake – Powder sub-basin watersheds.

Objective: Maintain or increase the number of core and conservation populations throughout the Middle Snake-Powder sub-basin watershed.

Action Item: Assess distribution of non-native species

Action Item: Investigate the interactions (predation, competition) of Redband with non-native fishes.

Oregon Closed Basins GMU

The Oregon Closed Basins GMU includes one HUC 6-digit basin, the Oregon Closed Basins with eight sub-basins containing interior Redband. The ODFW has defined five species management units (SMUs) for Redband across these sub-basins. ODFW is developing a Conservation Plan[3] for the two SMUs in the eastern part of the basin. The intent of this conservation strategy is to emulate the draft ODFW Conservation Plan.

The eastern portion of the Oregon Closed Basins has Redband populations in five of the HUC 8-digit sub-basins (Table 9). The Malheur Lakes SMU is comprised of nine populations and the Catlow Valley SMU (Guano subbasin) is comprised of four populations. The Western portion of the Oregon Closed Basins has 15 populations, across four GMUs.

Table 9. Summary statistics for the Oregon Closed Basins Redband[4].

HUC 8-digit Code	Sub-basin Name	Number of Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
Malheur Lakes SMU						
17120001	Harney-Malheur Lakes	5	470	72,978	153	387
17120002	Silvies	1	14,251	0	760	13
17120003	Donner and Blitzen	2	716	0	537	689

[3] The ODFW Conservation Plan will conform to guidelines within the ODFW Native Fish Conservation Policy, and will describe population-level conservation goals, threats and limiting factors, and proposed actions

[4] Summary statistics in this table differ from those in the 3R analysis. For example, the ODFW Conservation Plan does not distinguish between conservation versus non-conservation populations. It also appears there are differences in how populations are circumscribed spatially within stream networks. The GMU team will need to resolve these differences with future updates to this strategy document.

17120004	Silver	1	343	0	228	0
Catlow Valley SMU						
17120008	Guano	4	265	0	119	160
Fort Rock SMU						
17120005	Summer Lake	3	262	0	119	4,725
Chewaucan SMU						
17120006	Lake Abert	4	671	0	404	0
Warner Lakes SMU						
17120007	Warner Lakes	4	463	37,328	294	13,177

Representation

Goal: Improve the spatial structure and ecological diversity of Redband in this GMU. Doing so will help maintain the processes that lead to genetic integrity of Redband populations in this GMU.

Objective: Look for opportunities to improve the natural distribution of Redband by improving fish passage of all life stages to high quality habitat.

Action Item: Inventory and assess where fish passage barriers limit natural dispersal across historical habitat, and prioritize removal and passage improvement.

Action Item: Work with landowners to assess diversion structures for passage improvements.

Action Item: Improve fish passage conditions by replacing or repairing diversion structures or other instream barriers.

Action Item: Use existing inventories and databases of barrier problems and locations at road crossings to repair or replace crossings impeding natural movement of Redband.

Action Item: Design and implement passage improvements and repairs at road crossings (identify each one as an action item).

Action Item: GMU Team will work with Federal and private landowners to restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity. Team will use the Oregon Department of Fish and Wildlife fish passage priorities database and USDA Forest Service PNW Regional Fish Migration Barrier Database to identify fish migration barriers and work with Federal and State agencies and willing private landowners to provide passage. The team will encourage agencies, organizations, and private landowners to seek funding through grants or other sources to remove fish

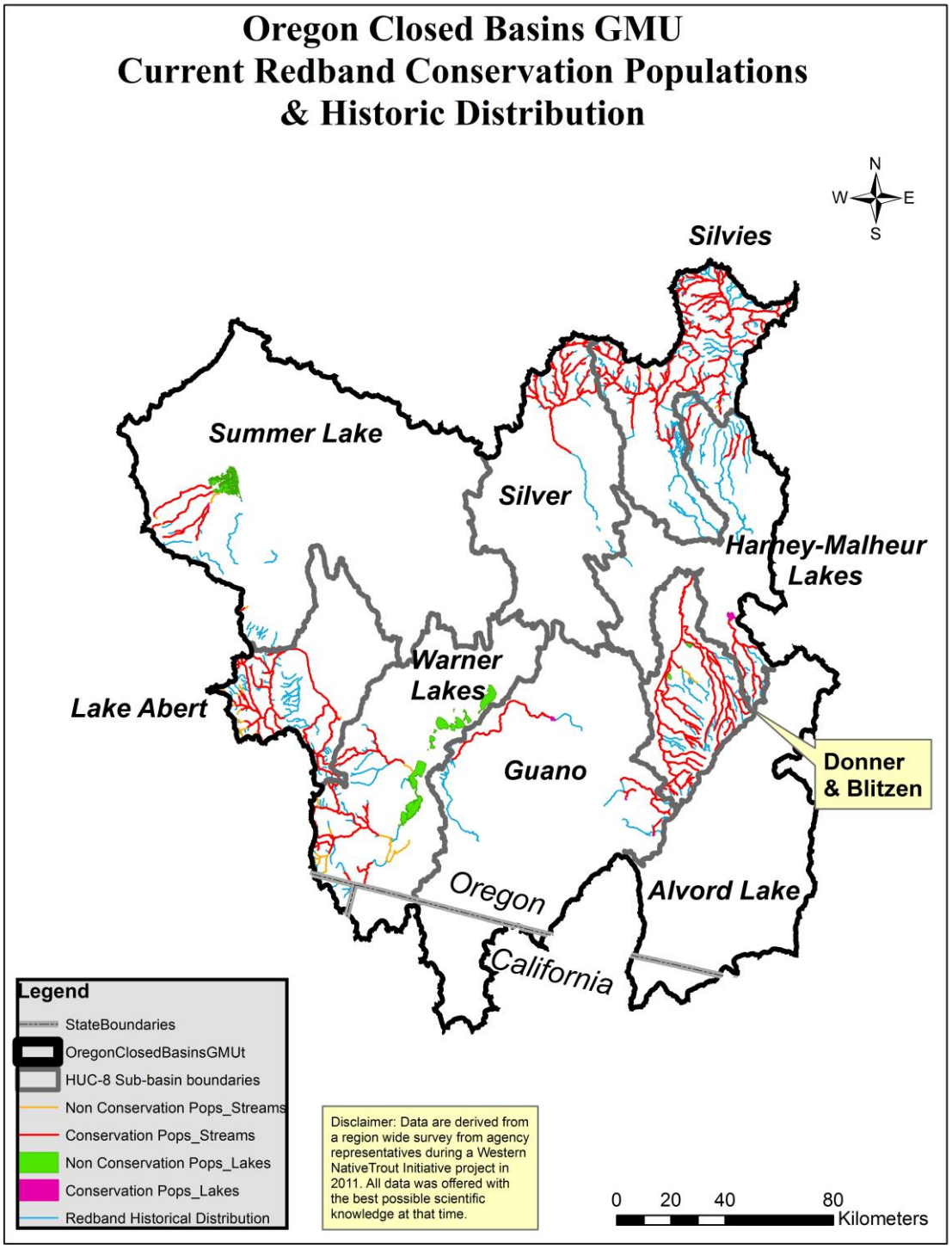

Figure 6. Oregon Closed Basins GMU Redband distribution based on 2011 Western Native Trout Initiative.

passage barriers on their properties.

Objective: Look for opportunities to maintain and improve Redband life history diversity through a habitat strategy of reconnecting stream-river corridors (fluvial traits), and lotic-lentic interfaces (adfluvial traits).

Action Item: Identify reconnections of tributary-main stem corridors (such as passage improvements at water control structures), prioritize them, secure funding for planning and implementation phases, implement and monitor for improved life history diversity.

Goal: Conserve existing Redband genetic and phenotypic diversity in the GMU.

Objective: Reduce the impact of introduced species on Redband populations and prevent the introduction of new non-native species.

Action: The GMU Team will work with Federal and private landowners to reduce the impact of introduced salmonids on Redband populations and prevent the introduction of new non-native salmonids. Staff will utilize current and future Statutes (ORS), rules (OAR), and policies to prevent new non-native fish species from being introduced into the GMU. Staff will utilize strategic opportunities that are socially accepted to remove or reduce non-native fish populations in Redband streams within the GMU.

Action Item: Develop plans for eliminating non-native salmonids using techniques such as barrier construction to isolate populations, and piscicide or mechanical removal to remove the unwanted fish species. Prioritize these actions for the most important populations.

Action Item: Assess feasibility for non-native fish removal on a stream reach scale. Where feasible, implement non-native fish removals and restock with native Redband.

Action Item: Develop and implement a fish management plan for all basins to conserve natural populations of Redband free of influence from stocked non-native hatchery Rainbow Trout.

Action Item: Prepare a fish stock management plan to be implemented by the ODFW which emphasizes conservation of native Redband and eliminates non-native stocking where incompatible with native fish management.

Resilience

Goal: Look for opportunities to improve the productivity of populations in the GMU. Productivity is directly linked to the quality and quantity of habitat. Enhancing the habitat will help these populations be resilient to short and long term environmental change.

Objective: Restore channel structure and complexity, and maintain unimpaired structure and complexity.

Action Item: GMU Team will work with willing landowners to maintain and restore channel structure and complexity.

Action Item: The ODFW will coordinate with USFS and BLM staff to prioritize channel habitat restoration areas for streams containing Redband within the Malheur Lakes and

Catlow Valley SMU's; then work to implement restoration actions to improve channel structure and complexity.

Action Item: The GMU Team will work with willing private landowners, watershed councils, and OWEB to prioritize channel habitat restoration areas for streams containing Redband within the GMU. They will collaborate to implement restoration actions to improve channel structure and complexity.

Action Item: Assess current condition of geomorphic processes influencing fish habitat such as pool forming processes.

Action Item: Develop a plan for habitat improvement projects which will increase and improve Redband habitat while discouraging habitat preferred by non-native fish such as eastern brook trout, carp, and bass.

Objective: Restore riparian condition and large woody debris (LWD) recruitment, and maintain unimpaired conditions.

Action Item: The GMU Team will work with willing landowners to restore riparian condition, LWD recruitment in appropriate areas, and maintain unimpaired conditions. Staff will coordinate/collaborate with USFS and BLM fisheries, range, and forestry staff to review grazing management plans, timber sales, and other projects that can affect riparian conditions near Redband streams.

Action Item: The GMU Team will work with willing private landowners, watershed councils, the High Desert Partnership, Soil and Water Conservation District (SWCD), Natural Resources Conservation Service (NRCS), and OWEB to develop projects on private property that will prevent further degradation of riparian conditions and begin the restorative processes, promoting LWD recruitment in the future and maintaining unimpaired riparian conditions.

Action Item: Develop plans to remove juniper to allow riparian vegetation improvement and growth.

Objective: Restore and maintain floodplain connectivity and function.

Action Item: The GMU Team will work with willing landowners to restore and maintain floodplain connectivity and function.

Objective: Restore and maintain water quality sufficient to support the needs of Redband.

Action Item: The GMU Team will work with willing landowners to restore and maintain water quality sufficient to support the needs of Redband within the GMU. ODFW staff will continue to work with Federal agencies (BLM, USFS, USFWS) to encourage management actions that will improve water quality on Federally managed land.

Action Item: The GMU Team will work with willing private landowners to encourage management actions that will improve water quality on their land. Staff will collaborate with and support agencies (NRCS, SWCD, ODEQ) or entities (OWEB, Oregon Department of Agriculture-Local Advisory Committee) that encourage improved water quality.

Objective: Restore and maintain water quantity sufficient to support the needs of Redband.

Action Item: The GMU Team will work with willing landowners to restore and maintain water quantity sufficient to support the needs of Redband within the GMU. Opportunities to restore and maintain water quantity sufficient to support the needs of Redband in the

Catlow Valley SMU are limited by climate, however the Team will work with willing private landowners to improve water quantity as options become available.

Objective: Restore degraded upland processes to minimize unnatural rates of erosion and runoff and maintain natural upland processes.

