Redband Trout

(*Oncorhynchus mykiss* sub-species)

Data: Muhlfeld et al. (2015), Conservation Strategy for Interior Redband Trout (2016), Redband Trout Status Update Summary (2012), other state and federal documents

Partners: California Department of Fish and Wildlife, Idaho Department of Fish and Game, Montana Fish Wildlife and Parks, Nevada Department of Wildlife, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, U.S. Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Burns Paiute Tribe, Coeur d'Alene Tribe, Confederated Tribes of the Umatilla Indian Reservation, Kootenai Tribe of Idaho, Shoshone-Bannock Tribes, Trout Unlimited.

Redband trout. Photo credit: Idaho Game and Fish Department.

Status of Redband Trout

Six states, four federal agencies, five tribal governments and one non-governmental organization signed a Rangewide Conservation Agreement for Interior Redband Trout in July of 2014. Interior Redband Trout are considered a species of special concern by the American Fisheries Society and the U.S. Fish and Wildlife Service (FWS) in most states where the subspecies historically existed, and are classified as a sensitive species by the U.S. Forest Service and Bureau of Land Management. The various forms of Redband Trout in California, Oregon, Washington, Nevada, Idaho and Montana are considered to be sensitive species or species of concern in all the states. Redband Trout 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 1990s. The FWS determined there was insufficient information for listing Redband Trout 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 rangewide Redband Trout assessment found even though the species occur in only 42% of its estimated historical range, it was not viewed as being at imminent risk of extinction (Muhlfeld et al. 2015). The assessment suggested Redband Trout 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.

Sportfishing Status

Native populations of Redband Trout provide diverse and popular recreational angling opportunities. Their willingness to take a variety of fishing gear, impressive fighting ability when hooked, spectacular appearance and potential to reach large size all contribute to their popularity. Special regulations for waters possessing Redband Trout populations balance angling opportunities with conservation needs to ensure sustainable Redband Trout populations.

Redband Trout Distribution[1]

Interior Redband Trout historically occupied portions of major river basins that were considered outside the range of anadromy in six states—Nevada, California, Oregon, Washington, Idaho, and Montana. They once occupied an estimated 60,295 km of stream habitat and 152 natural lakes in habitats in the drainages of the middle and upper Columbia River basins, the Kootenai-Pend Oreille-Spokane basin, the Snake River basin, the Oregon Closed Basins, the Klamath-northern California coast basins, the Sacramento basin, and the north Lahontan basin.

Redband Trout currently occupy an estimated 25,417 km of stream habitat (42% of their historical range) and 124 lakes, or reservoirs (Figure 1).

[1]Note: Scientists that initiated the 2011 status assessment of Interior Redband Trout chose to initially focus on populations outside the range of anadromy because of the large geographic scope of the species and the acknowledgment that Redband Trout within the range of anadromy were benefitting from protection, restoration, and enhancement actions underway for salmonids. All data presented here pertain to interior populations.

A total of 47% of the streams occupied by Redband Trout are on private lands whereas 45% are on public lands, and 8% are in protected areas. A total of 1% of the currently occupied habitat in streams and 74% of the currently occupied habitat in lakes occurs outside of historically occupied habitat.

Table 1. Estimated amount of stream habitat occupied by Redband Trout in six states (Muhlfeld 2015).

	HISTORICAL RANGE (STREAMS)	CURRENT RANGE (STREAMS)
IDAHO	21,556 KM (36%)	8,928 KM (35%)
OREGON	19,839 KM (33%)	11,016 KM (43%)
WASHINGTON	10,598 KM (18%)	2,828 KM (11%)
CALIFORNIA	4,606 KM (7%)	534 KM (2%)
NEVADA	2,606 KM (4%)	1,301 KM (5%)
MONTANA	1,067 KM (2%)	788 KM (3%)

A total of 210 populations of Redband Trout are considered conservation populations[2]; 49 of the 210 are core conservation populations[3], which occupy 50% of the currently occupied stream habitat and 52% of the currently occupied lake habitat.

[2]A naturally reproducing population of native Redband Trout managed to preserve the historical genome and/or unique genetic, ecological, and/or behavioral characteristics. May be considered as sources for introductions or reintroductions when the objective is to foster unique ecological, genetic, or behavioral attributes.

[3]A conservation population that contains 100% Redband Trout (0% introgression) based on accepted genetic testing protocols, or no historical stocking record or presence of non-native hybridizing species. Serve as the primary source of gametes for assisted colonization and reintroductions through transplants to improve genetic status of existing hybridized populations, and for broodstock development.

