Mulkey and Golden Trout creeks

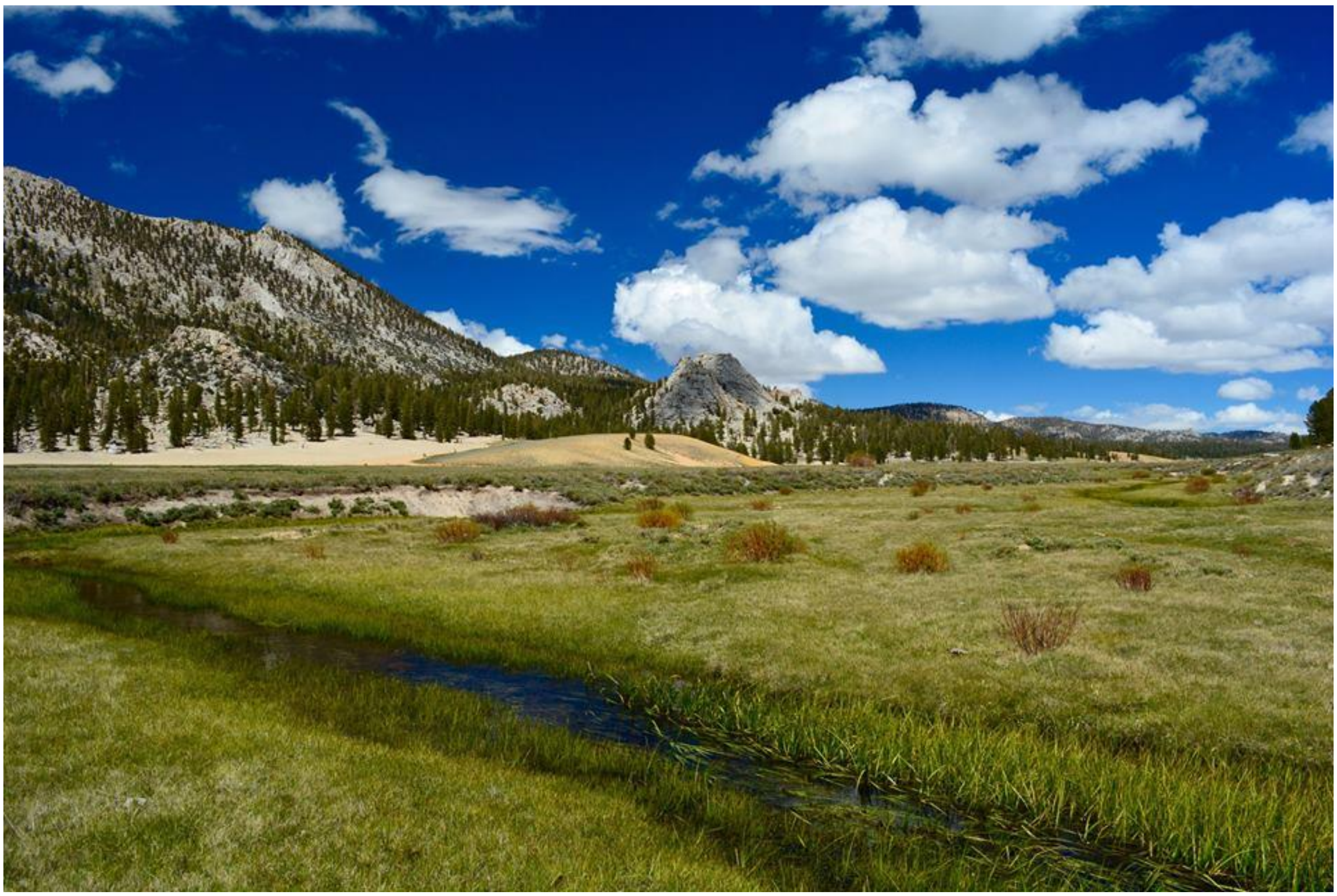
2015 Summary Report

June 12 – 15, 2015

State of California

Department of Fish and Wildlife

Heritage and Wild Trout Program



Prepared by Claire Buchanan, Stephanie Hogan and Jeff Weaver

Introduction

California Golden Trout (*Oncorhynchus mykiss aguabonita*; CAGT) are the official California State Freshwater Fish and a California Department of Fish and Wildlife (CDFW) Species of Special Concern. CAGT are endemic to two major eastern Kern River tributaries: the South Fork Kern River (SFKR) and Golden Trout Creek (Inyo National Forest; Tulare County; Figure 1). Portions of these drainages are within the Golden Trout Wilderness Area.

CAGT are threatened by non-native trout and land use impacts from long-term and historically-intensive grazing activities. Introduced Rainbow Trout (*Oncorhynchus mykiss*) in the Kern River plateau threaten the genetic integrity of CAGT through hybridization and Brown Trout (*Salmo trutta* compete for habitat and resources and may become predatory at larger sizes.

In 1997, the California Fish and Game Commission designated the majority of the SFKR watershed, including Mulkey Creek, as a Wild Trout Water (Figure 2). Wild Trout Waters are those that:

- support self-sustaining trout populations
- are aesthetically pleasing and environmentally productive
- provide adequate catch rates in terms of numbers or size of trout
- are open to public angling
- not stocked with catchable-sized hatchery trout (Bloom and Weaver 2008)

Mulkey Creek is a tributary to the SFKR that originates on the crest of the Sierra Nevada Mountains and flows in a southwest direction, entering the SFKR in Templeton Meadow. Two permanent barriers to upstream fish migration segregate the middle and upper portions of Mulkey Creek from the SFKR. Genetic analyses of samples collected from upper Mulkey Creek, in the vicinity of Mulkey Meadows, show introgression values of less than one percent (Stephens et. al 2013). The populations in upper Mulkey and Golden Trout creeks are believed to have the highest genetic integrity when compared to populations downstream. These populations of high conservation value were surveyed in 2015 to assess drought conditions, fish abundance, and habitat status.

The CDFW Heritage and Wild Trout Program (HWTP) monitors these fisheries and has conducted fishery and habitat assessments, benthic macroinvertebrate studies, angler surveys, and habitat restoration efforts over many decades throughout the native range of CAGT.

In 2006 and 2008, the HWTP conducted multiple-pass electrofishing surveys in Mulkey Creek in Mulkey Meadows in five different sections. In 2015, the HWTP continued Phase 4 surveys (long-term monitoring of designated waters) and conducted multiple-pass electrofishing surveys on four additional sections in Mulkey Creek (Figure 3).

Negative effects from drought on inland native trout populations and their habitats have been historically documented and, in some cases, led to localized extirpation. Recent drought conditions (2012-present) are exceptionally severe. Related impacts on CAGT may be further exacerbated by reduced snowpack, increased summer water temperatures, and decreased winter water temperatures. The latter may cause anchor ice formation or even freezing of entire stream segments. During the Mulkey Creek population assessments, two surveyors walked the upper Golden Trout Creek drainage to evaluate drought conditions, delineate wetted versus dry habitat and extent of occupied trout habitat, document trout size class distribution, and measure water temperature.

There is a known population of Mountain Yellow-legged Frogs (*Rana muscosa*, MYLF) in Mulkey Creek and surrounding headwater meadows. MYLF were listed as endangered under the Federal

Endangered Species Act in 2013 and populations in Mulkey Bear, and Bullfrog meadows, are likely an important genetic source for the species' recovery. During the Mulkey Creek population assessments, crews conducted visual encounter surveys (VES) throughout Mulkey Creek and associated tributaries to determine the presence and distribution of MYLF and other amphibians.

Methods

Multiple-pass electrofishing

Multiple-pass electrofishing was used to generate population-level data, including species composition, size class structure, and estimates of abundance. These data, if collected using consistent methods over time, can be used to study long-term population trends. HWTP staff and volunteers conducted surveys from June 12 to 15, 2015 at four locations (Figure 4). All electrofishing sections were newly established and randomly selected. Using Geographic Information System software, Mulkey Creek was delineated into points spaced at 100-meter intervals that were sequentially numbered. Using a random numbers table, four points were chosen.

