Drought assessments of imperiled Paiute cutthroat trout populations in California

2015

Alpine and Mono counties

State of California

Department of Fish and Wildlife

Heritage and Wild Trout Program

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Overview

In 2014, the California Department of Fish and Wildlife, Heritage and Wild Trout Program (HWTP) initiated drought assessments on several waters in California. The Threatened Trout Committee (TTC) and HWTP staff developed a prioritized list of streams with native trout species of high conservation value that may be at risk due to drought conditions. This list was prioritized based on genetic integrity, with a focus on putative populations, species on federal and state endangered species lists and perceived threat level. The latter included consideration of slope, aspect, streamflow, water source and surrounding land use activities.

In one case, priority was given due to the threatened listing status of the Paiute Cutthroat Trout (*Oncorhynchus clarkii seleniris*), under the Federal Endangered Species Act. An ongoing multi-agency restoration project in its native range amplified the perceived need to monitor this subspecies. As such, populations within the Silver King Creek basin (Alpine County), along with out-of-basin refuge populations, were deemed high priority for drought assessment.

A structured decision-making matrix was created to aid staff in assessing drought conditions, evaluate whether fish rescues were necessary to protect certain populations and identify potential locations for translocations (within the same waterbody, within basin or out-of-basin). In June 2015, drought assessments were conducted in seven streams supporting Paiute Cutthroat Trout.

Some of the surveys were located in unnamed tributaries and, for the purpose of this report, common stream names were used. Surveys were conducted in the Silver King Creek basin (Corral Valley, Coyote Valley, Fly Valley, Four-Mile Canyon, and Silver King creeks) and in two out-of-basin refuge populations in Leidy and North Fork Cottonwood creeks.

Need

Negative effects from drought on inland native trout populations and their habitats have been historically documented and, in some cases, have led to localized extirpation. Recent drought conditions (2012-present) have been exceptionally severe and related impacts on inland fishes may be further exacerbated by water diversions, presence of barriers (artificial and natural), reduced snowpack, increased summer water temperatures and decreased winter water temperatures, potentially leading to anchor ice formation or entire stream segments freezing solid. Despite negative effects of the drought in California, population persistence and recovery may be expected if habitat conditions improve and/or recolonization from reconnected populations occurs.

Methods

Survey protocols were developed based on parameters outlined in the Drought Response Implementation Plan and Rescue-Translocation Decision Model (Model; Table 1). Key parameters included: streamflow, extent of occupied fish habitat, depth

and frequency of pools (or deeper water) and water temperature. Surveys were initiated at the downstream extent of known or assumed distribution of the at-risk population, oftentimes associated with a barrier to upstream fish migration, and proceeded in an upstream direction. Surveys were concluded when one of the following occurred:

1. Surveyors reached the upstream extent of fish distribution or wetted habitat
2. A minimum of 200 age 1+ trout were observed within 2000 meters of connected habitat
3. A quarter mile of dewatered habitat was documented and the likelihood of water farther upstream was low
4. A barrier to year-round fish migration was documented and zero trout were observed within 500 feet of habitat directly upstream
5. Safety or time constraints required the survey to end

Streamflow

Streamflow (cfs) was measured at the start of the survey (if water was present). Where feasible, one to two additional locations were selected to document changes in flow within a waterbody and establish benchmark locations to compare changes over time. Benchmark locations were selected near trail crossings or roads for future ease of access.

Pool Depth

Pools, as identified following Level 2 protocol in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998), were counted. Every fifth pool was measured for maximum water depth (ft). Habitat condition, number of trout observed and other parameters were noted. If pools were infrequent (less than five pools in 0.25 miles), all pools were measured. Water temperature (C°) and dissolved oxygen (mg/l) was measured at various locations throughout the survey.

Barriers

Year-round barriers to upstream fish migration were photographed and geo-referenced using hand-held Global Positioning System (GPS) units (North American Datum 1983). Other measured or estimated attributes included: feature length (ft), slope (%), streamflow (cfs), pool maximum depth (ft), pool length (ft) and average wetted width (ft).