Habitat Requirements for Redband Trout

Redband Trout populations have evolved in a variety of habitats from montane forests to high desert stream environments that are characterized by unpredictable and intermittent flows, high summer water temperatures, high alkalinity, drought, and fire. As a result, populations have historically been exposed to naturally high levels of disturbance, and have developed traits that allow them to survive in conditions inhospitable to other types of trout. In vegetated montane streams, the presence of Redband Trout has been positively related to the abundance of pools and negatively related to stream gradient, whereas in lowland desert streams, Redband Trout presence has been associated more closely with shaded reaches of stream that block solar radiation and contain cooler stream temperatures.

At least three basic life history strategies have been categorized, based on how Redband Trout occur within their available hydrologic network during their life cycle: 1) lake dwelling (adfluvial), 2) stream dwelling (fluvial) and 3) resident. An adfluvial strategy can be detected when Redband Trout can migrate from lentic waters to tributaries, mostly for reproduction. Adfluvial populations of Redband Trout can flourish when lacustrine habitat, such as lakes and marshes, is available, and migratory corridors connect it with the with surrounding stream network. Trout in these populations spend most of their life cycle in lakes and reservoirs before returning to stream headwaters and tributaries to spawn. Adfluvial trout are much larger and more fecund than the fluvial and resident forms. Redband Trout that use both relatively larger streams and rivers and lower-order tributaries exhibit a fluvial strategy. Fluvial populations of Redband Trout spend their

entire life cycle in flowing waters—they return to the headwater streams to spawn. Redband Trout with more restricted movements within stream networks are considered resident fish. The abilities of individuals to express all these life histories is often tied to climatic regimes. Migratory life histories are expressed during wet cycles; the fish revert to resident life history during dry cycles.

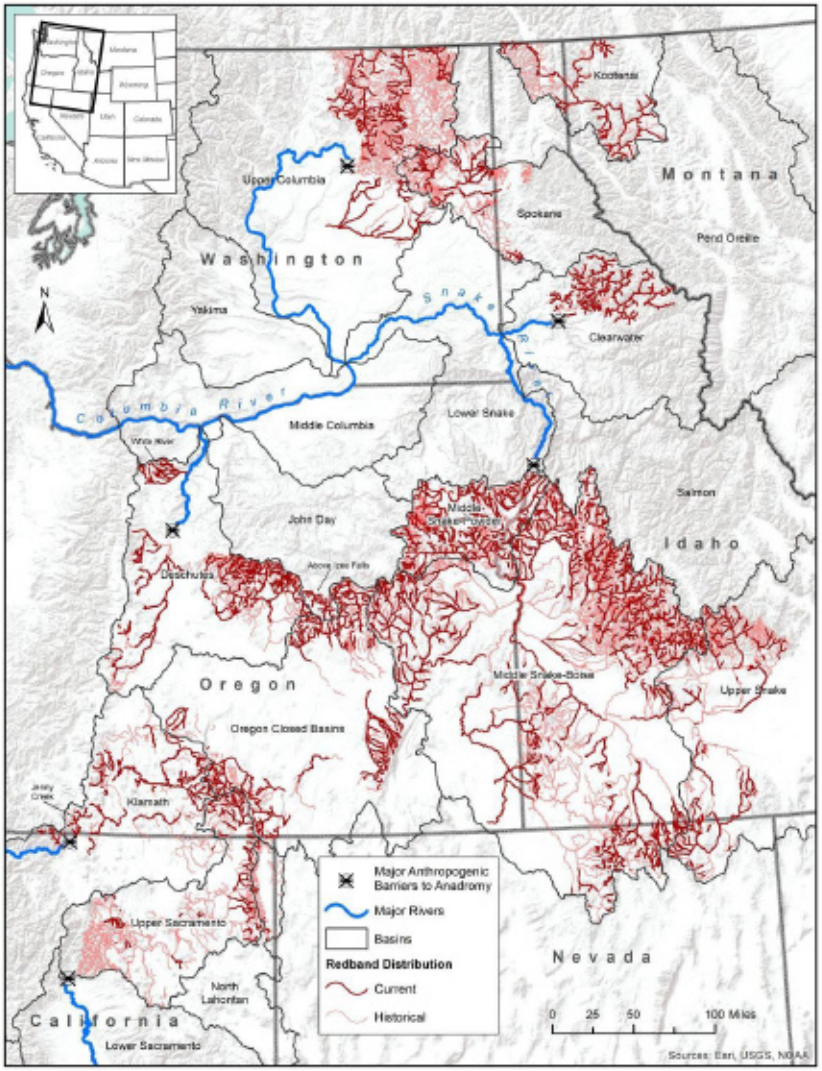


FIGURE 1. CURRENT INTERIOR REDBAND TROUT DISTRIBUTION (RED LINES) OVERLAIN ON ESTIMATED HISTORICAL DISTRIBUTION (PINK LINES).