Using Global Position System (GPS) equipment, surveyors navigated to each randomly selected point and determined survey feasibility. Where feasible, the downstream mesh block net was installed at the randomly selected point. If a mesh block net could not be installed at the randomly selected location and/or flows and water depth were not conducive to backpack electroshocking, HWTP staff moved upstream and located the nearest suitable site. Surveyors measured upstream approximately 500 feet and installed an upstream block net at a location conducive to net placement.

Specific section boundaries were chosen at areas where mesh block nets could be effectively installed and maintained throughout the survey effort. Nets were installed across the wetted width, closing the population within the section. Both sides of the net were secured above bankful width and both heavy rocks and sand bags were placed side by side along the bottom of the nets. The top of the net was secured out of the water. Nets were routinely monitored to ensure their integrity and prevent fish from moving in or out of the section.

Before electrofishing surveys began, air and water temperature (ºC, in the shade) and both specific and ambient conductivity (microsiemens) were measured. These factors were used to determine appropriate electrofisher settings. Geographic coordinates were recorded at the upstream and downstream survey boundaries (North American Datum 1983). Current weather conditions were noted and the area was scouted for any species of concern prior to commencing the surveys. Crews specifically looked for MYLF in the area using VES.

Personnel needs were determined based on stream width, habitat complexity, and water visibility. Individuals were assigned to shock, net, and tend live cars for the duration of the effort. Surveys began at the downstream block net and proceeded in an upstream direction. Netters captured fish and placed them in live cars to be held until processed. Live cars were ten-gallon plastic trash bins perforated with holes to allow water circulation. Fish were stored separately by pass number. A minimum of three passes were conducted within each section unless zero fish were captured in any pass.

Surveyors handled fish carefully to minimize injury and stress and processed fish separately by pass number. Each fish was identified to species and total length (mm) and weight (g) were measured. All captured trout were examined for injury, including electrofishing-related bruising, as well as fin ray abnormalities. Fish were recovered in live cars secured in the stream (with fresh flowing water) before being released back into the section.

MicroFish was used to estimate average weight (g) and section population (based on the capture rate and probability of capture) of each species. These data were used to determine biomass (pounds per acre; lb/ac) and density (fish/mi) of each species.

Habitat Assessment

A habitat assessment was conducted in each section to document resource condition, including habitat types and quality, water conditions, substrate, discharge, bank condition, and other attributes. The HWTP habitat assessment is a pared-down synthesis of Rosgen (1994) and the California Salmonid Stream Habitat Restoration Manual (CSSHRM; Flosi et. al. 1998). For each section, surveyors measured section length along the thalweg (ft). The length of the section was then divided into five cells of equal length. Wetted widths were measured at the center of each of the five cells. Across each width transect, five depths were taken (also at the center of five evenly divided cells), and both widths and depths were averaged for each section.

Active and bankful erosion were estimated as a percentage of bank area. Canopy cover was estimated as the percentage of total stream area (assuming the sun was directly overhead). Section percentages were defined for each habitat type: riffle, flatwater, and pool following Level II protocols defined by the CSSHRM.

Using visual observation, substrate size classes and the percent of each class relative to the total bottom material within the wetted width were quantified. A rating (between poor and excellent) was given to the instream fish cover and cover types were identified and defined as the percent of total instream cover. The change in water surface elevation (section gradient; %) and streamflow (cubic feet per second; cfs) were measured. Representative photographs were taken.

Drought assessment

Drought assessments were conducted in the Golden Trout Creek drainage on June 14-15, 2016. Due to the remote nature of the survey location, protocols were a modified/abbreviated version based on parameters outlined in the Drought Response Implementation Plan and Rescue-Translocation Decision Model (Table 1). Surveyors walked the length of the following reaches:

- Golden Trout Creek near Tunnel Meadow upstream to the headwaters
- Barigan Stringer from the Golden Trout Creek confluence upstream two miles
- Stokes Stringer from the Golden Trout Creek confluence upstream one-half mile
- Unnamed tributary to Golden Trout Creek (commonly referred to as Siberian Stringer) from the confluence with Golden Trout Creek upstream 1.5 miles (Figure 5)

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

- Survey start and end points
- 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.)

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

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.

Visual encounter surveys

VES were used to document the presence, distribution, and habitat utilization of other aquatic species. VES were conducted in the upper portion of Mulkey Creek and associated tributaries in Bull Frog and Bear meadows. Crews walked in tandem on opposite creek banks observing the adjacent bank, looking for adults, juveniles, tadpoles, and egg masses. If suitable amphibian habitat occurred away from the stream bank, these areas were also surveyed. Observed amphibians were identified to species and geo-referenced. Surveyors focused on locating MYLF to avoid incidental take during electrofishing surveys.

Results

Multiple-pass electrofishing

The HWPT conducted multiple-pass electrofishing surveys in four sections: 84, 120, 136, and 150. A combined total of 1097 CAGT were captured. Densities of CAGT in Mulkey Creek ranged from 1616 fish/mi (Section 84) to 4686 fish/mi (Section 120), with an average of 2893 fish/mi (Figure 7).Captured CAGT ranged in size from 52 to 193 mm total length with a mean of 110 mm. The average biomass of CAGT was 73.38 lb/acre. Two shockers were used in all sections except for Section 150, where only one shocker was used. At least two netters and one live car tender were used in all sections.

Habitat assessment

During the surveys, air temperature was between 12 and 26 ºC, depending on the time of day. Average water temperature was 10 ºC and water clarity ranged from zero to four feet. Ambient conductivity averaged 244 microsiemens. Streamflow was measured at three locations (Sections 84, 120 and 150) and averaged 0.5 cfs. Overall stream gradient was 3.3% (Table 2).

Canopy cover was estimated at 9%, overall instream fish cover for all sections was “good,” active erosion was 51%, and bankful erosion was 20%. The total survey length was 2253.4 ft, with an average wetted width of 9.3 ft and average water depth of 0.6 ft.

The predominant habitat type surveyed was flatwater, with a small percentage of pools and zero riffles. Substrate was dominated by vegetation with some cobble and gravel. No bedrock was observed in any of the four sections (Figure 8, Table 3). Aquatic vegetation was the dominant instream cover type, with some water depth and undercut banks in lesser quantities. Overhanging vegetation, boulders, and water turbulence provided small percentages of cover. Surveyors did not observe large woody debris in any of the sections (Figure 8, Table 4).

Section 84 was located at the upstream end of an extensive boulder field that isolates fish in Mulkey Meadows from reaches farther downstream (Figure 9). The barrier is 0.3 miles long, with a slope of 25º, and subsurface flow through the large boulders (Figure 10). At the base of this barrier, where flow resurfaces, the wetted width was approximately eight feet with a maximum depth of two feet. The randomly selected downstream point for Section 84 was located within the boulder complex of the barrier where flow was subsurface. As a result, the entire section was shifted approximately 150 feet upstream to a location conducive to effective block net installment.

Sections 120, 136, and 156 were located in Mulkey Meadows where there were heavily incised stream banks, thick vegetation, and sediment (Figure 11). Surveyors observed a small Mountain Garter Snake (*Thamnophis elegans elegans*) and a small (approximately one inch) Pacific Tree Frog (Pseudacris regilla).

Drought assessment

The Golden Trout Creek drought assessment was initiated in meadow habitat near Tunnel Meadow. A brief angling effort was conducted to get fish in hand, examine trout condition, and take photographs. Two anglers each fished for 1.25 hours and collectively captured 23 small- and 3 medium-sized CAGT (Figure 12). Average catch per unit effort was 11.6 trout/hour. Water temperature was 7º C and air temperature was 16º C at 0800. Streamflow was estimated at two cubic feet per second. Substrate consisted predominantly of sand and gravel with some boulder and cobble. Fish cover was abundant with large woody debris, undercut banks, water depth, and other features. A short distance upstream from the survey start, gradient increased (to medium-gradient) and continued to Big Whitney Meadow. Habitat appeared excellent with frequent deep pools. Trout were readily observed throughout the survey area and appeared to be in high densities. Although surveyors did not tally all observed trout in all habitats, it was estimated that >1000 CAGT were observed.