Fish counts

Surveyors counted observed trout by species and size class and tallied within continuous wetted habitat reaches. If a dry segment was encountered surveyors ended the tally, recorded geographic coordinates and started a new tally if trout were observed in a separate wetted reach. Size classes were divided into the following categories: young of year (YOY); small (< 6 inches); medium (6-11.9 inches); large (12-17.9 inches) and extra-large (≥ 18 inches). YOY are defined by the HWTP as age 0+ fish, emerged from the gravel in the same year as the survey effort. Depending on species, date of emergence, relative growth rates and habitat conditions, the size of YOY varies greatly, but is generally between zero and three inches in total length. If a trout was observed to be less than six inches in total length but was difficult to determine whether it was an age 0+ or 1+ fish, by default it was classified in the small (< 6 inches) size class.

Stream condition

Using hand-held GPS units (North American Datum 1983), surveyors geo-referenced:

- Survey start and end
- Wetted, dry and intermittent habitat
- Observed trout distribution
- Unique habitat or land use activities if perceived to impact flow and/or trout persistence (e.g., heavy sedimentation, grazing, mining, water diversions, beaver dams, etc.)
- Tributaries at their confluence with the main-stem
    - If wetted, each tributary was surveyed upstream no more than 2000 feet, trout were counted by size class and flow conditions were documented. If dry at the confluence, the tributary was only surveyed upstream 500 feet.

Observations related to riparian habitat, relative fish densities, perceived threat level and likelihood of anchor ice formation were recorded in field notebooks. Representative photographs of the waterbody and other environmental or habitat conditions were taken.

Results

Silver King Creek

Silver King Creek, tributary to the East Carson River, was surveyed on June 25th and 26th, 2015 from Llewellyn Falls, a natural waterfall barrier, upstream 2.5 miles (Figure 1). Streamflow was measured at 2.6 and 12.7 cfs. A total of 18 pools were measured (every fifth pool) with maximum pool depths between 1.6 and 4.3 feet. Water temperature was between 9.9 and 18.3 °C. Air temperature was measured at 25 °C. Dissolved oxygen was measured at 6.79 to 9.13 mg/l.

One small-sized trout was observed in 2.5 miles of habitat (assumed to be Paiute Cutthroat Trout). Visual assessment was difficult due to high water velocity, thick instream vegetation, and glare created by the substrate color and composition (Figure 2). Four wetted tributaries entered Silver King Creek in the surveyed reach: Bull Canyon, Four-mile Canyon, and Fly Valley creeks and one unnamed tributary. Two off-channel areas with active springs were observed (Figure 2).

An extensive complex of beaver dams was observed approximately .25 miles downstream of the Fly Valley Creek confluence (Figure 2). Deep and wide ponds spanned approximately a third of a mile. HWTP personnel were unable to navigate the entire expanse of the beaver complex due to water depth and time restraints. The water depth was measured at 4 ft in one location in the ponds. Signs of active beaver work were observed on willow branches.

Flow was contiguous throughout the surveyed area, the average streamflow was 7.65 cfs, and pools were frequent. With only one fish observed during the survey, Silver King Creek was characterized as at-risk and given a threat level of 2, assuming a low population exists. The HWTP recommends a more thorough evaluation of the population via electrofishing to determine whether this assumption is correct and whether a fish rescue/translocation is warranted. Potential negative effects from bottlenecking and low genetic diversity should also be evaluated.

Coyote Valley Creek

Coyote Valley Creek, a tributary to Silver King Creek, was surveyed on June 27, 2015 starting 0.3 miles upstream of the confluence with Silver King Creek and extending approximately 2.6 miles upstream (Figure 1). The survey began 200 ft upstream of a large barrier complex in a steep canyon. Streamflow was measured at 0.13 and 0.79 cfs. A total of 21 pools were measured (every fifth pool) with maximum pool depths between 0.7 and 2.5 ft. Water temperature was between 11.2 and 14.2 °C. Air temperature was measured at 19 °C. Dissolved oxygen was measured at 6.99 to 7.56 mg/l.

A total of 120 trout were observed in Coyote Valley Creek (all assumed to be Paiute Cutthroat Trout). Three small-sized trout were observed between two barriers in approximately 0.5 miles of stream. These fish were isolated from the remaining 117 trout observed upstream of the barrier in approximately 1.25 miles of meadow habitat (Figure 3). The majority of fish were observed in the meadow, upstream of the trail crossing. The size-class distribution for trout observed above the barrier was 98.3% small-sized fish and 1.7% YOY. There was approximately 0.4 miles of stream between the barrier and the meadow habitat where zero trout were observed.