Concerns, Issues, or Obstacles Relative to the Conservation and Improvement of the Status of Redband Trout

Habitat degradation and fragmentation as well as nonnative species introductions and climate change effects are the primary threats to Redband Trout populations.

Population Viability Concerns

Although Redband Trout are widely distributed over a large geographic area, the effects of human activities over the past century have reduced their overall distribution, life history diversity, and abundance. Increased habitat fragmentation from dams, diversions, land and water management practices, and human development has reduced the amount of available connected habitat necessary for long-term sustainability of Redband Trout. Gene flow among populations is restricted when hydrologic connectivity is reduced, resulting in isolated populations and the associated conservation risks. Migration corridors that connect foraging, migrating, and over-wintering habitat with spawning tributaries are crucial to sustaining Redband Trout life history diversity and maintaining sufficient genetic variability. Fragmentation, isolation, and the resulting inability for populations to exchange individuals remains an obstacle to population viability.

Habitat Concerns

A variety of anthropogenic activities negatively affect Redband Trout habitat, including agricultural practices, grazing, water diversion, dams, mining, timber harvest, recreation, and road construction. These activities create migration barriers, reduce streamflow, increase sedimentation, deplete groundwater, increase water temperature, homogenize aquatic habitats, entrain fish, isolate populations, eliminate habitat, reduce gene flow and genetic diversity, and reduce the frequency and area of pools. Major habitat concerns typically relate to:

- Modification and fragmentation of habitat, barriers to fish passage, entrainment, and thermal and chemical barriers due to dams and diversions.
- Habitat degradation and alteration from land use practices.
- Flow depletion and water manipulation due to drought, hydropower, and municipal and agricultural withdrawal.
- Reduction in amount of suitable habitat resulting from changing climate.
- Sediment loading due to runoff from road construction and related land use activities.
- Inadequate water quality (temperature, sediment, toxins).
- Secondary impacts of dams and reservoir pools in large river systems (i.e., hydropower entrainment, gas supersaturation, modification of flow patterns, creation of nonnative fish habitat).

Inadequacy of Existing Regulatory Mechanisms

Challenges include consistency and lack of shared goals/objectives within and among land management agencies across the large geographic range of Redband Trout, limited funding and personnel available for proactive management of fish and their habitat, and detrimental effects as a result of other management practices, such as hatchery fish supplementation or poor conservation practices in riparian areas.

Non-native or Introduced Species Concerns

The introduction and subsequent spread of non-native trout and other fishes are a significant long-term threat to Redband Trout. Across the range of Redband Trout, 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 Trout, including competition, hybridization/introgression, and predation. Non-native fish, represented by one or more species, co-exist with Redband Trout in 13,490 km (53%) of stream habitat (Muhlfeld et al. 2015).

The impacts of introduced non-native trout species, or stocks, on Redband Trout populations remain a major conservation concern, although primarily from a legacy perspective. The six states and Tribes have developed rules, regulations, and policies to manage native trout populations and habitat, control disease, and establish fishing and harvest 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 illegal stocking will require a targeted outreach campaign to educate the public on 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), most of which are invertebrates or plants. 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 Trout maintain inspection stations in an interstate coordinated effort.

Climate Change Effects

The effects of climate change include increasing water temperatures, increased water use, modified hydrologic regimes, increased disturbance events, and exacerbated effects of hybridization.

Opportunities for Improving Redband Trout Status

The overall goal of Redband Trout conservation and restoration is to ensure the long-term persistence of self-sustaining populations across the species' native range. To meet this goal, managers need to craft area-specific goals and objectives and implement associated strategies that maintain multiple inter-connected populations of Redband Trout across the diverse habitats of their native range, and preserve the diversity of their life-history strategies (e.g. resident and migratory forms). A rangewide conservation strategy has been developed from which locally scaled goals/objectives and strategies can be identified and developed.

The strategic framework of the Conservation Strategy for Interior Redband Trout in the States of California, Idaho, Montana, Nevada, Oregon, and Washington (2016) include these objectives:

- Identify and manage Redband Trout conservation populations to achieve specific conservation objectives and provide recreational and subsistence opportunities.