Barigan Stringer was dry at the confluence with Golden Trout Creek and the lower 275 feet were intermittent; one small CAGT was observed in an isolated pool (Figure 13). Flow became contiguous for approximately 0.16 miles and an additional nine small-sized CAGT were observed in small pools with one to two trout per pool. Water temperature was 9 ºC at 1000. The remainder of the surveyed area of Barigan Stringer was dry. There was evidence of past flow; the channel was deeply incised/scoured with exposed gravel in lower gradient meadow habitat and exposed gravel, cobble, and boulders in higher-gradient forested reaches.

Siberian Stringer at its terminus had more flow than Golden Trout Creek (Figure 14). Habitat was excellent with abundant fish cover and large numbers of trout. A total of 200 CAGT were counted within 0.1 miles of the confluence with Golden Trout Creek. Size class distribution was 205 small- and 3 medium-sized trout. Due to the observed high abundance and time constraints, surveyors stopped counting fish and only documented habitat for an additional 1.4 miles. Water temperature was 17 ºC at 1520. Pools were frequent and exceeded one foot in depth; approximately 12-15 trout were observed in every pool and trout continued to be abundant throughout the survey reach. Wetted habitat continued farther upstream from the survey end and the stream split into numerous braids. Due to time constraints and a perceived low threat assessment, surveyors did not attempt to document upstream wetted extent or fish distribution.

Stokes Stringer, at the Golden Trout Creek confluence, was stagnant with a lot of algae and instream vegetation (Figure 15). The stream quickly became intermittent with isolated pools and dense grass growing in-channel, especially in the dewatered segments. The downstream-most CAGT (three inches in length) was observed in an isolated pool approximately 0.2 miles upstream from the Stokes Stringer terminus. This pool was 7.6 feet in length, with a width of four feet and maximum water depth of 1.3 feet. Surveyors continued upstream for another .25 miles and counted 25 live and two dead CAGT, all less than six inches in length. The stream became dry near tree line and the survey was ended; however, while later hiking over Cottonwood Pass, surveyors noted flow farther upstream in Stokes Stringer (in higher-gradient forested habitat) but this area was not surveyed. Overall, habitat in Stokes Stringer was intermittent and poor, with both stranded and dead trout observed.

Visual encounter survey

Surveyors observed a total of eight adult MYLF in the tributary to Mulkey Creek in Bear Meadow. The wetted reach of the tributary had very little flow, with shallow pools connected by very small amounts of water. The pools were dominated by thick algae and instream vegetation. No fish were observed.

Two adult MYLF were observed in an unnamed tributary in Bullfrog Meadow, near the confluence with Mulkey Creek. The frogs were observed in a pool, approximately five feet long and two feet wide. Farther upstream, the channel became poorly defined and the meadow was moist over a relatively large area. No other frogs were observed farther upstream in Bullfrog Meadow.

Discussion

Estimated trout density in Section 120 was nearly three times higher than Section 84. This disparity was likely due to variations in habitat quality. Section 120 was located in meadow habitat dominated by aquatic vegetation, with deep areas that provided good cover. Section 84 was located at the downstream extent of the meadow, directly above a large barrier. The section was higher gradient with very little aquatic vegetation to provide cover. It was dominated by cobble and some boulders, which were not present in other sections located within the meadow. Flow velocity was higher, owing to the more constricted channel profile in this area. Capture efficiency was better in Section 84 but fewer trout were captured, indicating this was not preferred habitat for CAGT.

Sections 136 and 150 had lower estimated densities than Section 120, but were located in similar meadow habitat. Lower densities appeared to be related to decreased stream flow in the upstream areas surveyed.

When comparing estimated densities of CAGT from 2006, 2008, and 2015, it appears the population declined over this period (Figure 17). This apparent decline may be due, in part, to survey bias. The sections surveyed in 2006 and 2008 (Catot and Weaver 2006; Weaver and Mehalick 2008) were not selected at random and did not include higher-gradient habitat with a more constricted channel found farther downstream. As noted, this habitat type was surveyed in 2015 (Section 84) and had lower densities of trout. In 2006, the HWTP conducted population estimates in Mulkey Creek at two locations to specifically compare trout populations inside and outside of a cattle exclosure fence. In 2008, survey locations were selected to include representative habitat. In both years, all sections were concentrated in the middle portion of the meadow where densities were likely the highest (Table 5).

Although variation in survey locations over time may account for the apparent decline of CAGT in this area, it may also be a result of drought-related impacts and changing habitat conditions. Streamflow declined from 4.0 cfs in 2006, to 0.93 in 2008, and 0.48 cfs in 2015. This is likely a direct result of reduced snowpack and precipitation correspondent with the onset of drought in 2012.

MYLF observations were similar to those from 2008. It is important to continue monitoring these populations due to their listing status.

Conclusion

A long-standing dataset on Mulkey Creek allows the HWTP to compare CAGT abundance and size class structure over time. Although overall abundance in 2015 was comparatively low (Figure 17), the densities in Mulkey Meadows were relatively high and the population appears to be self-sustaining.

Golden Trout Creek and Siberian Stringer had excellent habitat conditions and CAGT were observed in high densities in these streams. The extended drought did not appear to negatively affect these populations but they should continue to be monitored over time. In contrast, Barigan and Stokes stringers appeared to be severely impacted by drought and these populations may not persist. Barigan Stringer was, for the most part, dry although this stream has been documented as dry in past years.

The HWTP recommends intermittent monitoring in the Golden Trout Creek drainage (frequency dependent on climatic conditions and perceived threat level), as well as continued Phase 4 monitoring of Mulkey Creek including:

- Replicating historic electrofish sections
- Updating the genetic analysis of the Mulkey Creek population
- Monitoring drought impacts
- Continued monitoring of all MYLF life stages

References

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Figure 1. Vicinity map of South Fork Kern River and Golden Trout Creek