One Yosemite Toad (*Anaxyrus canorus*) was observed (instream) near the end of the surveyed reach on Coyote Valley Creek (Figure 3). Multiple unidentified toads were also observed throughout the creek. Some areas of the creek had dense vegetation that made access to, and visibility of, the water difficult for fish detection. The survey ended

due to thunder storms and time restraints; the upstream extent of fish distribution was not determined.

The Paiute Cutthroat Trout population in Coyote Valley Creek was characterized as at-risk and assigned a threat level of 2. Instream water quality was sufficient to maintain biological function and fish health, flow was contiguous for 2.6 miles, and pool habitat existed and exceeded 300mm in depth. However, streamflow was an average of 0.46 cfs and the population was below 200 adults. The HWTP recommends that a more comprehensive survey, potentially utilizing electrofishers, should be performed to validate population numbers and size class distribution. Potential negative effects from bottlenecking and low genetic diversity should also be evaluated.

Corral Valley Creek

Corral Valley Creek, a tributary to Coyote Valley Creek, was surveyed on June 28, 2015 from the confluence with Coyote Valley Creek upstream approximately 2.3 miles (Figure 1). Streamflow was measured at 0.03 cfs. A total of 27 pools were measured (every fifth pool) with maximum pool depths between 0.6 and 2.7 ft. Water temperature was between 12.2 and 14.3 °C. Air temperature was measured at 25 °C. Dissolved oxygen was measured at 7.23 to 7.85 mg/l.

Eighty-five trout were observed with a size class distribution of 89.4% small- and 10.6% medium-sized fish (all assumed to be Paiute Cutthroat Trout). The first trout was observed less than 100 feet upstream of the survey start point. This small-sized trout was the only trout observed in the first 1.3 miles of stream surveyed. The remaining 84 trout were observed in 0.8 miles of meadow habitat. The survey ended after zero trout were observed in a quarter mile and instream vegetation became too thick to visually detect trout. Three unnamed, wetted tributaries entered Corral Valley Creek in the surveyed reach.

Flow was contiguous throughout the surveyed area and pools were deep and frequent, but streamflow was 0.03 cfs and only 85 Paiute Cutthroat Trout were observed in Corral Valley Creek. This population is considered to be at-risk and assigned a threat level of 2. The HWTP recommends a more thorough evaluation of the population via electrofishing to determine whether a fish rescue/translocation is warranted. Potential negative effects from bottlenecking and low genetic diversity should also be evaluated.

Four-Mile Canyon Creek

Four Mile Creek, a tributary to Silver King Creek, was surveyed on June 29, 2015 from the confluence with Silver King Creek upstream approximately 1.3 miles (Figure 1). Streamflow was measured at 1.44 cfs. A total of 12 pools were measured (every fifth pool) with maximum pool depths between 1.0 and 2.1 ft. Water temperature was between 9.7 and 12.3 °C. Air temperature was measured at 17 °C. Dissolved oxygen was measured at 8.03 to 8.55 mg/l.

Two trout were observed with a size class distribution of 50% small- and 50% medium-sized fish (all assumed to be Paiute Cutthroat Trout). High water velocity and willows made visibility difficult in some areas of the creek. A barrier to fish migration was documented approximately .15 miles upstream of the Silver King Creek confluence. The barrier was a 15 ft waterfall composed of large boulders (Figure 5). One tributary with a small amount of water entered Four-Mile Canyon in the surveyed reach and, approximately.15 miles downstream from the end point of survey, the creek branched into two flowing streams.

Pool habitat and sufficient flow were present in Four Mile Canyon Creek, however only two trout were observed. This population is considered to be at-risk and assigned a threat level of 2. The HWTP recommends a more thorough evaluation of the population via electrofishing to determine whether a fish rescue/translocation is warranted. Potential negative effects from bottlenecking and low genetic diversity should also be evaluated.