• Manage the genetic integrity of core and conservation populations of Redband Trout (targets and strategies to be developed by GMU teams).

  • Upper Columbia-Spokane GMU

  • Kootenai GMU

  • Clearwater River Geographic Management Unit GMU

  • Snake River GMU

  • Oregon Closed Basins GMU

  • Deschutes GMU

  • Klamath, Upper Sacramento, North Lahontan GMU

• Apply decision tools to identify priority information gaps for the management and conservation of Redband Trout.

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

• Develop and maintain a Redband Trout database and web portal.

• Initiate an administrative framework that improves cooperation and coordination between agencies and entities involved in the conservation of Redband Trout.

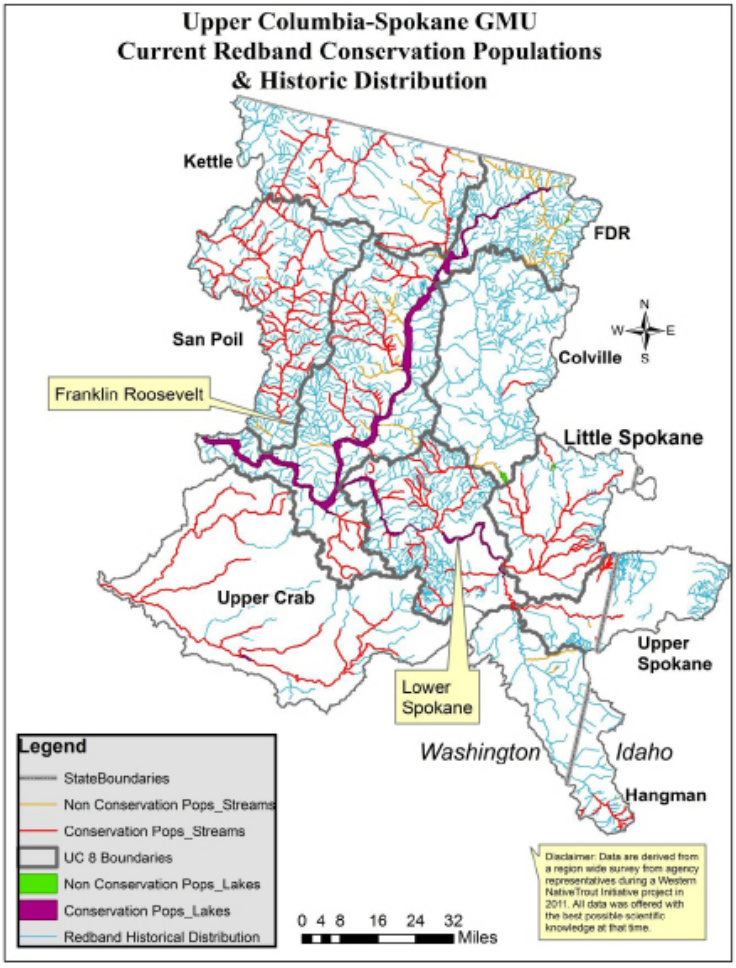
IDENTIFICATION OF UNSCREENED DIVERSIONS IN SQUAW CREEK, IDAHO WILL HELP TO REDUCE ENTRAINMENT THROUGH INSTALLATION OF FISH SCREENS. PHOTO CREDIT: IDAHO FISH AND GAME DEPARTMENT.

Table 2. Conservation opportunities that have been identified for Redband Trout conservation populations.

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 Trout 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 Trout 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. Twelve of 23 sub-basins do not contribute to redundancy. A total of 116 non-conservation populations in 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.
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.

BASIN NAME	PORTFOLIO SUMMARY	CONSERVATION OPPORTUNITY
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 representation of stonei subspecies.	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.	Protection of large populations in Silvies River and Donner und Blitzen River.
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 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 Trout 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.

Upper Columbia-Spokane GMU



Upper Columbia basin—at least 36 Redband Trout conservation populations.

Spokane basin—at least 37 Redband Trout conservation populations.

Anadromy to this GMU was permanently blocked by the Grand Coulee Dam in 1945 on the Columbia River.

Representation

Redband Trout 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 Trout populations and genetic integrity in the UC-S GMU.

Resilience

The primary factors affecting Redband Trout 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 Trout populations facilitated through rehabilitations of stream habitat and restoration of ecological function in the riparian corridor of streams in the UC-S GMU.

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 Trout populations.

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

Kootenai GMU

Kootenai basin—Four of the five Kootenai sub-basins have conservation populations of Redband Trout.