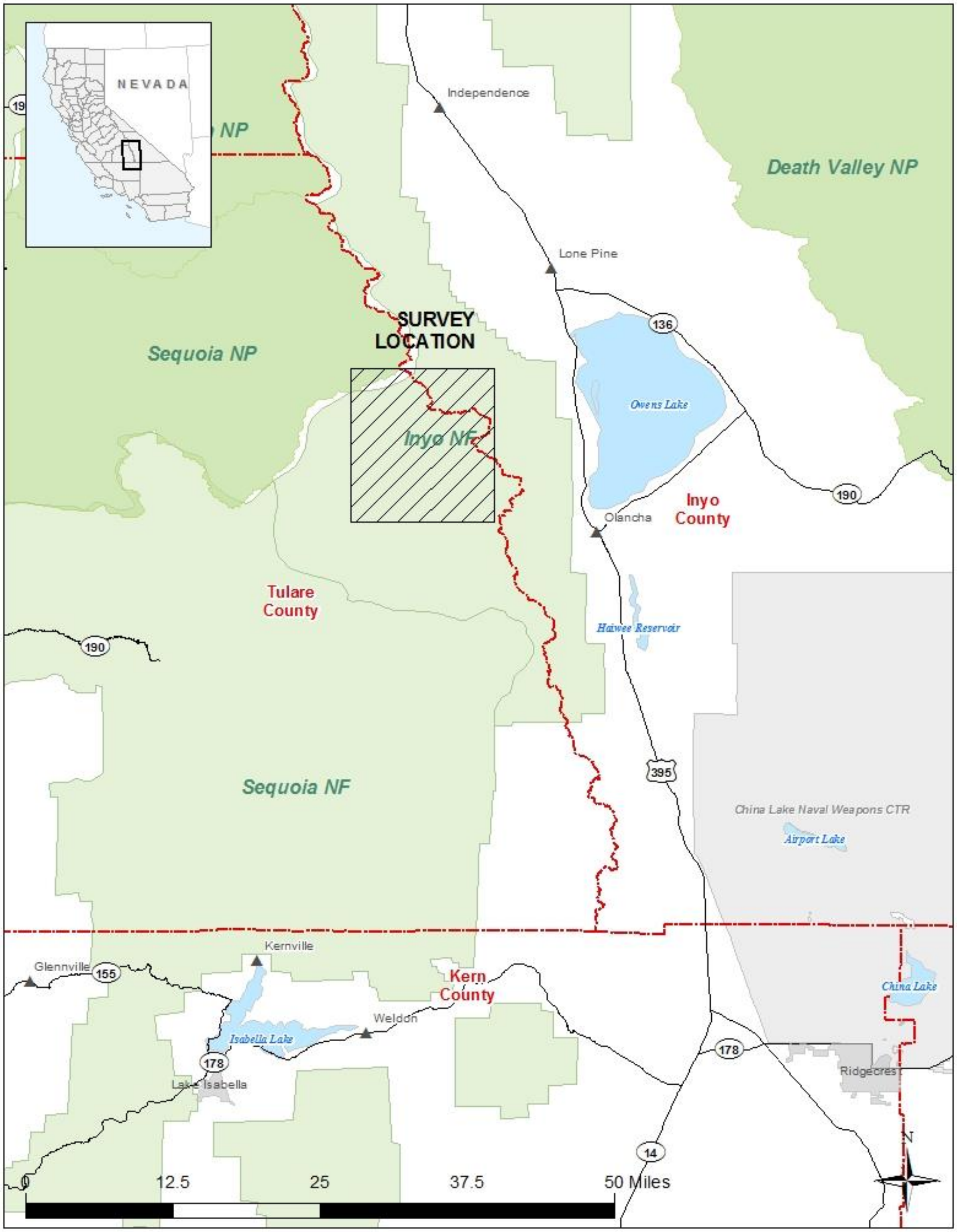
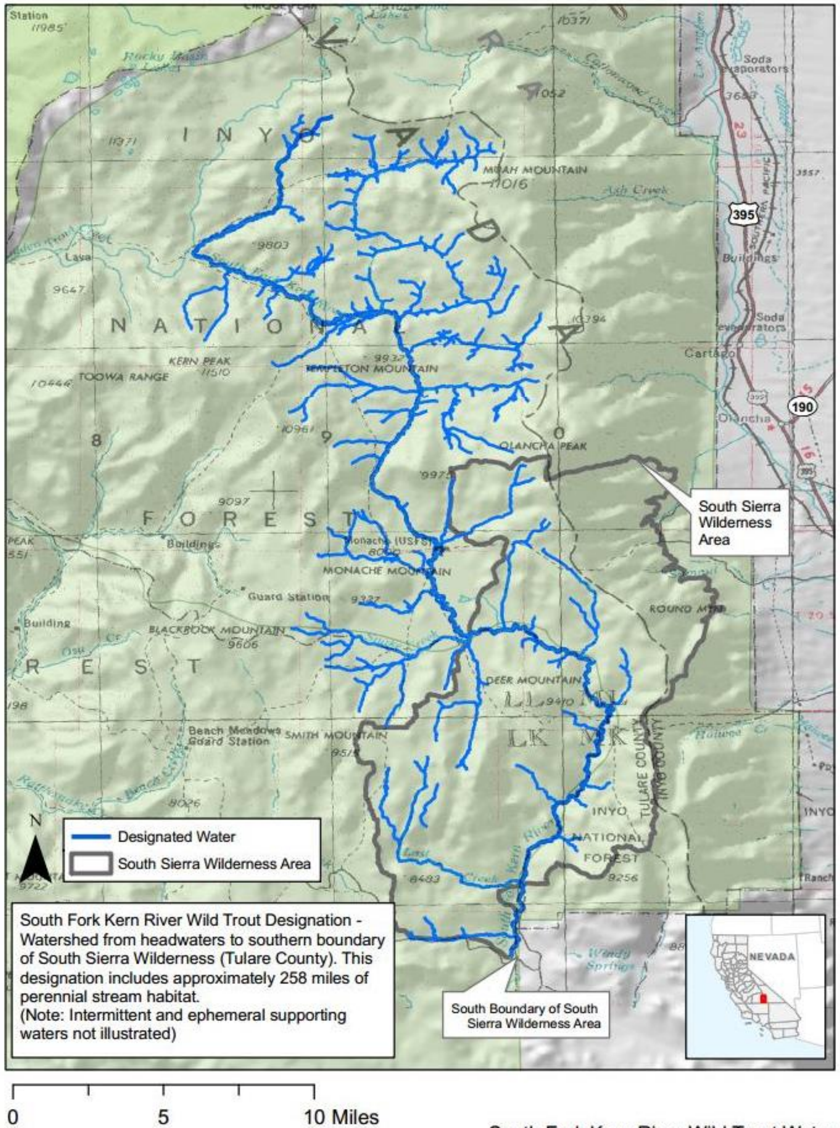
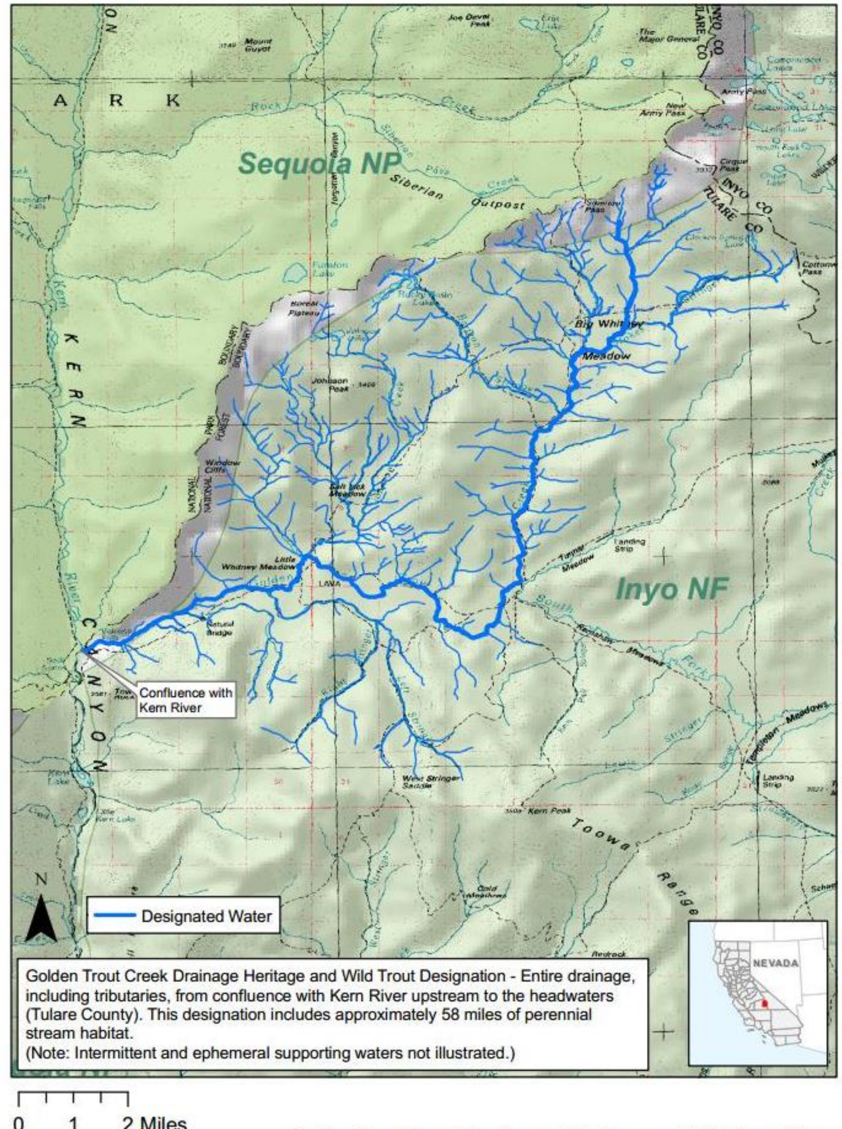


Figure 2. Map of the Wild Trout designation in the South Fork Kern River basin and Heritage and Wild Trout designation in Golden Trout Creek



South Fork Kern River Wild Trout Water



Golden Trout Creek Designated Heritage and Wild Trout Water

Figure 3. Detail map of Mulkey Creek depletion electrofishing section locations in 2006, 2008, and 2015