Fly Valley Creek

Fly Valley Creek, a tributary to Silver King Creek, was surveyed on June 26, 2015 from the confluence with Silver King Creek upstream approximately 1 mile (Figure 1). Streamflow was measured at 2.2 cfs. A total of 8 pools were measured (every fifth pool) with maximum pool depths between 0.8 and 1.8 ft. Water temperature was measured at 11.6 °C. Air temperature was measured at 28 °C. Dissolved oxygen was measured at 7.31 to 8.20 mg/l.

Two medium-sized trout were observed below a barrier approximately .3 miles upstream from the confluence with Silver King Creek (Figure 6). These trout appeared to be paired for spawning. Thirty-seven trout were observed above the barrier with a size class distribution of 73% small- and 27% medium-sized fish (all assumed to be Paiute Cutthroat Trout). An additional four YOY were observed above the barrier. No fish were observed 500 ft upstream of a branch in the creek.

Habitat availability and quality appears sufficient in Fly Valley Creek, but there were only 37 adult trout observed in approximately 0.65 miles of connected habitat. The HWTP has assigned Fly Valley Creek a threat level 2 and considers this populations at-risk. The HWTP recommends that a more thorough assessment of this population is conducted, as well as evaluation of the potential negative effects of bottlenecking and low genetic diversity.

Literature Cited

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual. 3rd Edition. Vol. 1. State of California Resources Agency. Department of Fish and Game. Inland Fisheries Division.