Action Item: The GMU Team will work with willing landowners to improve degraded upland processes and to minimize unnatural rates of erosion and runoff within the GMU.

Action Item: The GMU Team will continue to work with Federal agencies (BLM, USFS, USFWS) to encourage management actions that will improve degraded upland processes and reduce erosion on Federally managed land. Examples of such actions may include, but are not limited to: juniper thinning, grazing management, weed management, native plantings, etc.

Action Item: On Forest Service and BLM managed lands, reduce impacts to riparian vegetation by following progressive cattle grazing strategies which promote riparian vegetation health.

Action Item: The GMU Team will work with willing private landowners to encourage management actions that will improve degraded upland processes and reduce erosion on their land. Staff will collaborate with and support agencies (NRCS, SWCD, ODEQ) or programs (OWEB, ODA-LAC) that encourage improved management of degraded upland processes and to reduce erosion. Examples of such actions may include, but are not limited to: juniper thinning, grazing management, weed management, native plantings, etc.

Objective: Assess whether beaver are an appropriate habitat enhancement tool for each stream.

Action Item: Identify areas to promote beaver activity to improve Redband habitat.

Action Item: Identify appropriate habitat for translocation of beaver.

Action Item: Develop a plan at a stream reach scale for re-introduction of beaver into streams and enhancement of habitat to retain beaver in the stream systems. Promote the role of beaver in stream habitat in general.

Action Item: If implemented, develop technique to monitor persistence and changes in stream habitats from beaver activities.

Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Objective: Identify core conservation populations and verify previously identified populations.

Action Item: Use genetic testing and inspection of past stocking records to identify core conservation populations within the GMU.

Objective: Protect the integrity of core conservation populations

Action Item: Adjust stocking programs as necessary to protect conservation populations

Action Item: Use public outreach, including signage and user group presentations, where needed to protect core populations from illegal introductions of deleterious fish species.

Objective: If core population genetics are not pure, consider management actions to improve

genetics.

Action Item: Address incoming source of genes affecting population genetics, if it has not previously been addressed.

Action Item: Consider swamping gene pool with regular introduction of pure Redband genes.

Redundancy

The opportunities to expand/increase existing and establish new Redband populations need to be investigated and developed in the GMU. The challenges of removing non-natives and assisting the dispersal of Redband to new or previously extirpated areas need to be addressed so that "redundancy" may be enhanced, reducing the risk of Redband from future environmental changes and non-native trout threats.

Goal: Look for opportunities to repopulate Redband into previously extirpated area, or assist their establishment to new areas as a crisis strategy.

Objective: Repopulate previously extirpated areas

Action Item: Identify and prioritize areas appropriate for reintroduction, including cold water assets.

Action Item: Coordinate with associated landowners/ land managers

Action Item: Assess habitat conditions in identified areas and improve where necessary.

Action item: Determine needs for non-native trout eradication in connection with candidate Redband waters.

Deschutes GMU

The Deschutes GMU includes one HUC 6-digit basin, the Deschutes Basin. It has Redband populations in five of the HUC 8-digit sub-basins (Table 10), all of which are occupied by conservation populations of Redband. Although not part of the 3R Framework spatial area, the Lower Deschutes sub-basin (HUC 17070306) includes stream segments within the zone of anadromy, but contains a resident population complex in the Tygh Creek and White River HUC 10-digit catchments (HUC 1707030609).

Table 10. Summary statistics for the Deschutes Basin Redband GMU.

HUC 8-digit Code	Sub-basin Name	Number of Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
17070301	Upper Deschutes	Unknown	738	8,628	574	10,259
17070302	Little Deschutes	Unknown	359	3,823	167	0
17070303	Beaver-South Fork	Unknown	884	0	412	0
17070304	Upper Crooked	Unknown	1,400	0	698	1,305
17070305	Lower Crooked	Unknown	884	0	455	708
Totals		**14**	**4,265**	**12,451**	**2,306**	**12,272**

Representation

Goal: Protect and improve the genetic integrity of Redband populations within the Deschutes GMU.

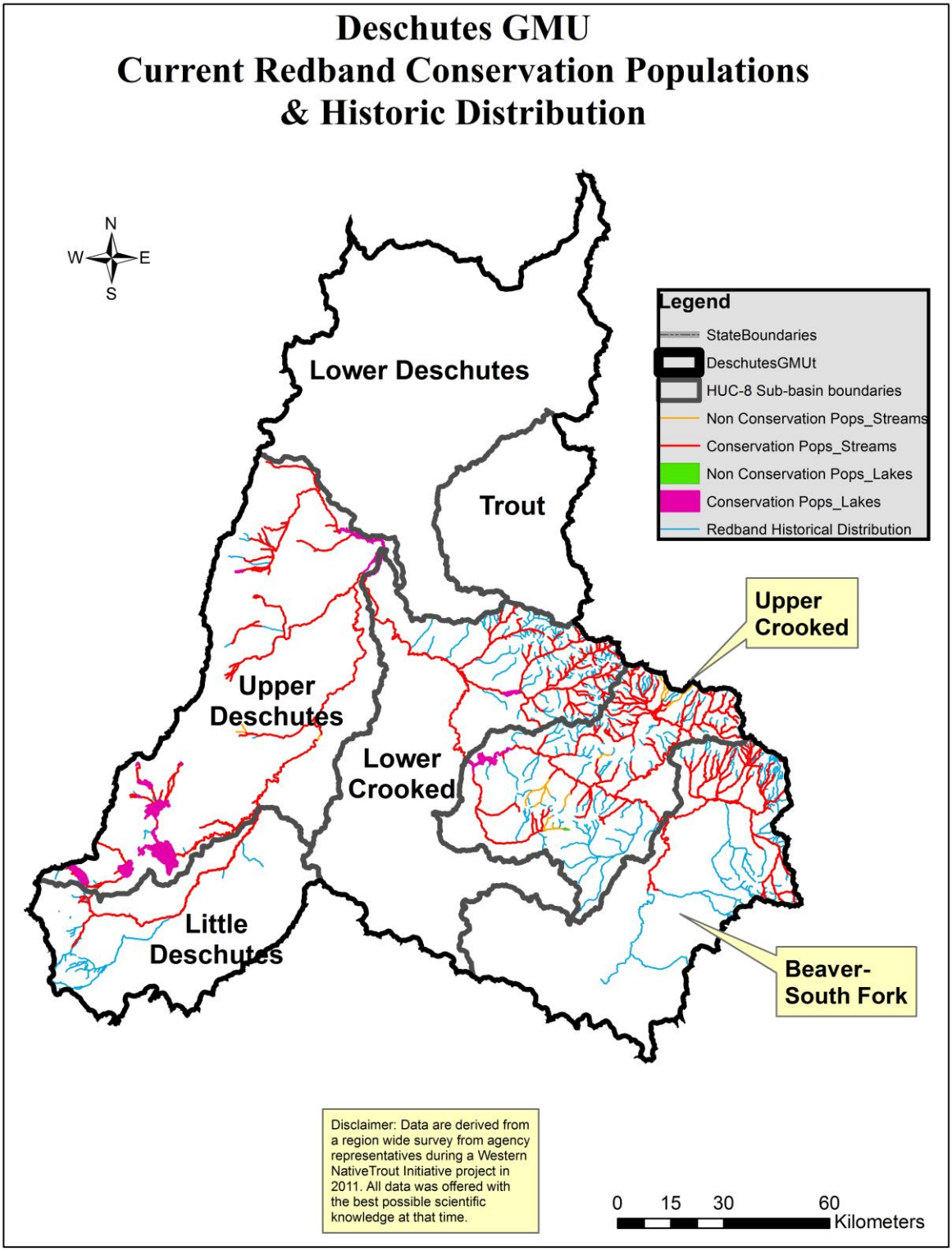

Figure 7. Deschutes GMU Redband distribution based on 2011 Western Native Trout Initiative.

Objective: Evaluate current genetic distribution data for accuracy and data gaps.

Action Item: Collaboratively pool resources to develop a funding base to collect and analyze prioritized genetic samples across the entire Deschutes GMU.

Action Item: Genetic analyses will be completed on known Redband populations that have not yet been genetically tested. Additional analyses will be conducted to update the genetic status of conservation populations when warranted.

Action Item: Create a genetic clearinghouse available to all entities of available data to help prioritize future genetic sampling efforts in the Deschutes GMU.

Action Item: Specific streams to be genetically analyzed will be discussed every year at an Annual Coordination Meeting and coordinated by the Deschutes GMU members.

Objective: Look for opportunities to secure the genetic integrity of populations that already meet the genetic integrity target.

Action Item: Identify populations where genetic integrity is at eminent risk. Work with partners to establish a feasible short and long-term "plan" to reduce the risk.

Reductions in risk may include:

- Restrict introduction of nonnative fish species near existing populations.
- Restrict spread of disease and invasive species.
- Remove non-native fish species.
- Regulate angling and enforcing regulations.
- Construct in-channel barriers.

Action Item: Manage hatchery stocking programs to minimize impacts to Redband, especially in areas where Redband exhibit high genetic integrity.

Action Item: Review past and current stocking practices and modify stocking practices as appropriate.

Goal: Protect and improve the existing life history diversity of Redband populations within the Deschutes GMU.

Objective: Look for opportunities to promote the maintenance and creation of life history diversity in the Deschutes River GMU in the 12 populations identified.

Action Item: Verify presence/absence of Redband in areas where there are assumptions made on presence.

Action Item: Provide connectivity through gaining fish passage at all artificial barriers. Enhance and/or restore connectedness and opportunities for migration to disjunct populations where possible. Actions may include culvert replacements, improved road drainage, road decommissioning, passage at water developments, etc.

Action Item: Create a prioritized list of all possible reconnection projects in the Deschutes GMU.

Action Item: Continue with or entertain other opportunities to reintroduce historical life history traits through the steelhead reintroduction effort in key areas.

Action Item: Secure funding for planning and implementation phases.

Resiliency

Goal: Protect and improve aquatic habitat for Redband within the Deschutes GMU.

Objective: Identify high priority areas across the Deschutes GMU and improve habitat conditions for Redband.

- Action Item: Identify and prioritize habitat restoration opportunities.
- Action Item: Maintain or restore instream flows to support healthy riparian and aquatics habitats. Network with area stakeholders to promote flow restoration opportunities.
- Action Item: Restore and maintain water quality and stream temperatures. Restore natural hydraulic and sediment regimes, restoration floodplain and riparian function, and expand available spawning and rearing habitat.
- Action item: Restore altered channel and habitat features to historical conditions. Actions may include stream bank stabilization, large wood debris introduction, and vegetation planting for improved riparian areas.
- Action Item: Restoration of groundwater/hyporheic exchange. This may include meadow restoration and beaver reintroduction.
- Action Item: Prioritize and implement fish screening projects in the Deschutes GMU.

Objective: Reduce the threats to Redband in the Deschutes GMU that cause present or potential destruction, modification, or curtailment of habitat or range.

- Action Item: Manage recreational use on public lands to minimize disturbance to Redband habitat (ie. OHV, mining, dispersed camping, etc.)
- Action Item: Manage livestock grazing to minimize or mitigate impacts to Redband habitats.
- Action Item: Manage feral livestock populations to minimize or mitigate impacts to Redband habitats.
- Action Item: Identify and prioritize highly vulnerable areas and populations to climate change (use South Central Oregon Adaptation Partnership document) and maintain cold-water refugia in those areas that will be highly susceptible to climate change.
- Action Item: Work collaboratively on changes to fishing regulations to improve resiliency of Redband in the Deschutes GMU. This could include catch and release areas or focusing on the removal of non-native species such as brown and brook trout.

Objective: Improve public information and education on the conservation of Redband.

- Action Item: Develop and implement a public information and education program.

Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Objective: Identify core conservation populations and verify previously identified populations.

- Action Item: Use genetic testing and inspection of past stocking records to identify core conservation populations within the GMU.