Representation

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

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

Resilience

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

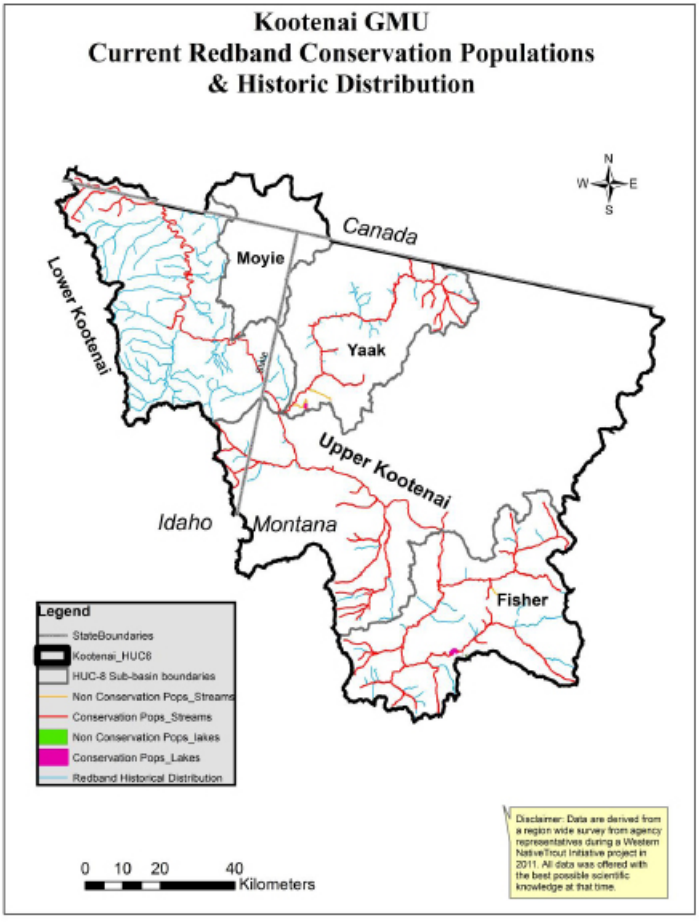
Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Redundancy

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

Goal: Maintain or enhance Redundancy throughout the Kootenai GMU.

Goal: Improve public perception about conservation of Redband Trout.



Clearwater River Geographic Management Unit GMU

Within the Clearwater River basin, only the North Fork Clearwater River upstream of Dworshak Dam, which was completed in 1973, is considered to have Redband Trout populations. Redband Trout occur throughout the North Fork Clearwater watershed and exhibit resident, fluvial, and adfluvial life history strategies. Two sub-basins within this GMU are occupied by conservation populations of Redband Trout.

Representation

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

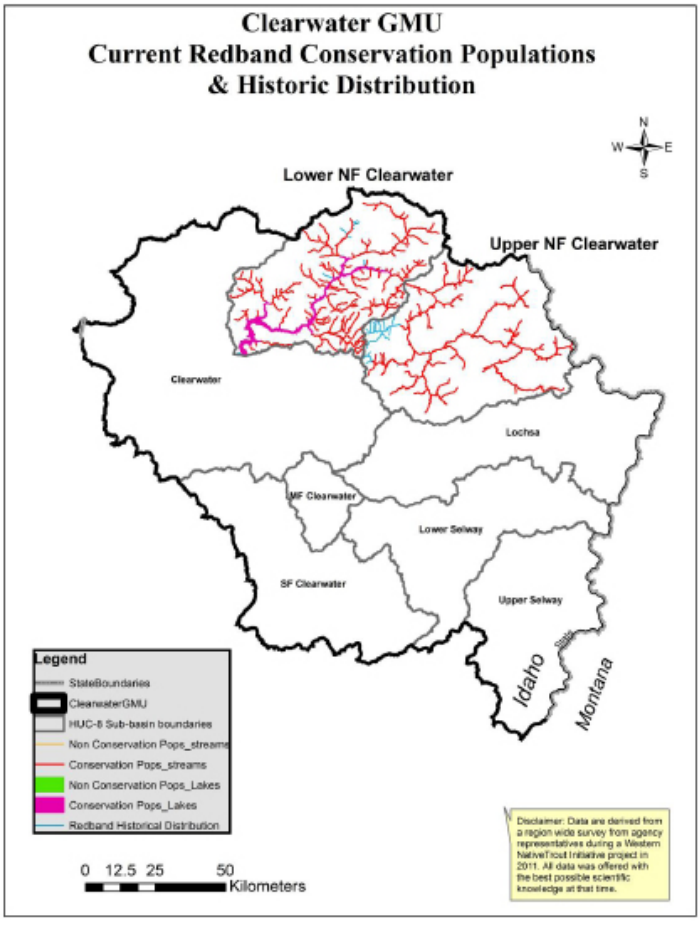
Resiliency

Goal: Maintain/Improve Redband Trout abundance.