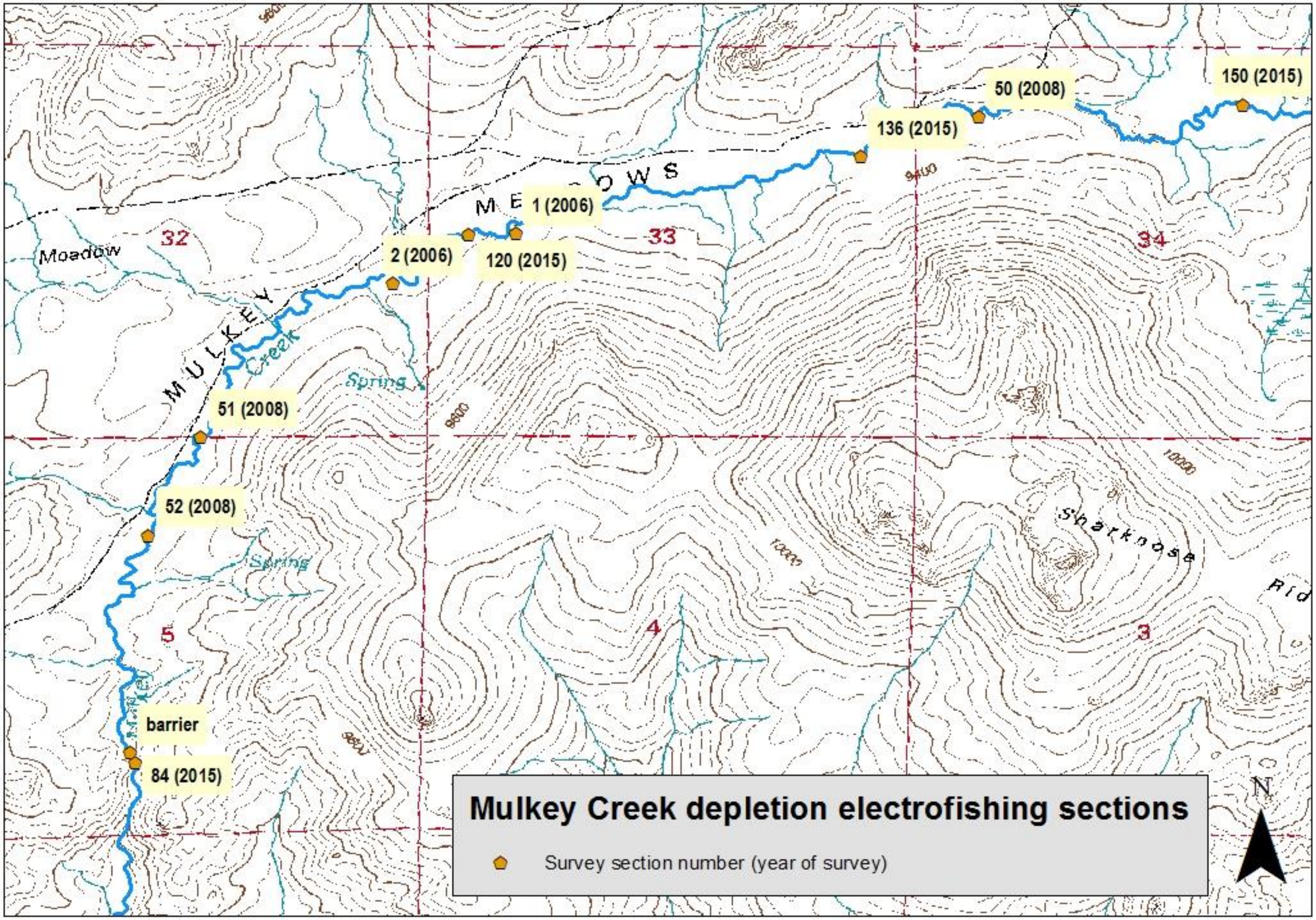


Figure 4. Detail map of Mulkey Creek 2015 depletion electrofishing section locations, MYLF observations, upstream wetted habitat, and CAGT distribution

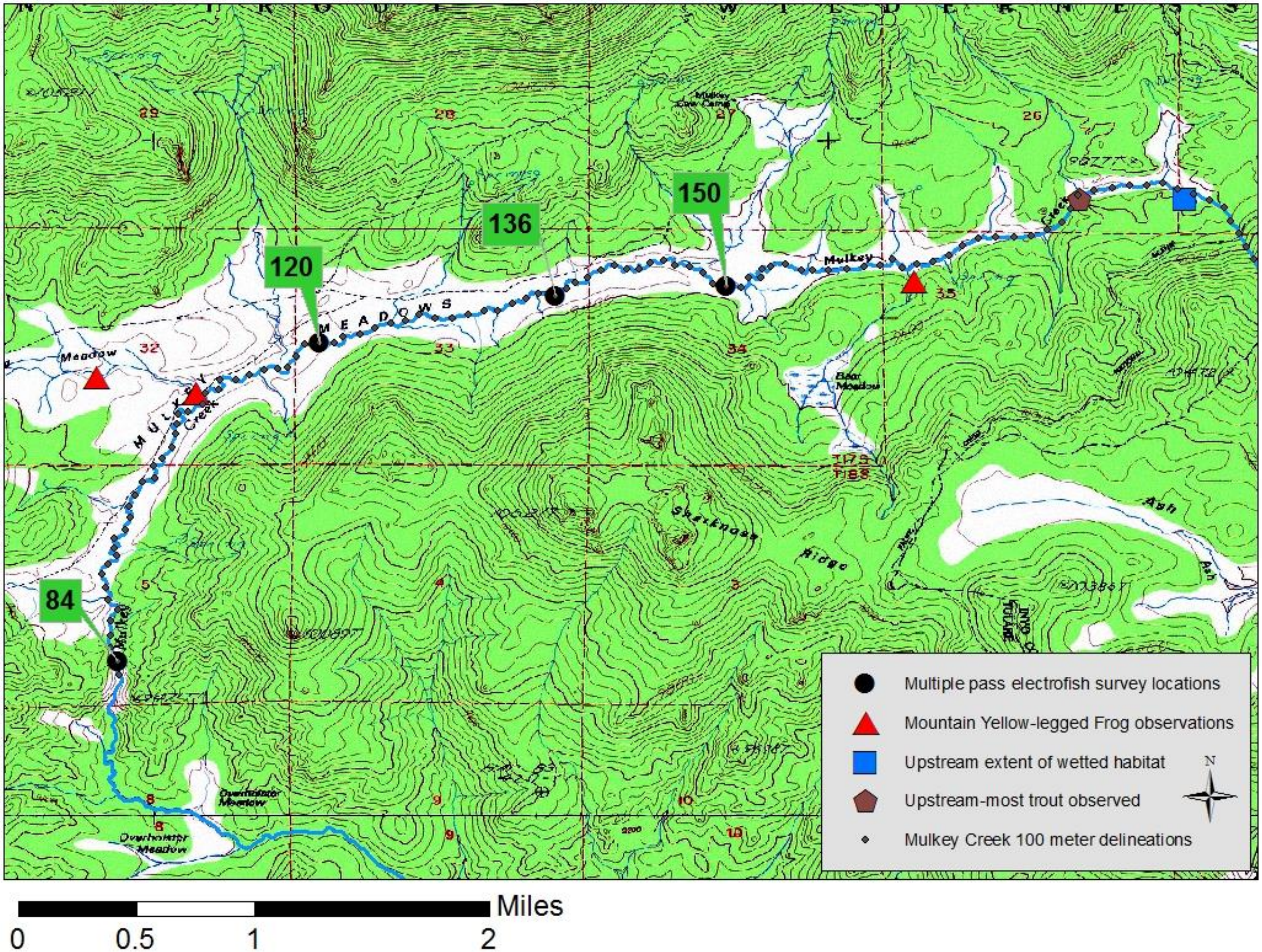


Figure 5. Detail map of drought assessments conducted in Golden Trout Creek drainage