Objective: Protect the integrity of core conservation populations

- Action Item: Adjust stocking programs as necessary to protect conservation populations
- Action Item: Use public outreach, including signage and user group presentations, where

needed to protect core populations from illegal introductions of fish with the potential of affecting core population genetics.

Objective: If core population genetics are not pure, consider management actions to improve genetics.

Action Item: Address incoming source of genes affecting population genetics, if it has not previously been addressed.

Action Item: Consider swamping gene pool with regular introduction of pure Redband genes.

Redundancy

There are populations of Redband well distributed throughout the Deschutes GMU. The Goal here is to maintain these populations. To do so, refer to objectives and action items in the Representation and Resiliency sections.

Klamath, Upper Sacramento, North Lahontan GMU (K-US-NL GMU)

The K-US-NL GMU includes three HUC 6-digit basins. The Klamath has Redband populations in five HUC 8-digit sub-basins, all of which support conservation populations (Table 11). Although not part of the 3R Framework spatial area, the Upper Klamath sub-basin (HUC 18010206) includes stream segments within the zone of anadromy, but contains resident populations in the Jenny Creek, Fall Creek, and Spencer Creek HUC 10-digit watersheds (HUC 1801020604 and 1801020601, respectively). The Upper Sacramento basin has Redband populations in four HUC 8-digit sub-basins, all of which support either core conservation or conservation populations.

The Feather River system had historical connection to anadromy but supported Redband similar to other Sacramento River forms as described by Behnke (1992). In the upper Feather River, two sub-basins (HUC 18020121 and HUC 18020122) may still support Redband in headwater reaches isolated from anadromous and stocked hatchery Rainbow Trout, similar to the resident streams identified for the Upper Klamath sub-basin. These Feather sub-basins were not part of the original 2012 Status Assessment but are included here as efforts to confirm presence of Redband in these headwater locations are in progress. The origin of Redband of the Surprise Valley sub-basin (HUC 18080001, North Lahontan basin) is not certain—native or introduced status is not clear from existing records. The genetic status, also uncertain, needs further research but the sub-basin likely supports some introgressed populations of Redband. Pending the results of further genetic sampling and analysis this sub-basin's populations should be managed as conservation populations.

There are 14 conservation populations identified in the Klamath Basin. The Williamson sub-basin contains three populations, Sprague sub-basin six populations, and Upper Klamath Lake sub-basin has one population, Lost River sub-basin one population, and Upper Klamath sub-basin supports three populations.

Table 11. Summary statistics for the Klamath-Upper Sacramento-North Lahontan Redband GMU.

HUC 8-digit Code	Sub-basin Name	Number of Conservation Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
Klamath Basin						
18010201	Williamson	3	373	0	89	0
18010202	Sprague	6	883	0	676	84
18010203	Upper Klamath Lake	1	333	0	183	34,917
18010204	Lost[1]	1[1]	639	0	115	1,543
18010206	Upper Klamath[2]	3	TBD	0	TBD	TBD
Upper Sacramento Basin						
18020001	Goose Lake	8	904	0	455	39,887
18020002	Upper Pit	6	1,442	192	254	78
18020003	Lower Pit	1	1,382	0	46	0
18020004	McCloud	7	832	0	89	0

Table 11. Continued.

HUC 8-digit Code	Sub-basin Name	Number of Conservation Populations	Historical		Current	
			Stream Length (km)	Lake Area (ha)	Stream Length (km)	Lake Area (ha)
Lower Sacramento Basin						
18020121	North Fork Feather	TBD	TBD	0	TBD	TBD
18020122	East Branch North Fork Feather	TBD	TBD	0	TBD	TBD
	Totals		**4,560**	**192**	**844**	**39,965**
North Lahontan Basin						
18080001	Surprise Valley	5	485	0	57	115
	Totals					

[1] Most likely extirpated from the Oregon portion of the sub-basin

[2] Tributary streams to Klamath River downstream of Upper Klamath Lake (Jenny, Spencer, and Fall Creeks)

Representation

Redband in the Klamath Basin have genetically pure populations with multiple life histories represented (resident, adfluvial, fluvial) and are well distributed in the sub-basins with the presence of peripheral populations. The Upper Sacramento Basin supports pure Redband populations in isolated tributaries in the McCloud sub-basin and the Goose Lake lacustrine-adfluvial life history form apparently persists despite more recent desiccation events in the lake and challenges with migration obstacles in the tributaries. The genetic status of populations in both Pit sub-basins, Goose Lake and Surprise Valley sub-basins is in need of assessment and may improve determinations of conservation populations.

Klamath Basin

Goal: Identify data gaps on life history, distribution, genetics, and/or threats to Redband.

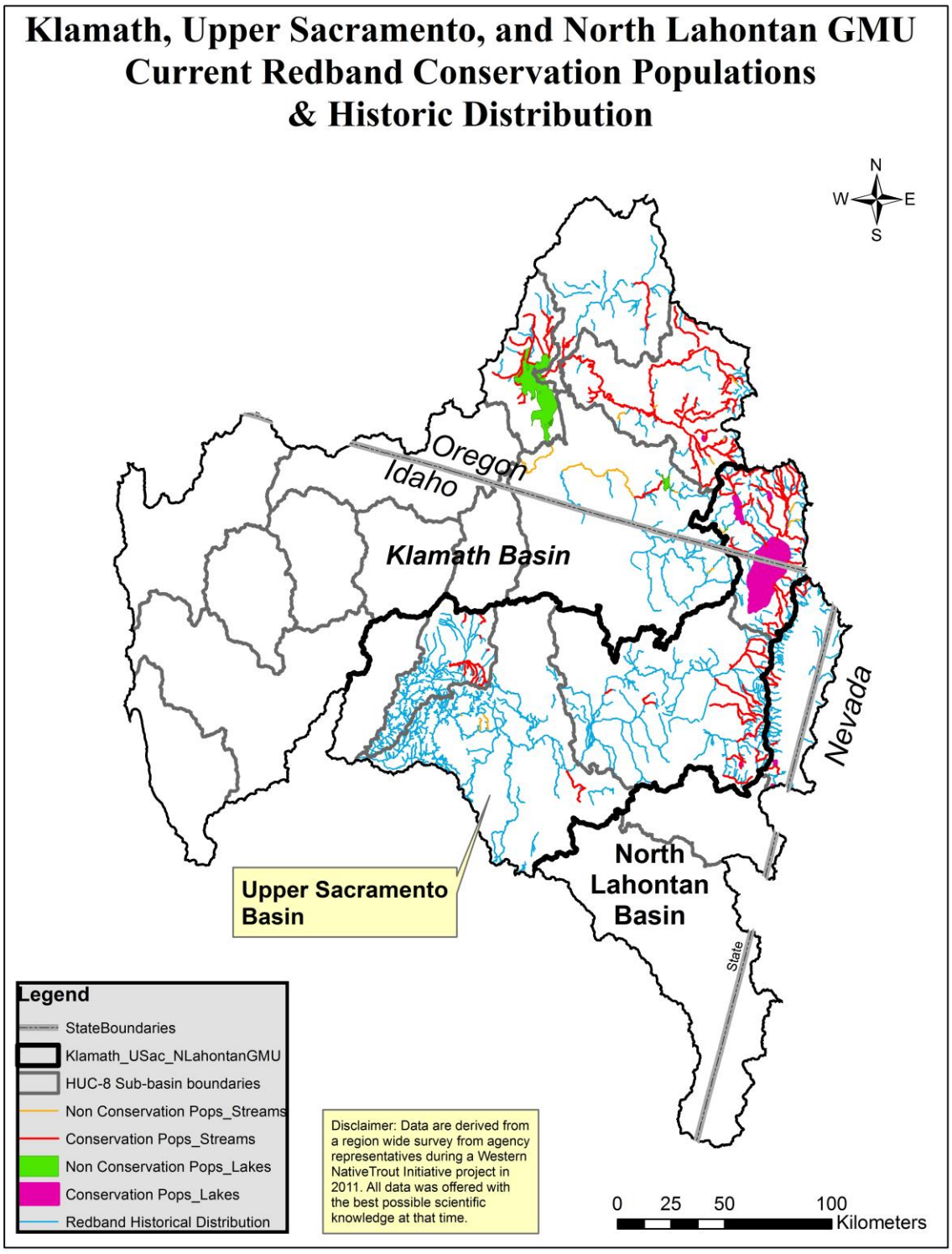

Figure 8. Klamath, Upper Sacramento, and North Lahontan GMU Redband distribution based on 2011 Western Native Trout Initiative.

Objective: Determine specific data gaps by sub-basin.

Action Item: For the Williamson sub-basin, obtain more detailed information on the life histories of Redband in Annie Creek and Sun Creek.

Action Item: For the Sprague sub-basin, genetic integrity of the Redband in Paradise Creek (SFK Sprague) is unknown. Implement biological and/or eDNA sampling to collect genetic material.

Action Item: Secure funding for Paradise Creek genetic analysis and reporting.

Action Item: For the Upper Klamath sub-basin, conduct a thorough genetic analysis of Jenny Creek and all tributaries.

The headwaters of the Lost River in California have been infrequently surveyed and not surveyed by CDFW since the 1980s when a few wild populations were documented in tributaries, such as North Fork Willow Creek. Other streams (e.g. Boles, Rock, and Fletcher Creeks) held trout that may have been wild or hatchery-origin. The current status of these populations is unknown as is their relationship to hatchery trout that may have been planted in several stock ponds and small reservoirs in the drainage.

The population in Miller Creek is likely extirpated from the Oregon portion of the sub-basin. See 2016 Klamath Watershed District Stock Status Review of Native Fish report by the Oregon Department of Fish and Wildlife for discussion on possible extirpation.

Action Item: For the Lost River sub-basin, determine the status of remaining populations in the Oregon portion of the sub-basin. Continue to sample streams for the presence of Redband in the sub-basin.

Action Item: For the California portion of the Lost River headwaters, conduct reconnaissance surveys to locate remaining Redband populations and determine status. Collect genetic samples from any Redband populations encountered. (CDFW)

Upper and Lower Sacramento/North Lahontan Basins

Goal: Conserve, protect, and enhance Redband population/life history/genetic integrity.

Objective: Gather necessary information to further improve status and identity of conservation populations in all sub-basins.

Action Item: For McCloud, Upper and Lower Pit, and Surprise sub-basins, continue to monitor and survey populations, and collect genetic samples, especially historical locations not recently visited. (CDFW 2016-20)

Action Item: Expand survey efforts to seek out Redband populations in North Fork Feather River headwaters tributaries and collect genetic samples. (CDFW, NGOs, volunteers)

Action Item: Develop a SNP-marker genetic monitoring panel for McCloud Redband (CDFW & UC Merced, 2018)

Action Item: Construct a SNP-based phylogenetic tree of Redband and selected Rainbow Trout relationships using RAD-seq data for all sub-basins. (CDFW & UC Merced, 2018)

Action Item: Utilize new SNP-based genetic tools to evaluate sub-basin populations and refine status and location of conservation populations. (CDFW, 2018-2020)

Action Item: Develop priority for pursuit of genetics management plans to guide future

conservation actions for sub-basin populations on a priority-based order. (CDFW)

Objective: Identify persistence of multiple life history strategies within Goose Lake sub-basin.

Action Item: Monitor lake and stream populations for migratory and habitat utilization patterns.

Action Item: Evaluate/analyze genetic status of populations that exhibit different life histories.

Resilience

The primary factors affecting Redband in the Klamath Basin include connectivity to historical habitats, fish passage/screening at diversions, degraded habitats, poor water quality and low stream flows, and the presence of non-native species. In the Upper Sacramento Basin, the McCloud sub-basin, pure (core conservation) populations are present in isolated headwater tributaries. Due to the volcanic geology of the area these tributaries flow goes sub-surface and seldom connect to the mainstem McCloud where hybridized Redband dominate. During wet years, Goose Lake supports lacustrine Redband but these fish must recolonize the lake after periods of desiccation that have occurred more frequently in recent decades. Most populations in the sub-basins of the Upper Sacramento and the Surprise sub-basins are present in isolated headwaters. Only limited Redband streams and a few tributaries are present, mostly on the west slope of the Warner Mountains.