Figure 1. Overview map of surveys conducted in Silver King Creek basin

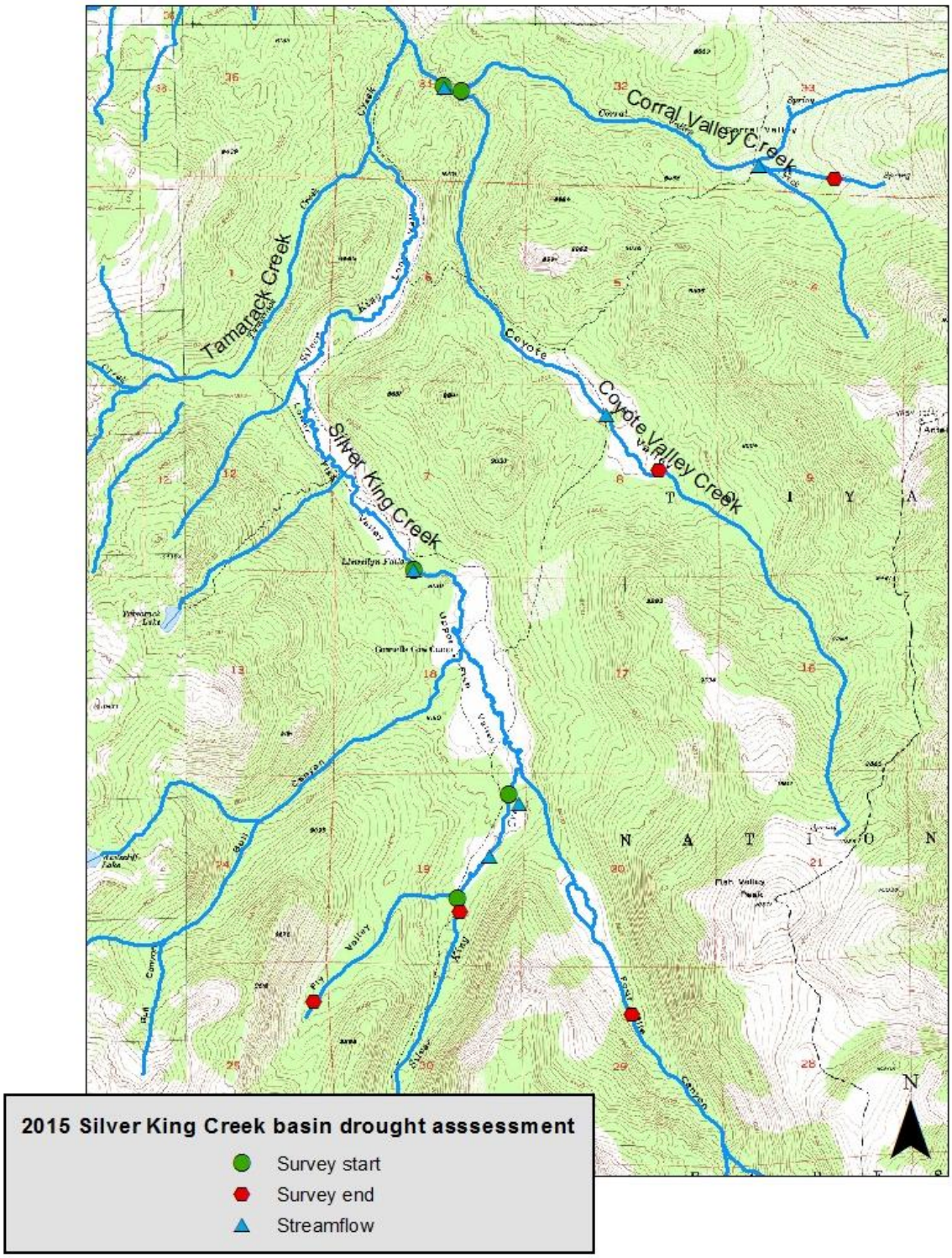

Figure 2. Representative photos of drought assessment efforts on Silver King Creek (clockwise from top left): instream shot in higher gradient portion, instream shot of meadow habitat, active springs, and beaver complex.

Figure 3. Representative photos from drought assessment efforts on Coyote Valley Creek (clockwise from top left): barrier separating observed trout, meadow habitat, yosemite toad, and second stream flow locaton.

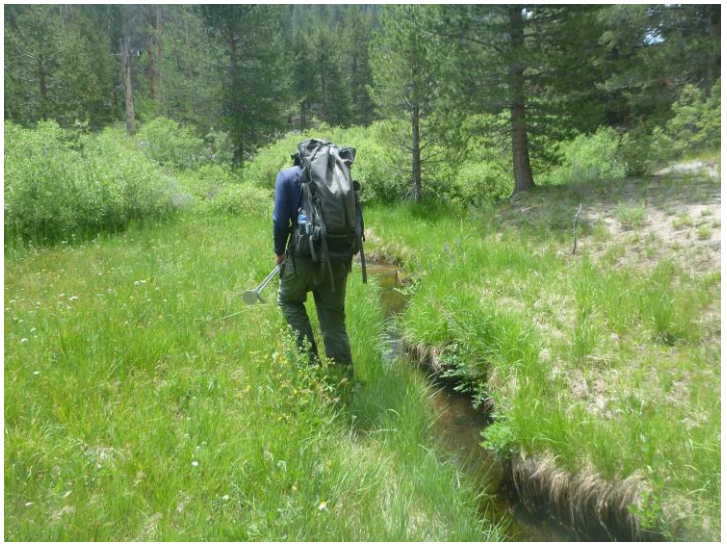

Figure 4. Representative photos from drought assessment efforts on Corral Valley Creek (clockwise from top left): location of single trout observed, instream photo, streamflow location, and meadow habitat with trout.

Figure 5. Representative photos from drought assessment efforts on Four-Mile Canyon Creek (clockwise from top left): 15ft fish barrier and three instream photos moving upstream.

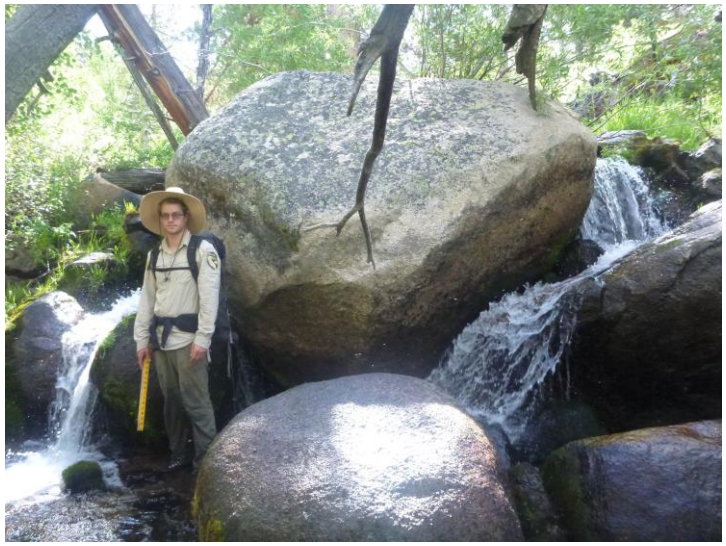

Figure 6. Representative photos from drought assessment efforts on Fly Valley Creek (clockwise from top left): fish barrier and three instream photos moving upstream.