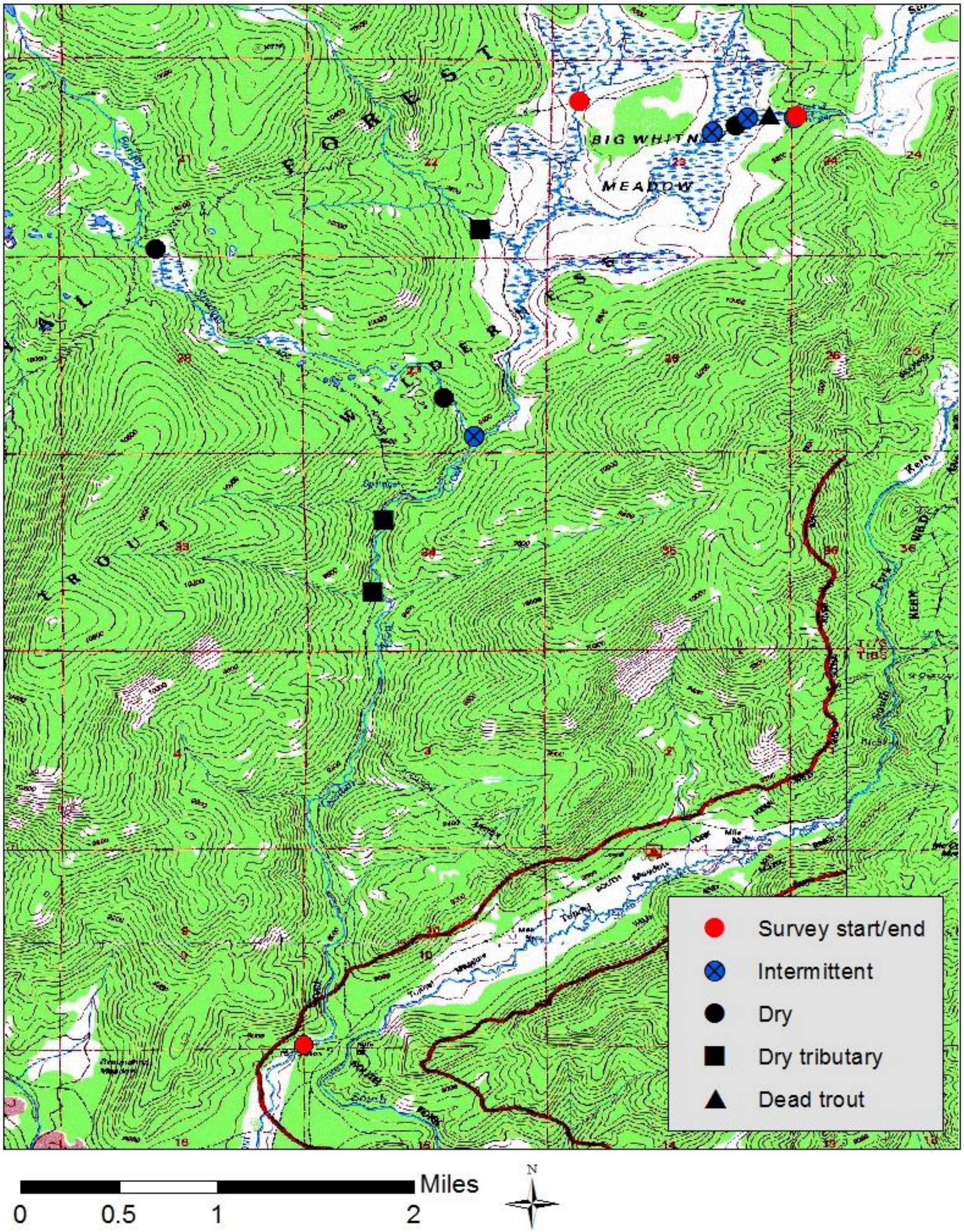


Figure 6. Graph of Mulkey Creek 2015 electrofishing data: estimated density (fish/mile) by section

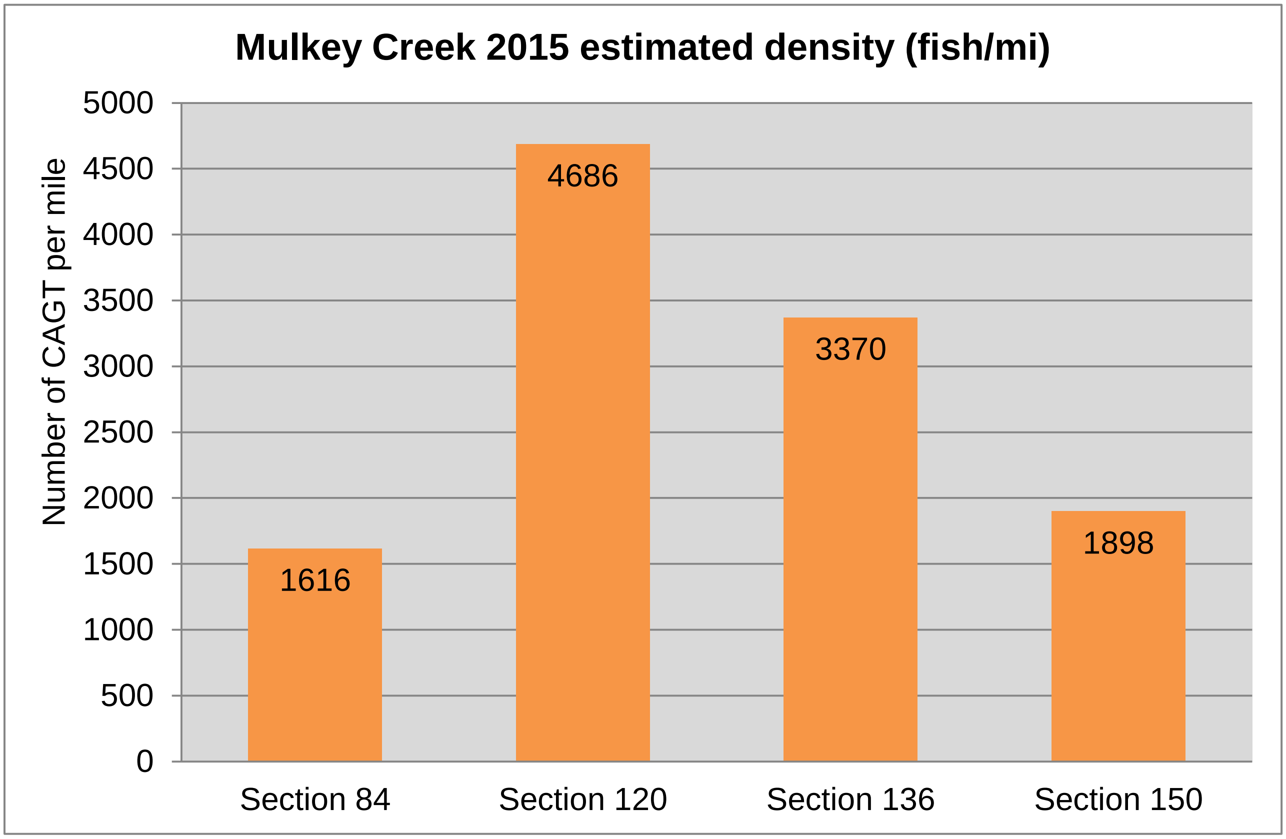
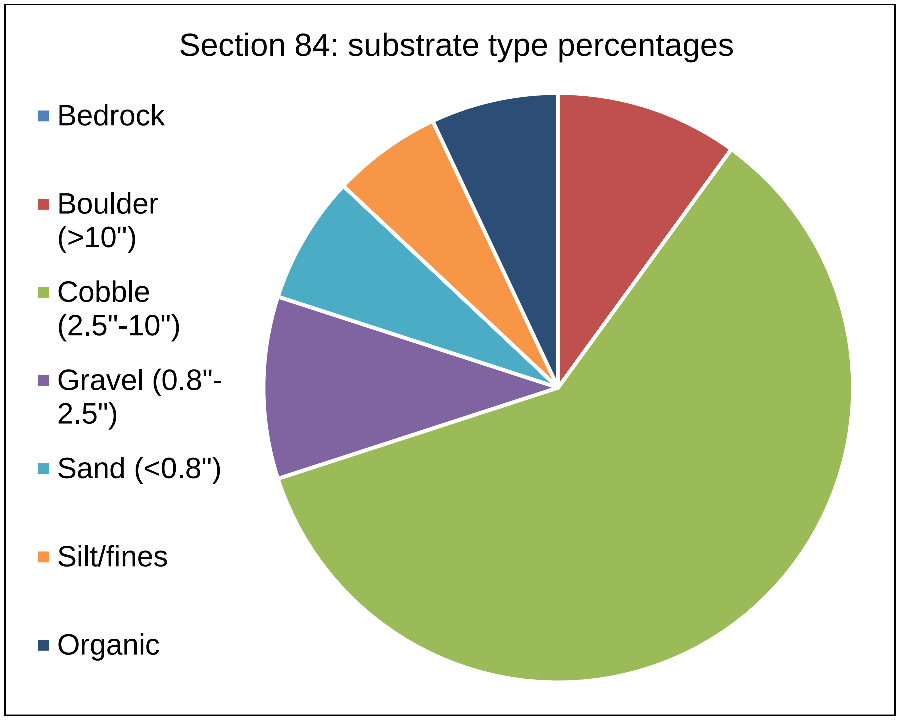