General Conservation Measures Addressing Resilience

Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Objective: Identify core conservation populations and verify previously identified populations.

Action Item: Use genetic testing and inspection of past stocking records to identify core conservation populations within the GMU.

Objective: Protect the integrity of core conservation populations

Action Item: Adjust stocking programs as necessary to protect conservation populations

Action Item: Use public outreach, including signage and user group presentations, where needed to protect core populations from illegal introductions of fish with the potential of affecting core population genetics.

Objective: If core population genetics are not pure, consider management actions to improve genetics.

Action Item: Address incoming source of genes affecting population genetics, if it has not previously been addressed.

Action Item: Consider swamping gene pool with regular introduction of pure Redband genes.

Williamson River sub-basin (HUC 18010201):

Goal: Improve connectivity to habitats for Redband throughout the sub-basin.

Objective: Address fish entrainment and/or passage issues at points of diversion on private lands in the sub-basin.

Action Item: There is an unscreened diversion on Lower Annie Creek. Work with landowners to identify type of screen needed and install.

Action Item: There is a diversion dam on Annie Creek which provides water to the Annie Creek Slough. Work with landowners to identify fish passage options for the diversion dam and screening for the slough and implement.

Action Item: There is an unscreened diversion on Lower Sun Creek. Work with landowners to identify type of screen needed and install.

Action Item: The Melhase Diversion on Wood River is not screened. Work with landowners to identify type of screen needed and install.

Action Item: The Hawkins Diversion on Wood River, the largest in regards to discharge, is unscreened. Work with landowners to identify type of screen needed and install.

Action Item: There is an unscreened diversion on Fort Creek. Work with landowners to identify type of screen needed and install.

Goal: Improve instream and riparian habitat to support all life stages of Redband.

Objective: Restore riparian vegetation and ecological function with focused efforts in Annie Creek and Crooked Creek above the hatchery.

Action Item: Identify areas along Crooked Creek above the ODFW Hatchery where riparian restoration is needed. Determine the type of restoration (fencing, planting, etc.) and implement.

Action Item: Areas along Annie Creek are in a degraded condition. Work with willing landowners to restore riparian plant communities by fencing and/or planting of native riparian vegetation.

Action Item: Areas along Larkin Creek (Lower Williamson) are in a degraded condition. Work with willing landowners to restore riparian plant communities by fencing and/or planting of native riparian vegetation.

Action Item: Areas along Sunnybrook Creek (Lower Williamson) are in a degraded condition. Work with landowners to restore riparian plant communities by fencing and/or planting of native riparian vegetation.

Objective: Restore stream channel geomorphic processes, hydrologic functions, and aquatic habitat conditions in the sub-basin.

Action Item: Working with landowners, implement channel restoration on Annie Creek at the confluence with Wood River to improve stream habitat conditions and a more defined mouth of Annie Creek.

Action Item: Working with landowners, add large wood to Annie Creek to improve habitat complexity.

Action Item: Working with landowners, implement restoration activities to improve geomorphic and hydrologic function, improve habitat conditions/complexity in Crooked Creek above the ODFW Hatchery.

Action Item: Add large wood to the Upper Williamson on USDA Forest Service land to improve habitat conditions and complexity.

Objective: Adjust land management activities, in particular grazing management, in the sub-basin to improve riparian and stream channel conditions.

Action Item: Pursue opportunities to adjust grazing strategies on private lands in the Upper

Williamson River.

Action Item: USDA Forest Service will work with permittees in the Upper Williamson River to adjust grazing strategies for pastures and allotments to improve riparian and stream channel conditions.

Action Item: Identify and pursue opportunities to adjust grazing strategies on private lands in other areas of the sub-basin.

Goal: Improve water quality and water quantity (instream flows) in the sub-basin.

Objective: Identify specific actions for water quality improvement as well as the feasibility of water rights acquisition.

Action Item: USDA Forest Service continues to implement actions identified in its Water Quality Restoration Plan for the Upper Klamath Basin.

Action Item: Identify areas of need for increased instream flows to improve water quality and habitat for Redband.

Action Item: Pursue opportunities for acquisition of instream water rights with particular emphasis on the Annie Creek and Crooked Creek.

Sprague River sub-basin (HUC 18010202):

Goal: Improve connectivity to habitats for Redband throughout the sub-basin.

Objective: Address fish passage issues at road/stream crossings with focused efforts in the North Fork Sprague River, South Fork Sprague River, and Sycan River watersheds.

Action Item: Identify and prioritize culverts for replacement in the sub-basin on private and state lands.

Action Item: Pursue funding options for replacement of culverts on private and state lands.

Action Item: A low-water concrete ford occurs on the South Fork Sprague River at Blaisdell that has been identified as a fish passage barrier. Work with willing landowners to determine options for improving fish passage and implement.

Action Item: An OC&E Rails to Trails segment crosses Fivemile Creek (NFK Sprague River) in several locations. Inventory these crossings and determine which ones are fish passage barriers and implement corrective actions.

Action Item: USDA Forest Service continues to replace fish barrier culverts that were inventoried and prioritized in 2003.

Objective: Address fish entrainment and/or passage issues at points of diversion on private lands in the sub-basin.

Action Item: Identify and implement corrective actions with willing landowner for fish passage issue at a diversion dam on Meryl Creek (NFK Sprague).

Action Item: There is an unscreened diversion on Long Creek (Sycan River). Working with the willing landowner, determine type of screen needed and install.

Action Item: There is an irrigation dam on Rock Creek (Sprague River). Working with willing landowner, determine fish passage options and implement.

Action Item: There are fish passage and screening issues associated with irrigation on Whiskey Creek (Sprague River). Working with land owner, determine fish passage and screening options and implement.

Action Item: There is a small hydroelectric dam on the North Fork Sprague River. Working

with the dam owner, determine fish passage options and implement.

Action Item: There are fish passage issues with an irrigation diversion dam on Paradise Creek (SFK Sprague River). Working with willing landowner, identify fish passage options and implement.

Action Item: There is an irrigation diversion/weir in the Sycan Marsh (Sycan River). Working with willing landowner, determine screening options and implement.

Action Item: There are several tributary springs to the Lower Sycan River that have been ponded. Work with landowners to determine the feasibility of fish passage into these ponds and implement.

Goal: Improve instream and riparian habitat to support all life stages of Redband in the sub-basin.

Objective: Restore riparian vegetation and ecological function with focused efforts in the North Fork Sprague River, South Fork Sprague River, and Upper Sycan watersheds.

Action Item: Riparian fencing and planting of native species along Fishhole Creek, Fivemile Creek, Meryl Creek and the lower 10 miles of the South Fork Sprague River.

Action Item: Riparian restoration along the North Fork Sprague River and Upper Sycan River and tributaries on lands administered by the US Forest Service.

Action Item: Levee removal to restore floodplain connectivity along with riparian fencing and planting along the mainstem Sprague River.

Objective: Restore stream channel geomorphic processes, hydrologic functions, and aquatic habitat conditions in the sub-basin.

Action Item: The lower South Fork Sprague River channel has been severely altered and degraded over time. Identify the appropriate techniques/methods to restore geomorphological process and hydrologic function to the section. Work with willing landowners to implement agreed upon restoration actions.

Action Item: Degraded habitat conditions occur along Fivemile Creek (NFK Sprague River). Working with the willing landowner, identify restoration activities and implement.

Action Item: The upper North Fork Sprague River and tributaries on USDA Forest Service land have opportunities for stream restoration. Identify appropriate restoration techniques/methods and implement.

Action Item: The Upper Sycan River and tributaries on USDA Forest Service land have opportunities for stream restoration. Identify appropriate restoration techniques/methods and implement.

Objective: Adjust land management activities, in particular grazing management, in the sub-basin to improve riparian and stream channel conditions.

Action Item: In general, work with private landowners throughout the sub-basin to improve range management and grazing strategies that will aide in the restoration of riparian and stream channel conditions.

Action Item: USDA Forest Service will work with permittees in the North Fork Sprague River to adjust grazing strategies for pastures and allotments to improve riparian and stream channel conditions.

Action Item: USDA Forest Service will work with permittees in the Upper Sycan River to adjust grazing strategies for pastures and allotments to improve riparian and stream

channel conditions.

Action Items: USDA Forest Service will work with permittees in the South Fork Sprague River to adjust grazing strategies for pastures and allotments to improve riparian and stream channel conditions.

Action Item: Work with willing landowners to Improve grazing management in the Sycan Marsh and tributaries (Long Creek and Calahan Creek).

Goal: Improve water quality and water quantity (instream flows) in the sub-basin.

Objective: Identify specific actions for water quality improvement as well as the feasibility of water rights acquisition.

Action Item: USDA Forest Service continues to implement actions identified in its Water Quality Restoration Plan for the Upper Klamath Basin (2003).

Action Item: Identify areas of need for increased instream flows to improve water quality and habitat for Redband.

Action Item: Pursue opportunities for acquisition of instream water rights with particular emphasis on the North Fork Sprague River.

Upper Klamath Lake sub-basin (HUC 18010203)

Goal: Improve connectivity to habitats for Redband throughout the sub-basin.

Objective: Address fish passage issues at road/stream crossings.

Action Item: Correct fish passage issue at Hwy 140 crossing of Moss Creek.

Objective: Address fish entrainment and/or passage issues at points of diversion on private lands in the sub-basin.

Action Item: There is an unscreened diversion on Denny Creek. Work with willing landowners to identify type of screen needed and install.

Action Item: There is an unscreened diversion on Fourmile Creek. Work with willing landowners to identify type of screen needed and install.

Action Item: There are two diversion dams on Fourmile Creek. Work with willing landowners to identify fish passage options and install.

Action Item: There are unscreened diversions on Threemile Creek. Work with willing landowners to identify type of screen needed and install.

Action Item: There are unscreened diversions on Cherry Creek. Work with willing landowners to identify type of screen needed and install.

Action Item: There are several unscreened diversions on Sevenmile Creek. Work with willing landowners to identify type of screen needed and install.

Action Item: There is a diversion dam on Crane Creek. Work with willing landowners to identify fish passage options and install.

Goal: Improve instream and riparian habitat to support all life stages of Redband.

Objective: Restore stream channel geomorphic processes, hydrologic functions, and aquatic habitat conditions in the sub-basin.

Action Item: Working with willing landowners, implement channel restoration on Denny Creek upstream of the Hwy 140 crossing to Upper Klamath Lake.

Action Item: Working with willing landowners, restore the stream channel on Crystal/Recreation Creeks impacted by historical logging operations.

Action Item: Working with The Nature Conservancy, assist in the restoration of recently purchased property along Fourmile Creek.

Action Item: Working with willing landowners, restore a channelized section of Threemile Creek and reconnect to Fourmile Creek.

Action Item: Working with willing landowners, restore a channelized section of Cherry Creek and improve connectivity to Fourmile Creek.

Action Item: Working with willing landowners, restore Sevenmile Canal to a more sinuous channel with habitat complexity.

Goal: Improve water quality and water quantity (instream flows) in the sub-basin.

Objective: Identify specific actions for water quality improvement as well as the feasibility of water rights acquisition.

Action Item: USDA Forest Service continues to implement actions identified in its Water Quality Restoration Plan for the Upper Klamath Basin.

Action Item: Identify areas of need for increased instream flows to improve water quality and habitat for Redband.

Action Item: Pursue opportunities for acquisition of instream water rights with particular emphasis Fourmile Lake.

Action Item: Improve water diversion efficiency during non-irrigation season on Blue Springs in the Sevenmile Creek drainage.

Goal: Identify data gaps on life history, distribution, genetics, and/or threats to Redband.

Objective: Determine specific data gaps by sub-basin.