Table 1. Drought Response Implementation Plan and Rescue-Translocation Decision Model

Assessment effort	Observed conditions	Threat Level (1 to 4, 4 being the highest risk)	Response
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, measure discharge, estimate population size by size class, and document water source.	Instream water quality is sufficient to maintain biological function and fish health, flow is contiguous and is >.5 cfs, pool habitat exists which exceeds 300mm in depth, population exceeds 200 adults, and wetted habitat is > 2000 meters	1	Document conditions/status, make recommendations on monitoring schedule,
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is sufficient to maintain biological function and fish health, flow is not contiguous and is <.5 cfs, pool habitat exists which exceeds 300mm in depth, population exceeds 200 adults, and although wetted habitat is not contiguous it is > 2000 meters	2	Document conditions/status, make recommendations on monitoring schedule, and identify a reference location for future measurements and comparisons.
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is sufficient to maintain biological function and fish health, flow is contiguous and is <.5 cfs, pool habitat does not exist which exceeds 300mm in depth, population exceeds 200 adults, and wetted habitat is contiguous for > 2000 meters	2	Document conditions/status, make recommendations on monitoring schedule, and identify a reference location for future measurements and comparisons.

Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is sufficient to maintain biological function and fish health, flow is not contiguous and is <.5 cfs, pool habitat exists which exceeds 300mm in depth, population is below 200 adults, and although wetted habitat is not contiguous it is > 2000 meters	2	Document conditions/status, make recommendations on monitoring schedule, and identify a reference location for future measurements and comparisons.
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is sufficient to maintain biological function and fish health, flow is not contiguous and is <.5 cfs, pool habitat exists which exceeds 300mm in depth, population is > 200 adults, and wetted habitat is < 2000 meters	2	Document conditions/status, make recommendations on monitoring schedule, and identify a reference location for future measurements and comparisons.
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is sufficient to maintain biological function and fish health, flow is not contiguous and is <.5 cfs, pool habitat exists which exceeds 300mm in depth, population is below 200 adults, and wetted habitat is < 2000 meters	3	Initiate translocation assessment strategy and or rescue alternatives and formulate plan
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is sufficient to maintain biological function and fish health, flow is contiguous and is <.5 cfs, pool habitat exceeding 300mm in depth does not exist, population is < 200 adults, and wetted habitat is contiguous for > 2000 meters	3	Initiate translocation assessment strategy and or rescue alternatives and formulate plan

Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is not sufficient to maintain biological function and fish health, flow is contiguous and is >.5 cfs, pool habitat exceeding 300mm in depth does not exist, population exceeds 200 adults, and wetted habitat is > 2000 meters	4	Initiate translocation assessment strategy and or rescue alternatives and formulate plan
Delineate connected and non-connected wetted habitat, document barriers, count and measure mean/maximum pool depth, gather stream temp, estimate discharge, and estimate population size by size class.	Instream water quality is not sufficient to maintain biological function and fish health, flow is not contiguous and is <.5 cfs, pool habitat exceeding 300mm in depth does not exist, population is < 200 adults, and wetted habitat is < 2000 meters	4	Initiate translocation assessment strategy and or rescue alternatives and formulate plan

Table 3. Number of fish observed by size during 2015 Silver King Creek basin drought assessments

Water	Species	Number of trout observed			
		YOY	Small	Medium	Total
			< 6"	6"-11.9"	
Silver King Creek	Paiute Cutthroat Trout	0	1	0	1
Coyote Valley Creek (below barrier)	Paiute Cutthroat Trout	0	3	0	3
Coyote Valley Creek (above barrier)	Paiute Cutthroat Trout	2	115	0	117
Corral Valley Creek	Paiute Cutthroat Trout	0	76	9	85
Fly Valley Creek	Paiute Cutthroat Trout	4	27	10	41
Four Mile Creek	Paiute Cutthroat Trout	0	1	1	2