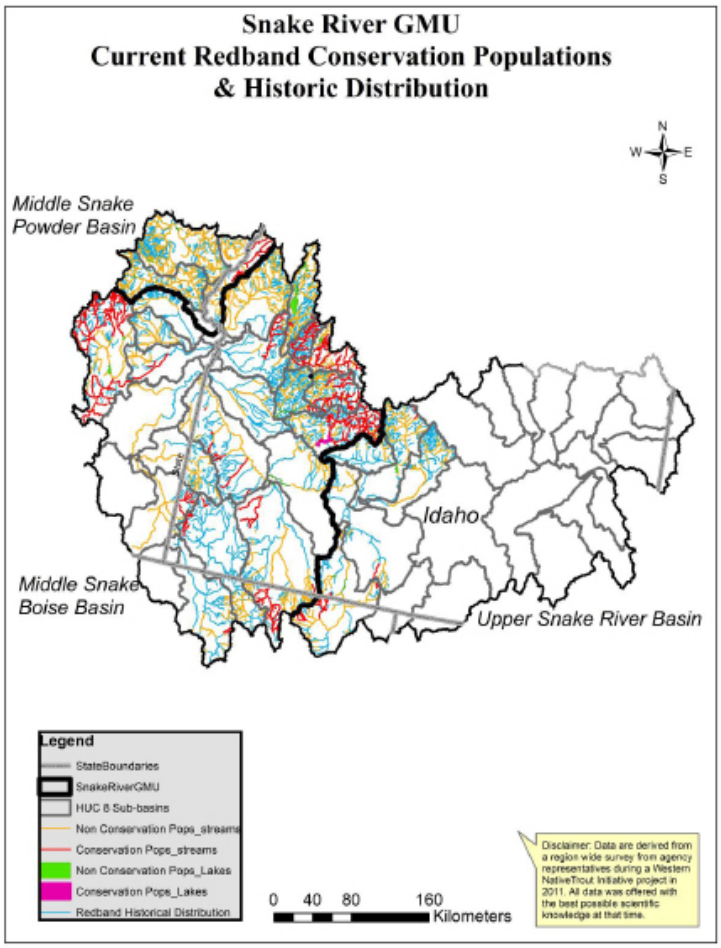
Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Redundancy

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



Snake River GMU



The Snake River GMU is large, includes a diversity of watersheds and habitat types, and supports 24% of habitat occupied by conservation populations, which is less than 15% of historical habitat in this GMU. A total of 116 non-conservation populations in this GMU may be able to contribute to representation and redundancy if limiting factors are addressed. A total of 31 Redband Trout populations exist in 31 sub-basins within this GMU. In addition to the general strategies listed below, Snake River GMU members identified sub-basin strategies.

Representation

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

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

Resilience

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

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

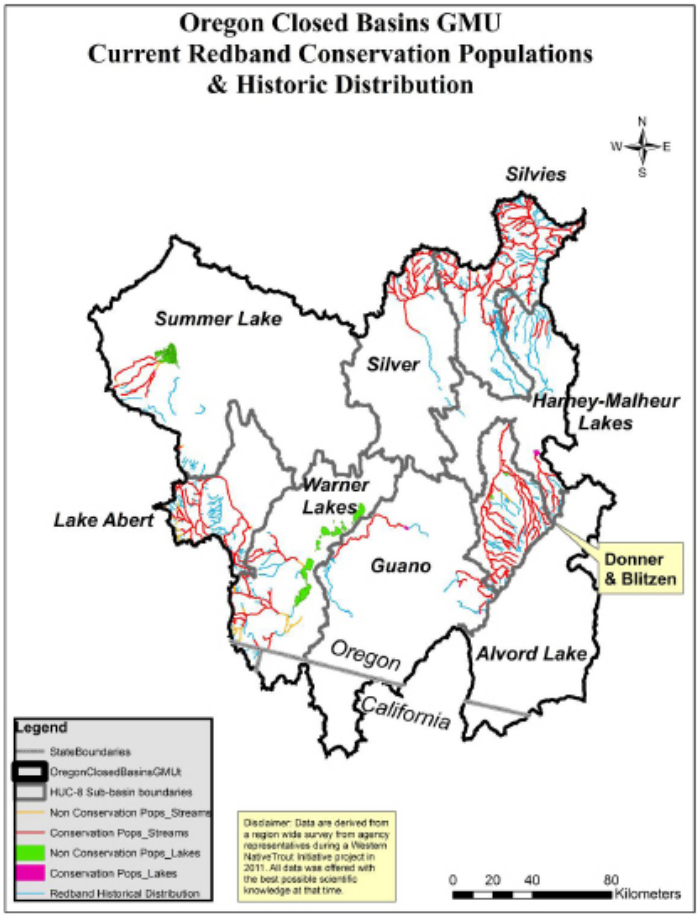
Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Redundancy