Action Item: Perform Redband density estimate in Denny Creek following restoration of identified section.

Action Item: Investigate presence of adfluvial Redband in Moss Creek.

Lost River sub-basin (HUC 18010204)

This population is likely extirpated from the Oregon portion of the sub-basin. See 2016 Klamath Watershed District Stock Status Review of Native Fish report by the ODFW for discussion on possible extirpation. If Redband presence is documented to occur in the sub-basin, the following should occur:

Goal: Water Quality/Quantity

Objective: Identify specific actions for water quality improvement as well as the feasibility of water rights acquisition.

Action Item: Pursue options for the acquisition of water rights in Miller Creek.

Action Item: Identify other areas of need for increased instream flows.

Goal: To identify data gaps on life history, distribution, genetics, threats to Redband.

Objective: Determine specific data gaps by sub-basin.

Action Item: Continue to sample streams for the presence of Redband in the sub-basin.

Upper Klamath sub-basin (HUC 18010206):

Goal: Improve fish management actions across ODFW Watershed Districts for the Jenny Creek drainage.

Objective: Minimize impacts of stocked Rainbow Trout on Redband.
- Action Item: Continue coordination between ODFW Klamath and ODFW Central Point Fish Districts with selection of Rainbow Trout stocks for Hyatt and Howard Prairie Lakes.
- Action Item: Identify and prioritize fish passage/entrainment issues at points of diversion in the watershed.

Goal: Improve instream and riparian habitat to support all life stages of Redband in the Spencer Creek drainage.

Objective: Restore stream channel geomorphic processes, hydrologic functions, and aquatic habitat conditions in the watershed.
- Action Item: Working with willing landowners, restore headwater springs area of Spencer Creek.
- Action Item: Working with willing landowners, restore stream channel through Buck Lake.

Goal: To identify data gaps on life history, distribution, genetics, threats to Redband in the Fall Creek watershed.

Objective: Determine specific data gaps in the watershed.
- Action Item: Conduct fish distribution and abundance survey.

Upper Sacramento and North Lahontan Basins:

Goal: Conserve, protect, enhance Redband populations within historical range

Objective: Seek opportunities to expand strongholds and/or establish metapopulations through collaborative efforts with government agencies, Tribes and private landowners.
- Action Item: Identify candidate waters/habitats to increase stronghold and connected populations.
- Action Item: Identify potential partners for stronghold/metapopulation enhancement projects.
- Action Item: Develop population/habitat enhancement plan and strategy to implement this plan.

Redundancy

The opportunities to expand/increase existing and establish new Redband populations need to be investigated and developed in all Basins of the K-US-NL GMU. The challenges of removing non-natives and reintroduction of Redband need to be addressed so that "redundancy" may be enhanced, improving security of Redband from future climate, habitat, and non-native trout threats.

Goal: Develop non-native species management plans for appropriate Klamath sub-basins.

Objective: Identify and prioritize areas to target for reduction and/or removal of non-native fish species and reintroduction of Redband in the Williamson sub-basin.

Action Item: Target brook trout and brown trout for removal from Annie Creek.

Action Item: Target brook trout and brown trout for removal from the headwaters of the Wood River.

Action Item: Target brook trout and brown trout for removal from Lower Sun Creek. Reintroduce Redband to Lower Sun Creek.

Objective: Identify and prioritize areas to target for reduction and/or removal of non-native fish species and reintroduction of Redband for the Sprague sub-basin.

Action Item: Remove brook trout from Calahan Creek (Sycan River).

Action Item: Develop brook/brown trout removal plans for more complicated areas. These areas include Long Creek (Sycan River), Upper Sycan River, South Fork Sprague River, and North Fork Sprague River.

Action Item: Continue with angler education on the impacts of non-native fish on Redband. Encourage harvest of warm water species in the Sprague River in particular those areas associated with tributary springs.

Objective: Identify and prioritize areas to target for reduction and/or removal of non-native fish species and reintroduction of Redband for the Upper Klamath Lake sub-basin.

Action Item: Research the interactions between Redband and yellow perch in Lower Crystal Creek.

Action Item: Continue to monitor rotenone treatment of Rock Creek along with brook trout removal. Retreat if necessary.

Action Item: Target brook trout for removal from Threemile Creek and Cherry Creek.

Goal: Increase/expand Redband populations and establish new refuge locations for the Upper Sacramento and North Lahontan Basins.

Objective: Investigate suitable habitats/waters that may serve as new locations to establish Redband or protection from catastrophic events.

Action Item: Determine candidate waters for new Redband populations within the historical range.

Action Item: Determine candidate waters for new Redband populations in out-of-range basins.

Action item: Determine needs for non-native trout eradication in connection with candidate Redband waters.

Action item: Establish priority list of candidate waters for new Redband populations and develop strategy to implement restoration projects on priority basis.(CDFW)

Additional Concerns

As an outcome of persistent drought conditions and significant declines in Redband habitats and populations in California Basins a systematic approach to respond to drought threats to Redband has been developed and implemented.

Goal: Protect at-risk Redband populations from drought-induced habitat threats.

Objective: Implement multi-level drought response matrix in response to drought threats

Action Item: When drought conditions warrant, monitor at-risk populations and habitats

Action Item: Determine drought threat criteria from monitoring results and drought response protocols.

Action Item: Evaluate response-options based on monitoring results and threat criteria. Options include: continued monitoring; evaluate translocations to several alternative habitat options; rescue Redband into captivity as last resort.

Action Item: Evaluate and perform translocations to alternative (safer) habitats as warranted.

Action Item: Evaluate and perform if warranted a rescue of Redband into captivity at isolated hatchery facility.

Action Item: If Redband are rescued to captivity, develop plans and procedures to follow, as needed, for captive breeding; broodstock development; return-captives- to- the-wild; or other conservation options if necessary.

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XI. Appendix A: 3R Analysis Maps

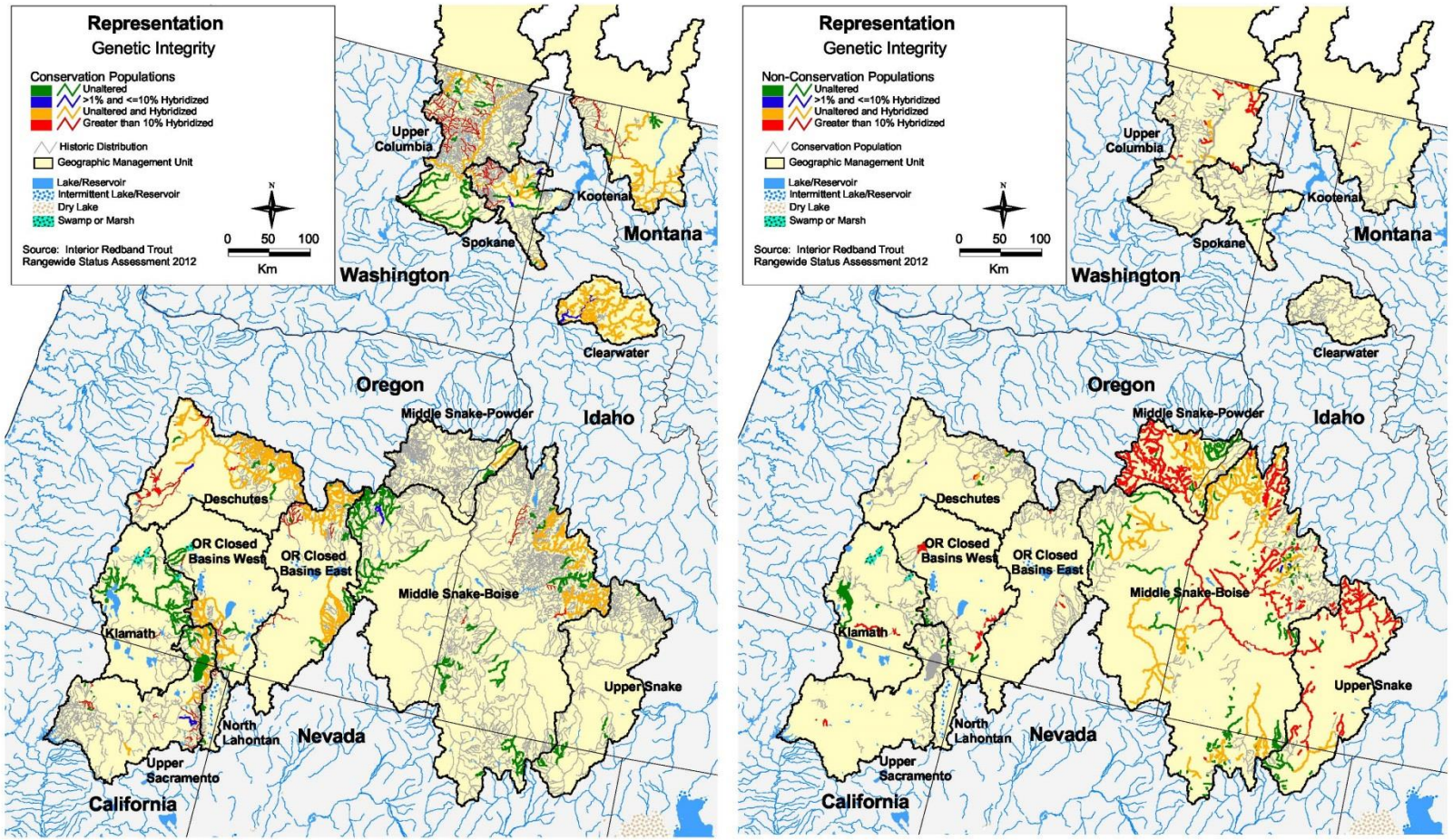

Figure 9. Representation of Redband conservation populations (left panel) and non-conservation populations (right panel) using genetic integrity criteria.

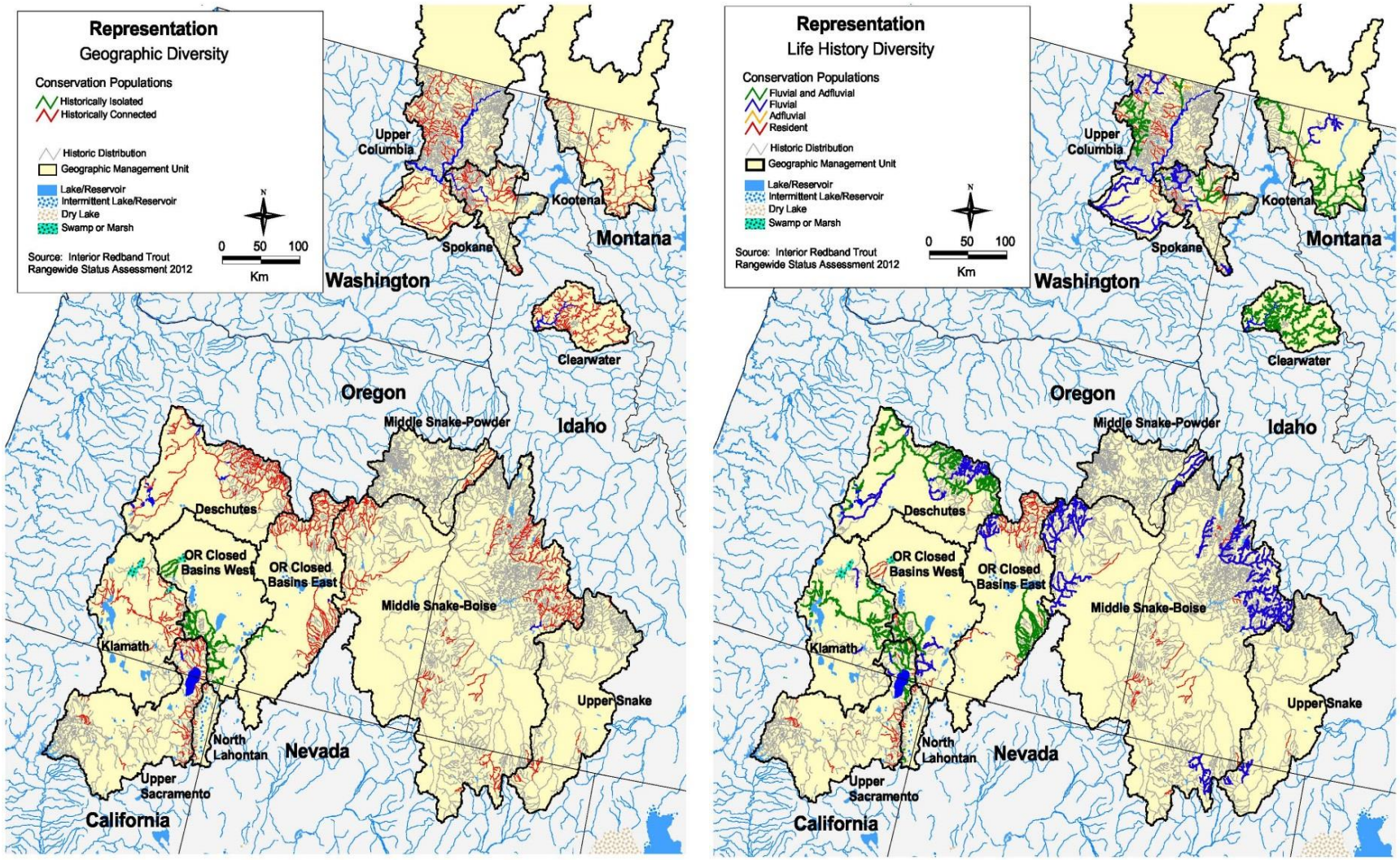

Figure 10. Representation of Redband conservation populations using geographic diversity criteria (left panel) and life history diversity criteria.