Figure 7. Mulkey Creek 2015 charts of substrate type in multiple-pass electrofishing sections; Section 84 was extracted from the average values to show how it differed from Sections 120, 136, and 150



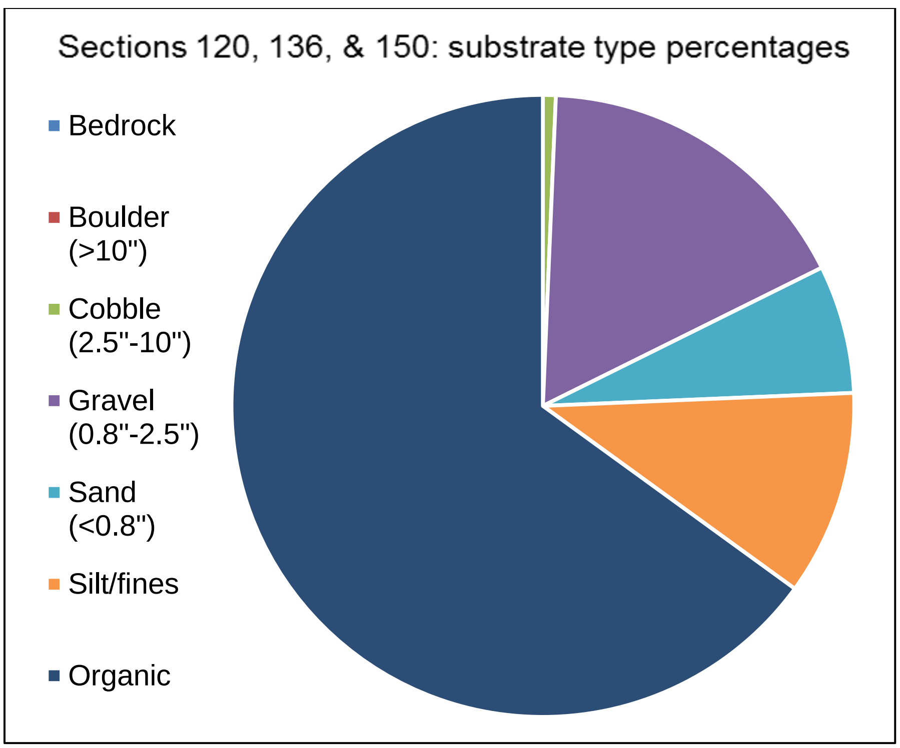
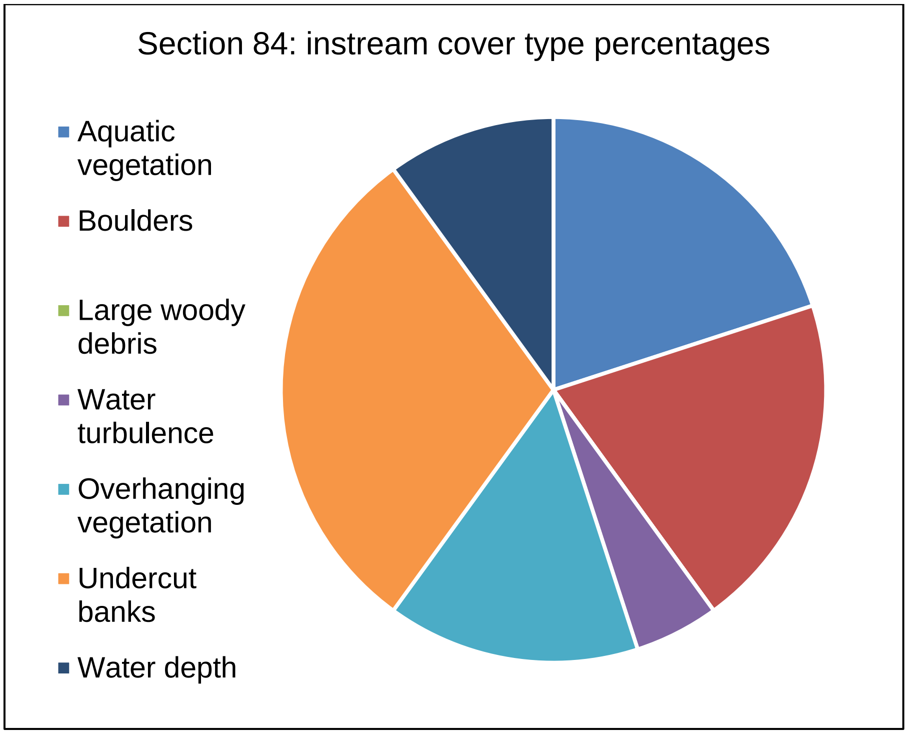


Figure 8. Mulkey Creek 2015 charts of cover types in multiple-pass electrofishing sections; Section 84 was extracted from the average values to show how it differed from Sections 120, 136, and 150



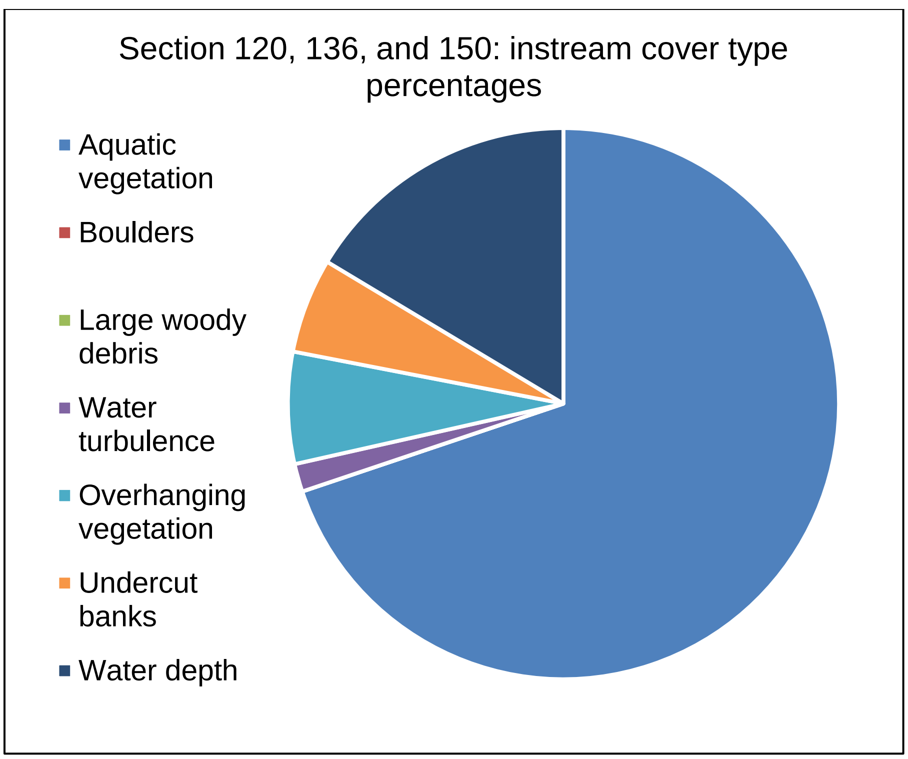


Figure 9. Representative photographs of Mulkey Creek multiple-pass electrofishing Section 84