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

Oregon Closed Basins GMU

This GMU contains eight sub-basins, seven of which contain Redband Trout populations. The GMU is divided in half for coordination purposes. The eastern portion of this GMU has 13 Redband Trout populations in the Silver, Silvies, Harney-Malheur Lakes and Guano sub-basins. The western portion of the GMU has 15 populations in the Summer Lake, Lake Abert, and Warner Lakes sub-basins.



Representation

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

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

Resilience

Goal: Seek opportunities to improve population productivity 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.

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

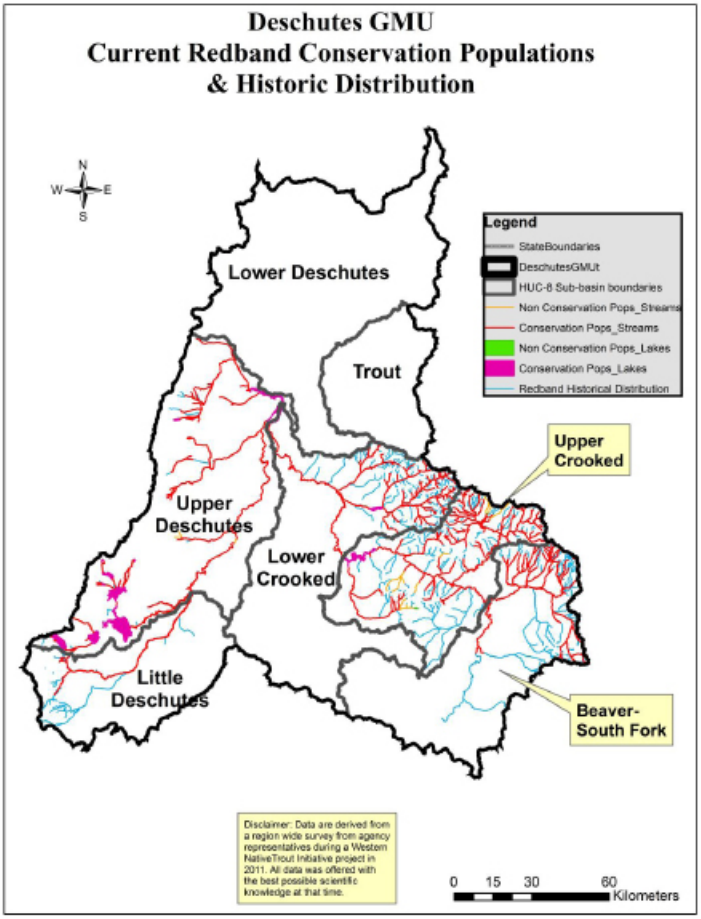
Redundancy

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

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

Deschutes GMU

This GMU includes the Deschutes Basin, which has conservation populations of Redband Trout in five of its sub-basins. There are stream segments within the zone of anadromy in the Lower Deschutes sub-basin.