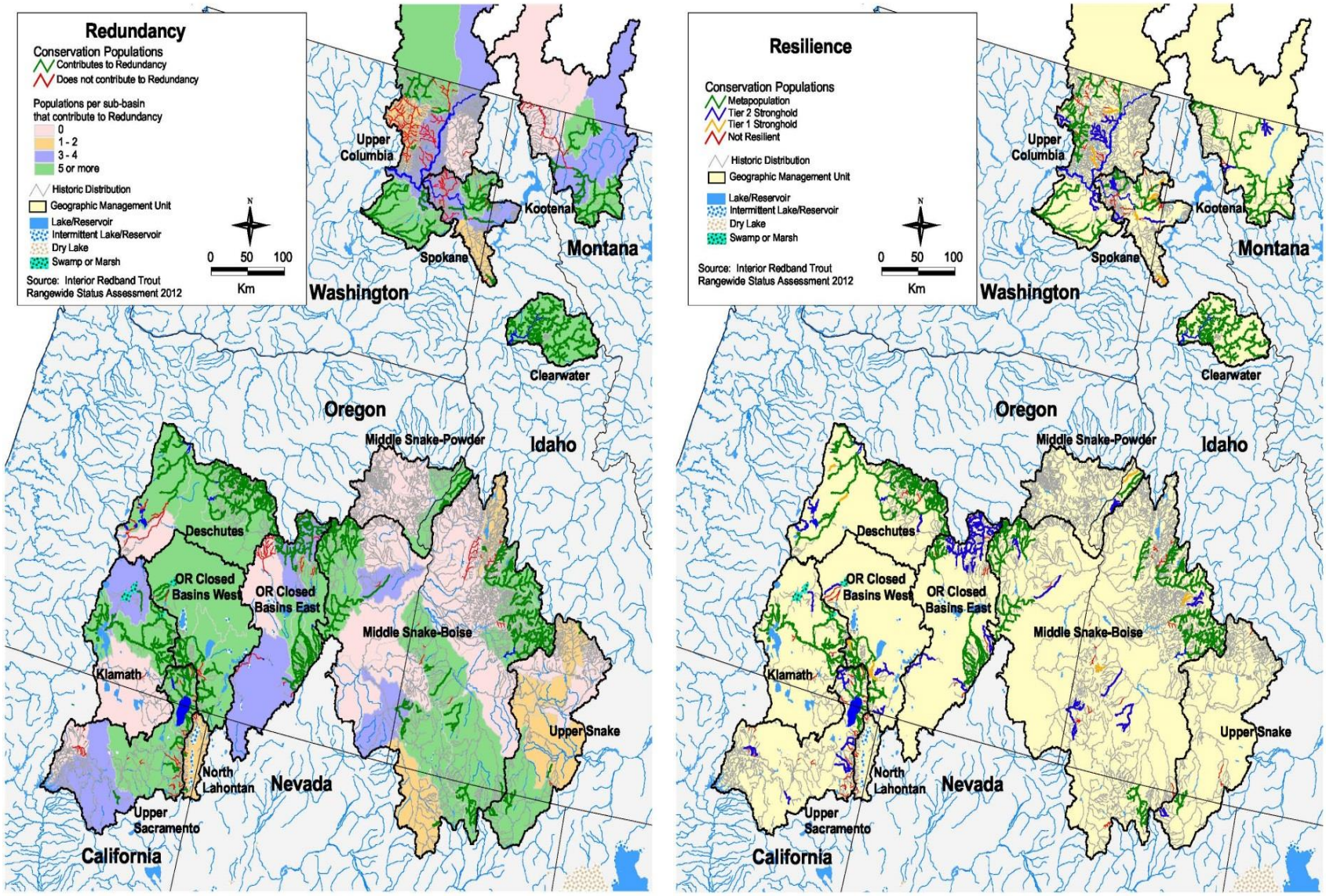

Figure 11. Redundancy (left panel) and resilience (right panel) of Redband conservation populations.

XII. Appendix B, Existing Programs and Strategies

A foundation for coordinating actions in the strategy is to assure there is consistency among multijurisdictional signatories and accordance with state and federal Fish and Wildlife agency policies and strategies. The following section provides a high level summary for each state, federal, and Tribal government involved in managing Redband and their habitats.

Burns Paiute Tribe

The Burns Paiute Tribe (BPT) actively manages fish and wildlife populations on trust lands for hunting, fishing, and conservation through its Natural Resources Department (NRD). The BPT NRD additionally manages three on-going Bonneville Power Administration Projects which include annual actions that directly or indirectly target the protection, restoration and enhancement of Redband in the Malheur River Subbasin. To ensure consistency with management strategies occurring on nontribal lands and to identify areas of interagency collaboration and cost-share, the BPT Natural Resources Department regularly leads resident fish coordination for this subbasin. Types of actions include:

- Riparian restoration on Tribal lands to encourage channel complexity and improvements in water quality;
- Upland and agricultural management on Tribal and nontribal lands to increase water quantity;
- Improvement or elimination of passage barriers on Tribal and nontribal lands including both temperature barriers and diversion dams;
- Removal of nonnative brook trout on nontribal lands;
- Providing input on proposed federal habitat restoration actions;
- Partnering with private landowners and permittees to reduce the impacts of irrigation practices and livestock grazing on instream condition; and
- Periodic population monitoring including genetic assessments.

The Burns Paiute Tribe is committed to the health of native fish species in its usual and accustomed area. Several BPT Council policies guide the prioritization, development, and implementation of these actions. These policies and associated actions may change at the discretion of BPT Council.

Colville Confederated Tribes

The Confederated Tribes of the Colville Reservation (CCT) Fish and Wildlife Department follows the Integrated Resource Management Plan (IRMP 2015), which contains a set of management goals, objectives, and strategies designed to help attain the Tribe's Holistic Goal for the Reservation and the Tribal Membership's vision for the future related to its fish and wildlife resources. The Tribe seeks to ensure the sound management of fish, wildlife, and habitat resources (restoration, enhancement, and protection) within the external boundaries of the Colville Reservation, on the North Half and within the Tribes' Usual and Accustomed areas, where applicable. The Tribe has dedicated two projects for the conservation, protection, and enhancement of Redband Trout populations. The Redband Rainbow Trout Research, Monitoring and Evaluation Project focuses on filling data gaps within the system and the Lake Roosevelt Rainbow Trout Habitat Improvement Project is designed to increase Redband Trout production through habitat restoration and protection. These projects address the following CCT IRMP goals:

- Maintain and protect viable populations of salmonid fish and their supporting habitats.
- Conserve, enhance, and restore native fish populations within water bodies surrounding the Reservation and the North Half, and, where appropriate, provide opportunities for subsistence harvest by the Colville Tribal members and recreational anglers.
- Restore healthy and harvestable salmonid populations through rehabilitation of stream habitat and restoration of ecological function in the riparian corridors of streams.
- Ensure hatchery practices have minimal adverse impacts on the long-term productivity of naturally spawning fish and their ecosystems.

Citation

IRMP, Integrated Resource Management Plan. 2015. Confederated Tribes of the Colville Reservation. http://www.colvilletribes.com/media/files/IRMP%20Draft%205%20online.pdf

Shoshone-Paiute Tribes of the Duck Valley Indian Reservation

The Shoshone-Paiute Tribes (SPT) actively manage fish and wildlife populations on trust lands for hunting, fishing, and conservation through its Fish, Wildlife, and Parks Department (FWP). The SPT FWP additionally manages three on-going Bonneville Power Administration projects which include annual actions that directly or indirectly target the protection, restoration and enhancement of Redband Trout in the Owyhee and Bruneau/Jarbridge river subbasins. To ensure consistency with management strategies occurring on nontribal lands and to identify areas of interagency collaboration and cost-share, the SPT FWP participates in resident fish coordination for these subbasins. Types of actions include:

- Riparian restoration on Tribal lands to encourage channel complexity and improvements in water quality;
- Upland and agricultural management on Tribal and nontribal lands to increase water quantity;
- Improvement or elimination of passage barriers on Tribal and nontribal lands, with special emphasis on road crossings and stock water diversion dams;
- Development of spring boxes, off-site stock watering troughs, and riparian exclosures;
- Trapping and relocation of beaver to upland tributary locations;
- Providing input on proposed federal, state, and private habitat restoration actions;
- Partnering with private landowners and permittees to reduce the impacts of irrigation practices and livestock grazing on instream condition; and,
- Periodic population monitoring including genetic assessments.

The Shoshone-Paiute Tribes are committed to the health of native fish species in its usual and accustomed area. Direction from the SPT Business Council guides the prioritization, development, and implementation of these actions. This direction and associated actions may change at the discretion of SPT Business Council.

California Department of Fish and Wildlife

The general direction for managing the diversity of native trout in California is established in the Department of Fish and Wildlife (CDFW) Strategic Plan for Trout Management. Also there is specific direction in law (California Fish and Game Code Section 1725 et seq.) that establishes priority for protection and restoration of wild, self-sustaining native trout populations and cold water ecosystems that support them. This law establishes priority for native trout when stocking of hatchery trout is utilized.

The Strategic Plan is organized around the themes of protecting, restoring, and enhancing cold water ecosystems and providing diverse angling opportunities. Implementation of the Strategic Plan is developed through preparing management plans for specific watersheds and management units. These watershed or basin plans should define the management unit and the distribution of the trout resources. The plans should identify key trout management and habitat management items along with a priority system for implementing them. The plans identify necessary coordination and collaboration with other agencies to implement management actions.

Conservation of redband trout in California also involves development of conservation strategies with appropriate state and federal agencies, NGOs, Tribes, and the private sector. An existing Conservation Agreement for McCloud River Redband is in the process of revision and nearing completion. A Goose Lake Fishes Conservation Strategy has been developed for the Goose Lake Redband and other endemic fishes of this lake basin. CDFW takes a leading role in developing and implementing these conservation strategies and the other management and conservation plans that will be produced for Redband in California.