Representation

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

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

Resiliency

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

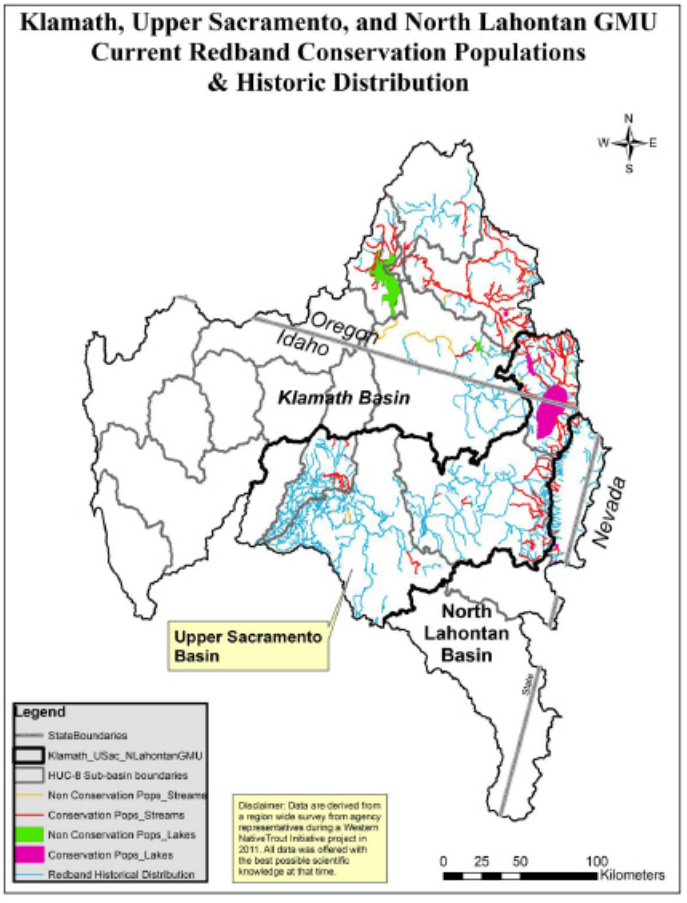
Goal: Identify core conservation populations, protect their integrity, and improve their conditions where necessary.

Redundancy

The goal of managing Redband Trout populations in this GMU is to maintain these populations using the strategies in the Representation and Resiliency sections of the 2016 Conservation Strategy for Interior Redband (*Oncorhynchus mykiss* subspecies) in the States of California, Idaho, Montana, Nevada, Oregon, and Washington.

Klamath, Upper Sacramento, North Lahonton GMU

This GMU includes three basins, with Redband Trout conservation populations in five sub-basins. Interior Redband Trout populations also exist in the Upper Klamath sub-basin within the zone of anadromy. The Upper Sacramento basin has Redband Trout populations that support core conservation, or conservation, populations. A total of 14 conservation populations exist in the Klamath Basin, including three in both the Williamson sub-basin and Upper Klamath sub-basin, six in the Sprague sub-basin, and one each in the Upper Klamath Lake and Lost River sub-basins.



Representation

Redband Trout 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.

Klamath Basin

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

Upper and Lower Sacramento/North Lahontan Basins

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

Resilience

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 are the key threats to Redband Trout in the Klamath Basin.

General Conservation Measures Addressing Resilience

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

Redundancy

The opportunities to expand/increase existing and establish new Redband Trout populations need to be investigated and developed in all basins within this GMU. The challenges of removing non-natives and reintroduction of Redband Trout 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.

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

WNTI Completed Projects

2007
- Trout Creek (CA) Restoration for Redband Trout ($30,000)

2008
- Redband Trout Rangewide Status Review and Workshop (CA, ID, MT, NV, OR, WA) ($28,450)
- Trail Creek Culvert Replacement to Benefit Redband Trout in Elko County, Nevada ($5,000)
- Honey Creek Diversion (OR): Redband Trout Restoration and Warner Sucker Recovery ($43,885)
- Redband Trout Status and Protocol Evaluation in Washington State ($75,132)

2009
- Honey Creek (OR) Diversion 2: Redband Trout Restoration and Warner Sucker Recovery ($97,010)

2010
- Deep Creek and Crazy Creek Fish Passage and Habitat Restoration Project (OR) ($72,550)

2011
- Redband Trout Rangewide Status Assessment (CA, ID, MT, NV, OR, WA) ($79,000)
- Naches River / Eschbach Park Levee Removal (WA) ($60,000)

2012
- Genetic Analysis of Great Basin Redband Trout (OR) ($70,134)

2013
- Fish Screen - North Ditch Diversion, NF Sprague River (OR) ($35,000)

2014
- Sun Creek (OR) Channel Reconnection to Improve Bull Trout and Redband Trout Habitat ($20,000)

2016
- "k'wne' 'ulchiyark'wmntsut" Hangman Creek Relict Channel and Floodplain Reconnection (ID) ($42,292)

- Sprague River (OR) Restoration 2016 ($3,000)

- Redband Trout Thermal Habitat Assessment (WA) ($1,964)

2017
- Deep Creek (OR) Floodplain Restoration Project ($17,918)

- Boundary Creek (OR) Fish Passage Enhancement ($15,305)

- Whychus Canyon (OR) Restoration Project – Phase II ($33,652)

References

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