Coeur d'Alene Tribe

The Coeur d'Alene Tribe (CDAT) began a Bonneville Power Administration funded project in 2002 dedicated to recovery of Redband as part of the fish substitution policy set forth by the Power Planning Council. The Hangman Creek watershed within the Coeur d'Alene Reservation (CDA) is home to native redband (*Oncorhynchus mykiss gairdneri).* The watershed is the target of a comprehensive restoration effort with the objective of connecting several large-scale, multi-year habitat projects, each focused on improving the ecological and hydrologic processes most closely linked to the conservation and recovery of this species. Goals of the project include:

- Reconnect isolated subpopulations of Redband
- Provide mainstem rearing habitat for fluvial Redband
- Increase stream/floodplain connectivity through the reactivation of abandoned relict channels and by promoting the colonization and persistence of beaver
- Provide higher rates of mean baseflow while blunting the peak(s) in the hydrograph
- Reduce in-stream temperatures to levels acceptable for redband trout summer rearing
- Reestablish and support a resilient riparian ecosystem which can provide a buffer against projected climate change scenarios
- Use beaver as a restoration partner for a cost effective methodology
- Removal of non-native Cutthroat Trout and hybrids from all reaches of Hangman Creek within Idaho
- Remove migration barriers currently limiting Redband spawning habitat
- Provide outreach activities to support long term conservation goals

Idaho Department of Fish and Game

The Idaho Department of Fish and Game (IDFG) outlined several guidelines for managing native trout stocks in the 2013-2018 Fisheries Management Plan. This plan states that native salmonid species will be given priority management attention by implementing several measures to ensure their persistence. A brief summary of these management principles outlined in the plan include:

- Regulate harvest as needed to protect native trout populations;
- Reduce or eliminate hybridization and introgression with hatchery trout (i.e. stock only sterile triploid hatchery trout in native trout drainages to reduce the risk of hybridization);
- Remove or suppress populations of non-native trout species that compete or hybridize with native trout;
- Continue efforts to restore and protect aquatic, riparian, and wetland habitat;
- Encourage partnerships with resource agencies, water users, private landowners, Indian Tribes, and non-governmental organizations to reduce human-caused impacts to native trout, improve fish passage, reduce entrainment at diversions, and provide suitable flows where necessary;
- IDFG will work with appropriate state and federal agencies, non-governmental organizations, Tribes, and private landowners to identify, fund, and implement high-priority aquatic habitat restoration projects; and
- IDFG will participate in the review of proposed land and water use activities, policies, or programs that could result in significant loss of or degradation of fish habitat or populations, and will suggest alternative project designs and make recommendations that minimize or avoid such losses.

In addition to the general native salmonid management guidelines above, the IDFG 2013-2018 Fish Management Plan also includes several guidelines specific to managing Redband, including:

- Continue statewide population and trend monitoring
- Stock only sterile fish in areas where hatchery fish and Redband overlap
- Maintain or restablish connectivity of current Redband metapopulations
- Publish a status assessment for Redband
- Complete a state management plan for Redband

Kootenai Tribe of Idaho

The Kootenai Tribe envisions the Kootenai River and its floodplain as a healthy ecosystem with clean, connected terrestrial and aquatic habitats, which fully support traditional Tribal uses and other important societal uses. The Tribe has developed an Integrated Fish and Wildlife Program designed to address Tribal restoration objectives, including restoration of lost Treaty and subsistence resources. The Tribe has several supporting documents that outline the Tribe's goals and objectives relating to habitat and native fish and wildlife restoration. The Kootenai Tribal Council provides the direction for development and implementation of these actions.

The Kootenai River Habitat Restoration Program Master Plan goals are:

Morphology: Restore physical habitat by reducing the negative effects to the river and floodplain processes caused by river response to the altered landscape.

Riparian Vegetation: Restore native vegetation by establishing stream and floodplain conditions that sustain plant community development processes.

Aquatic Habitat: Restore aquatic habitat conditions that support all life stages of native fish and promote sustainable populations

River stewardship: Create opportunities for river and floodplain stewardship in the community

In addition to the Master Plan, the Kootenai River Subbasin Plan provides a comprehensive array of biological and ecological habitat objectives for fish and wildlife populations and habitat. The Tribe's Integrated Fish and Wildlife Program addresses limiting factors under these objectives to improve the Kootenai River ecosystem. Population objectives for Redband include maintaining or increasing the total number of genetically pure local populations and increasing population size to address the number of conservation populations, population size and stability in the Kootenai drainage.

Montana Fish, Wildlife & Parks

A primary goal of Montana Fish, Wildlife & Parks (FWP) fisheries program is to protect, maintain, and restore native fish populations, life histories, and genetic diversity, and continue to provide angling opportunities for native species whenever possible. This goal is backed by FWP policy, a foundation for which is the Statewide Fisheries Management Plan (2013 -2018) and state law, which require FWP to implement programs that manage sensitive native species in a manner that assists in the maintenance or recovery of those species, and that prevents the need to list the species under the federal Endangered Species Act (ESA).

Specifically, Montana Fish, Wildlife & Parks (FWP) and land managers (State, federal and private) are integral partners in the management of Redband. Current management efforts include assessing and monitoring remaining populations; protecting important habitats; and developing long-term conservation strategies that may include removal of non-native trout and placement of barriers to prevent their return, and reintroduction of Redband to streams where they have been lost. In addition, since 2002 FWP has developed and tested a Redband broodstock at FWP's Libby Isolation Facility and Murray Springs State Fish Hatchery. Established from a wild Redband population, this brood is being developed to replace the stocking, for recreational purposes, of hatchery coastal rainbow trout or Westslope Cutthroat Trout, in drainages where Redband are native.

The effort will reduce the likelihood of additional hybridization of the species. In the near term, the management direction for Redband includes maintaining the existing distribution and genetic diversity of remaining populations, and developing conservation plans and projects that ensure long-term, self-sustaining persistence of the subspecies in Montana. Though recreational angling opportunities for the Redband are currently limited outside of small streams, the development of a Redband brood stock should provide future opportunities to establish recreational fisheries in closed-basin lakes in the Kootenai drainage. Likewise, efforts to secure and expand the distribution of existing populations and reintroduce them into streams where they have been lost will result in additional opportunities to pursue this unique native sport fish.

Nevada Department of Wildlife, Fisheries Division

Native sport fish management in Nevada is founded within several Fisheries Management Concepts developed by the Nevada Department of Wildlife's (NDOW) Fisheries Division. Those concepts provide a wide array of fisheries management options for individual waters in order to provide for optimum quality, diversity, and opportunity of the State's coldwater fisheries, and are based on the understanding that the angling public desires a variety of fishing opportunities, and individual fisheries have specific biological potentials. Two Management Concepts apply specifically to the management of Interior Redband Trout:

- The Wild Fishery Concept applies to waters where management is primarily directed towards maintaining a sport fishery supported by natural reproduction of game fish species naturally occurring in the water. Waters managed under this concept must have a high potential for natural reproduction, densities of game fish capable of a fishery and angler harvest with no stocking program, or with regulations to produce a harvest in balance with the productive capability of the water. Harvest regulations are adopted to maintain the resource.

- The Native Fishery Concept applies to waters where management is primarily directed towards providing the angler with the opportunity to catch a native game fish species under a fishery totally supported by natural reproduction. Stocking of hatchery trout is restricted in these waters in accordance with Nevada Board of Wildlife Commission Policy. Some waters under this concept may be designated Core or Conservation populations and have harvest restricted in accordance with species management plan objectives. Management regulations are directed towards the capability of the resource to maintain the productivity of the fish population and may be more restrictive than the general statewide regulation. The maintenance of sustainable healthy populations will be a primary consideration.

Conservation of Redband in Nevada is guided by the NDOW Redband Trout Species Management Plan (SMP)(2005). The Redband SMP provides both a general management prescription for the species and more detailed management goals, objectives, and strategies. The general management prescription is:

- NDOW will seek to delineate populations of Redband on previously unsurveyed areas including private land; increase connectivity and the occupied range of Redband which might require removal of competing nonnative species if warranted; and promote good land management within its range in Nevada.

Goals of the Redband Trout SMP include:

- To delineate the complete distribution of Redband in Nevada and assess the habitat conditions.
- To conserve all known Redband streams.
- To improve the status of the Redband in Nevada.
- To provide anglers ample opportunity to utilize the Redband for recreation so long as more protective measures are not needed for management purposes.

The Redband Trout SMP is subject to periodic updating and is currently undergoing internal review.

Oregon Department of Fish and Wildlife

The conservation foundation for native fish management under Oregon Department of Fish and Wildlife (ODFW) authority is the Native Fish Conservation Policy (NFCP) and associated conservation plans. The NFCP is Oregon's policy for managing native fish and determining restoration priorities that improve the effectiveness of conservation efforts. The NFCP uses conservation plans as a means to identify and implement strategies and actions to restore and maintain native fish in Oregon. The conservation plans describe approaches that the State of Oregon can apply to the conservation and sustainability of species and restore biological attributes necessary to achieve desired status goals that will provide significant ecological, economic, and cultural benefits for all Oregonians. Conservation plans are developed through a sequential process and include the following elements:

- Determine the management unit and its current status.
- Define a desired status (viability attributes) and factors impeding attainment of desired status (limiting factors and threats). Targets include levels of hatchery influence in a sub-basin.
- Identify strategies and actions that address the limiting factors.
- Monitor and evaluate the status and actions implemented and use adaptive management to make adjustments.

ODFW has organized fish species and subspecies into Species Management Units (SMUs) that roughly correspond to the geographic metapopulations defined by federal agencies (Evolutionarily Significant Units [ESUs] and Distinct Population Segments [DPSs]). In the case of Redband, ODFW is currently developing a conservation plan for the Malheur Lakes and Catlow Valley SMUs, which directly corresponds with the Oregon Closed Basins-East GMU.

- ODFW works with appropriate state and federal agencies, non-governmental organizations, Tribes, and private landowners to identify, fund, and implement high-priority aquatic habitat enhancement projects.
- ODFW staff participates in the review of proposed land and water use activities, policies, or programs that could result in significant loss of or degradation of fish habitat or populations, and will suggest alternative project designs and make recommendations that minimize or avoid such losses.
- ODFW will work with implementers of the Redband strategy to assure alignment of goals, objectives, and priorities with adopted ODFW Conservation plans and in-place Fishery Management plans.

US Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) seeks to work with our partners and engage the public, using a science-based approach, to conserve, restore, and enhance fish and other aquatic resources for the continuing benefit of the American people. The USFWS's Fisheries and Habitat Conservation Strategic Plan 2016-2020 identifies three goals that are applicable to conservation of Redband:

Goal 1: Conserve Aquatic Species
Goal 2: Conserve, Restore, and Enhance Aquatic Habitats
Goal 5: Enhance Recreational Fishing and Other Public Uses of Aquatic Resources.

In addition to supporting the general goals above, the USFWS seeks to facilitate the cooperative conservation of Candidate Species or species likely to become Candidates for listing (such as Redband), so that listing under the Endangered Species Act of 1973 (ESA), as amended, may become unnecessary. Through Conservation Agreements, Conservation Strategies, and other USFWS action plans and actions, we advise and assist in implementation of range-wide species enhancement programs and projects such as habitat enhancement, re-introduction, non-indigenous species control, and research and monitoring projects. Using our authorities (ESA; Fish and Wildlife Coordination Act of 1934, as amended; and Fish and Wildlife Act of 1956, as amended), personnel, and funding (when available), we strive to integrate these conservation efforts across intermingled land ownerships to better ensure comprehensive and effective conservation of targeted Candidate species and Species of Concern. A key to our conservation success is the willingness of the cooperating parties to collaboratively develop and implement robust conservation measures for the Candidate species and Species of Concern.

US National Park Service

The National Park Service (NPS) preserves unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. The NPS cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

The NPS seeks to be proactive in determining the status of rare species and cooperating with other agencies to conserve declining species to avoid listing under the Endangered Species Act. Part of the NPS mission includes reducing the risk of extinction of plants and animals in the parks, and restoring species that have occurred in parks historically but have been lost. NPS *Management Policies* (2006) instruct parks to protect and preserve "biological processes such as native plants, animals and communities." Redband conservation in areas managed by the NPS supports this goal.

US Bureau of Land Management

The Bureau of Land Management (BLM) manages a significant amount of Redband habitat across their range. In some cases Redband co-occur with ESA-listed species and thus benefit from conservation provided by the PACFISH and INFISH strategies, various ESA Section 7 consultations, and recovery plans. In other cases Redband do not co-occur with ESA-listed species. In these instances, conservation is largely driven by their designation as a Special Status Species. Not all BLM lands in Oregon with Redband are covered by INFISH. These areas are managed by Resource Management Plans. Standards and guidelines in these RMPs are nearly identical to INFISH. Redband occur in some areas of BLM managed land in Oregon covered by the Northwest Forest Plan, which is currently under revision through the Western Oregon Resource Management Plan effort. In these areas of overlap, Redband habitat would be managed in accordance with the approved Resource Management Plan.

BLM Manual 6840, Special Status Species Management, provides direction for designating BLM Sensitive Species, managing and conserving Sensitive Species, and cooperating with partners in their conservation. Redband trout have been designated as a BLM Sensitive Species across most of their range. As a result, emphasis has been placed on conserving the species when planning, designing, and implementing various activities, including: Grazing, road construction and maintenance, mining, recreation, vegetation management, fire suppression, granting rights of way, and habitat restoration. In addition, when resource management plans are revised, specific aquatic guidelines are included that form the basis for managing aquatic resources in a manner that conserves or benefits Redband.

US Bureau of Reclamation

- The Bureau of Reclamation (BOR) considers the impacts of its management plans on Redband and their habitat in the Pacific Northwest Region, and avoids, minimizes, or mitigates such impacts when possible within the constraints of Reclamation policy and authority, and consistent with agency responsibilities under the Endangered Species Act (ESA) of 1973;
- BOR Implements Biological Opinions throughout the Pacific Northwest Region that include ecologically based measures for listed aquatic species provide incidental benefits to Redband.
- BOR will share existing data on Redband in a manner consistent with common formats to be developed pursuant to this agreement; and
- BOR will share existing data on the effects of climate change on water resources of the Pacific Northwest.

USDA Forest Service

The USDA Forest Service is a major federal land management agency within the range of Redband. The expansive Redband range includes 20 National Forests and extends across four National Forest Regions, including the Pacific Northwest, Pacific Southwest, Intermountain, and Northern regions. Sources for Forest Redband management direction include the Forest Service Manual, the respective National Forest Land Management Plans, and indirect benefits associated with sympatric Federally ESA-listed fish species management. These elements create a patchwork quilt of protection for the species.

Forest Service Manual direction includes policies to maintain the population viability of all native and desired non-native fish and wildlife, maintain diverse and productive fish and wildlife habitat, and ensure that species do not become Threatened or Endangered under the Endangered Species Act due to Forest Service actions. Currently the Manual provides direction for Regional Foresters to designate Sensitive Species, species with viability concerns, for focused conservation management strategies. Per the 2012 Forest Planning Rule direction, there's a transition towards designating Species of Conservation Concern (SCC), replacing Sensitive species designations. Through the SCC process, we determine if there is a concern about a particular species' ability to persist within the forest. If there is a concern, we design elements of the forest plan to provide the habitat conditions enabling the species to persist on the Forest. Redband are currently designated Sensitive in all but the Intermountain Region.

Most National Forests within the range of Redband operate under Forest plans amended by the Inland Native Fish Strategy (INFISH) or the Northwest Forest Plan, where Riparian Habitat Conservation Areas (RHCA) or Riparian Reserves (RR), respectively, are established along stream channels, flat water, wetlands, and landslide-prone areas to protect them from management actions and accelerate recovery. In these areas, riparian dependent resources receive primary emphasis. Default RHCA/RR widths vary according to type of habitat area (for instance, RHCA/RRs for fish-bearing streams are wider than intermittent stream channels) and can be adjusted through watershed analysis. Standards and guidelines provide specific direction to conserve native fish and their habitat. These Forest Plan amendments also emphasize watershed analysis, watershed restoration, and monitoring.

The other 5 National Forests operate under one of two more localized Forest Plans; the 2008 Southwest Idaho Ecogroup Forest Plan and the 2004 Sierra-Nevada Framework in California. There Forest Plans are more locally developed, but provide comparable protections to aquatic species and their habitat.

The range of Redband overlap with the range of federally listed species, indirectly further benefiting Redband through additional habitat protection and associated restoration actions. For example, most of the range of Redband overlaps with bull trout, listed as Threatened under the Endangered Species Act. Redband benefit from the associated recovery plans and critical habitat.

Frequently, Redband on and off National Forest Lands benefit from agency protection and restoration of habitat, including livestock grazing plan adjustments, riparian livestock exclosures, fish passage projects, road decommissioning, stream channel complexity projects, and riparian vegetation improvements. USDA Forest Service also works collaboratively with other agencies and organizations to accomplish these conservation actions.

Washington Department of Fish and Wildlife

The Washington Department of Fish and Wildlife (WDFW) has adopted management guidelines to ensure the long term persistence of Redband in Washington while meeting fisheries management objectives. A brief summary of these guidelines include:

- Adopt sport fishing regulations that limit the harvest of sub-adult fish;
- Manage fisheries with conservative season and bag limits when necessary;
- Limit the impacts of sport fishing during spawning periods near important spawning habitat;
- Limit stocking non-native trout to reduce potential of hybridization; and
- Conduct long term creel surveys to better understand angler catch and encounters of Redband in upper Columbia River.

In addition to these management guidelines the WDFW has initiated (or completed) conservation efforts and studies intended to document distribution, abundances and genetic uniqueness of Redband in Washington. These include the following;

- Evaluated population structures relative to hatchery influence and migration barriers in the Spokane River drainage (Small et al. 2007);
- Ashbrook et al. (2009) documented historical and current presence of Redband in the Columbia River;
- WDFW (Lee 2013) is collecting baseline data on Redband populations in the Spokane River to better understand spawning success relative to flow manipulation associated with the Spokane River Hydroelectric Project; and
- Continue statewide population and trend monitoring.

XIII Appendix: GMU Team Participants

Upper Columbia-Spokane GMU

Holly McLellan (Colville Confederated Tribes)

Shay Wolvert (Colville Confederated Tribes)

Bryan Jones (Colville Confederated Tribes)

Bruce Kinkead (Coeur d'Alene Tribe of Indians)

Larry Phillips (Washington Department of Fish and Wildlife)

Charles Lee (Washington Department of Fish and Wildlife)

Leslie King (Washington Department of Fish and Wildlife)

Bill Baker (Washington Department of Fish and Wildlife)

Randall Osborne (Washington Department of Fish and Wildlife)

Karen Honeycutt (USDA Forest Service, Colville National Forest)

Bill Abrahamsen (Trout Unlimited, Spokane Falls Chapter)

Cassandra Flanagan (Spokane Tribe of Indians)

Alix Blake (Spokane Tribe of Indians)

Elliott Kittel (Spokane Tribe of Indians)

Meghan Lyons (National Park Service)

Kootenai GMU

Rob Ryan (Idaho Department of Fish and Game)
Andy Dux (Idaho Department of Fish and Game)
Ryan Hardy (Idaho Department of Fish and Game)
TJ Ross (Idaho Department of Fish and Game)
Sean Stash (USDA Forest Service, Idaho Panhandle National Forest)
Mike Faler (US Fish and Wildlife Service)
Shawn Young (Kootenai Tribe)
Ryan Sylvester (Montana Fish Wildlife and Parks)
Mike Hensler (Montana Fish Wildlife and Parks)
Jim Dunnigan (Montana Fish Wildlife and Parks)

Brandon Glaza (USDA Forest Service, Idaho Panhandle National Forest)

Clearwater GMU

Daniel Stuart (Oregon Department of Environmental Quality)

Terry Cundy (Potlatch Corp)

Chris Tretter (Idaho Department of Lands)

Dan Kenney (USDA Forest Service, Clearwater National Forest)

Robert Hand (Idaho Department of Fish and Game)

Joe DuPont (Idaho Department of Fish and Game)

Middle Snake GMU

Kate Crane (Bureau of Land Management)

Janelle Alleman (Bureau of Land Management)

Kris Crowley (Burns Paiute Tribe)

Brandon Haslick (Burns Paiute Tribe)

Erica Maltz (Burns Paiute Tribe)

Dale Allen (Idaho Department of Fish and Game)

Jeff Dillon (Idaho Department of Fish and Game)

Martin Koenig (Idaho Department of Fish and Game)

Joe Kozfkay (Idaho Department of Fish and Game)

Liz Mamer (Idaho Department of Fish and Game)

Doug Megargle (Idaho Department of Fish and Game)

Kevin Meyer (Idaho Department of Fish and Game)

Kevin Netcher (Nevada Division of Wildlife)

Dave Banks (Oregon Department of Fish and Wildlife)

Jinwon Seo (Shoshone-Paiute Tribe)

Dan Dauwalter (Trout Unlimited)

Herb Roerick (United States Forest Service)

Bob Austin (Upper Snake River Tribes Foundation)

Oregon Closed Basins GMU

Alan Mauer (US Fish and Wildlife Service)

Jimmy Leal (Bureau of Land Management)

Jarod Lemos (Bureau of Land Management)

Lindsay Davies (Bureau of Land Management)

Justin Miles (Oregon Department of Fish and Wildlife)

David Banks (Oregon Department of Fish and Wildlife)

Ben Ramirez (Oregon Department of Fish and Wildlife)

William Tinneswood (Oregon Department of Fish and Wildlife)

Richard Pyzik (USDA Forest Service, Fremont-Winema National Forest)

Erica Maltz (Burns Paiute Tribe)

Brandon Haslick (Burns Paiute Tribe)

Deschutes GMU

Jennifer Mickelsen (USDA Forest Service, Ochoco National Forest)

Mike Riehle (USDA Forest Service, Deschutes National Forest)

Nate Dachtler (USDA Forest Service, Deschutes National Forest)

Thomas Walker (USDA Forest Service, Deschutes National Forest)

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Mark Lehner (USDA Forest Service, Ochoco National Forest)

Jimmy Eisner (Bureau of Land Management, Prineville District)

Jeff Moss (Bureau of Land Management, Prineville District)

Brett Hodgson (Oregon Department of Fish and Wildlife)

Erik Moberly (Oregon Department of Fish and Wildlife)

Tim Porter (Oregon Department of Fish and Wildlife)

Derek Staab (Trout Unlimited)

Brad Houslet (Confederated Tribes of Warm Springs)

Klamath and Upper Sacramento GMU

Christine Adelsberger (US Fish and Wildlife Service)

Jared Mckee (US Fish and Wildlife Service)

Nel Scott (Trout Unlimited)

Tony LaGreca (Trout Unlimited)

Dave Herring (Crater Lake National Park)

Bill Tinniswood (Oregon Department of Fish and Wildlife)

Megan Skinner (Klamath Tribes)

Jared Bottcher (Bureau of Reclamation)

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Terry Smith (USDA Forest Service, Fremont-Winema NF)

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Dave Lentz (California Department of Fish and Wildlife)

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Paul Divine (California Department of Fish and Wildlife)

Sam Plemons (California Department of Fish and Wildlife)

Tom Christy (California Department of Fish and Wildlife)

Dave Banks (Oregon Department of Fish and Wildlife)

Bill Brock (USDA Forest Service, Shasta-Trinity National Forest)

Steve Bachmann (USDA Forest Service, Shasta-Trinity National Forest)

David Myers (USDA Forest Service, Shasta-Trinity National Forest)

Herb Baldwin (Sierra Pacific Industries)

Paul Chapman (Campbell Global)

Dave Rumker (Campbell Global)

Tim English (ORM Timber Fund III Inc.)

Mike Mackelwich (ORM Timber Fund III Inc.)

Tim McBride (Hancock Forest Management)

Robert Bass (Hancock Forest Management)