Figure 10. Representative photographs of Mulkey Creek barrier

Figure 11. Representative photographs of Mulkey Creek multiple-pass electrofishing Sections 120, 136, and 150

Figure 12. Representative photographs of Golden Trout Creek drought assessment

Figure 13. Representative photographs of Barigan Stringer drought assessment

Figure 14. Representative photographs of Siberian Stringer drought assessment

Figure 15. Representative photographs of Stokes Stringer drought assessment

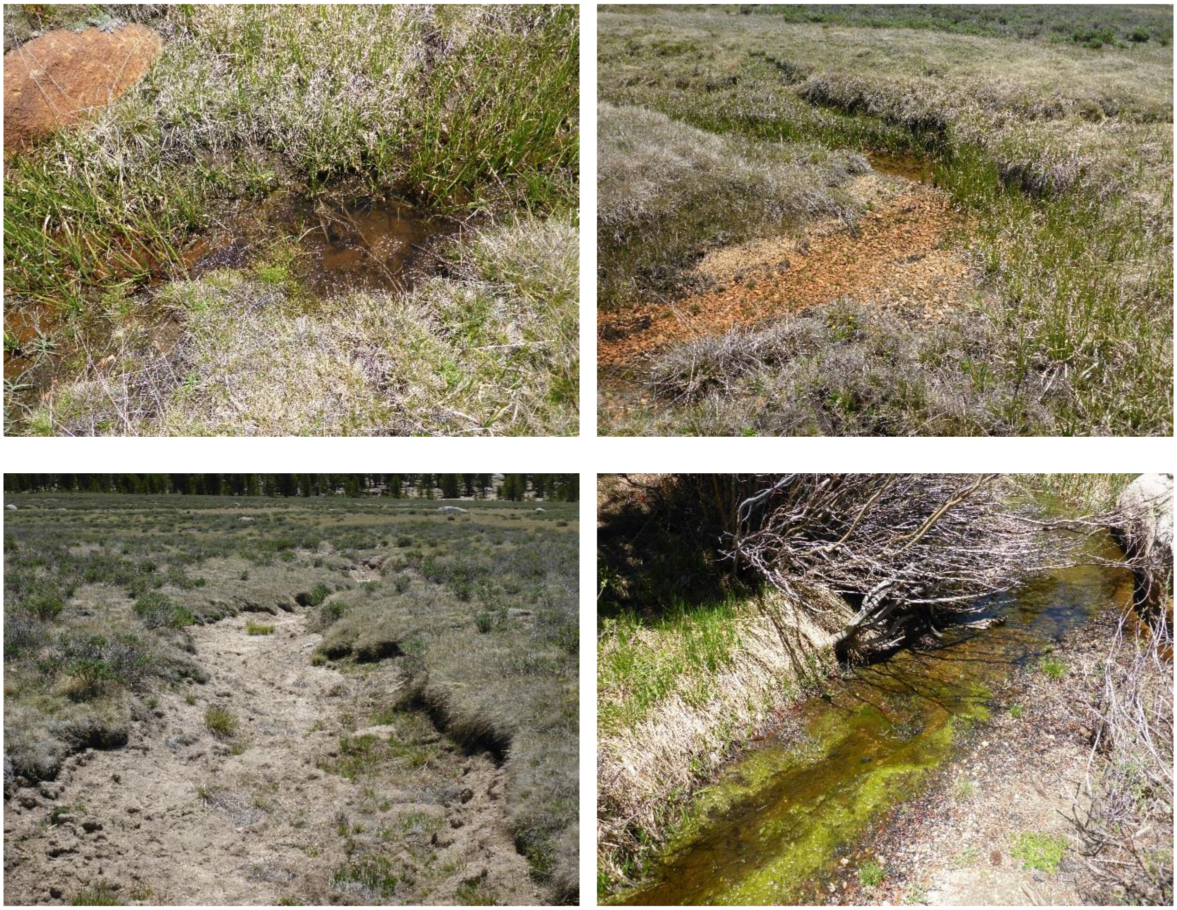


Figure 16. Graph of Mulkey Creek 2015 electrofishing data: number of trout captured by section

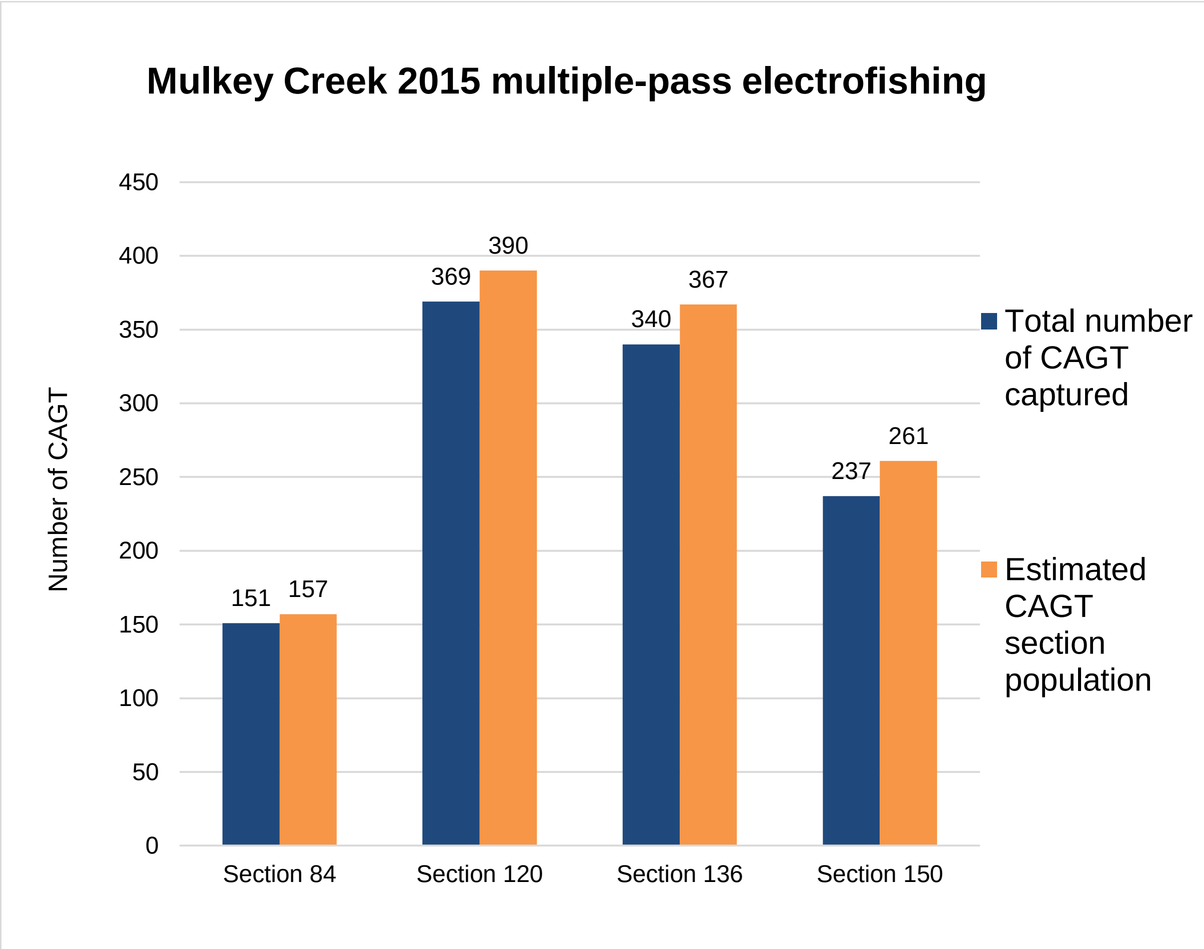


Figure 17. Graph of Mulkey Creek electrofishing data: average estimated density (trout/mile) 2006-2015

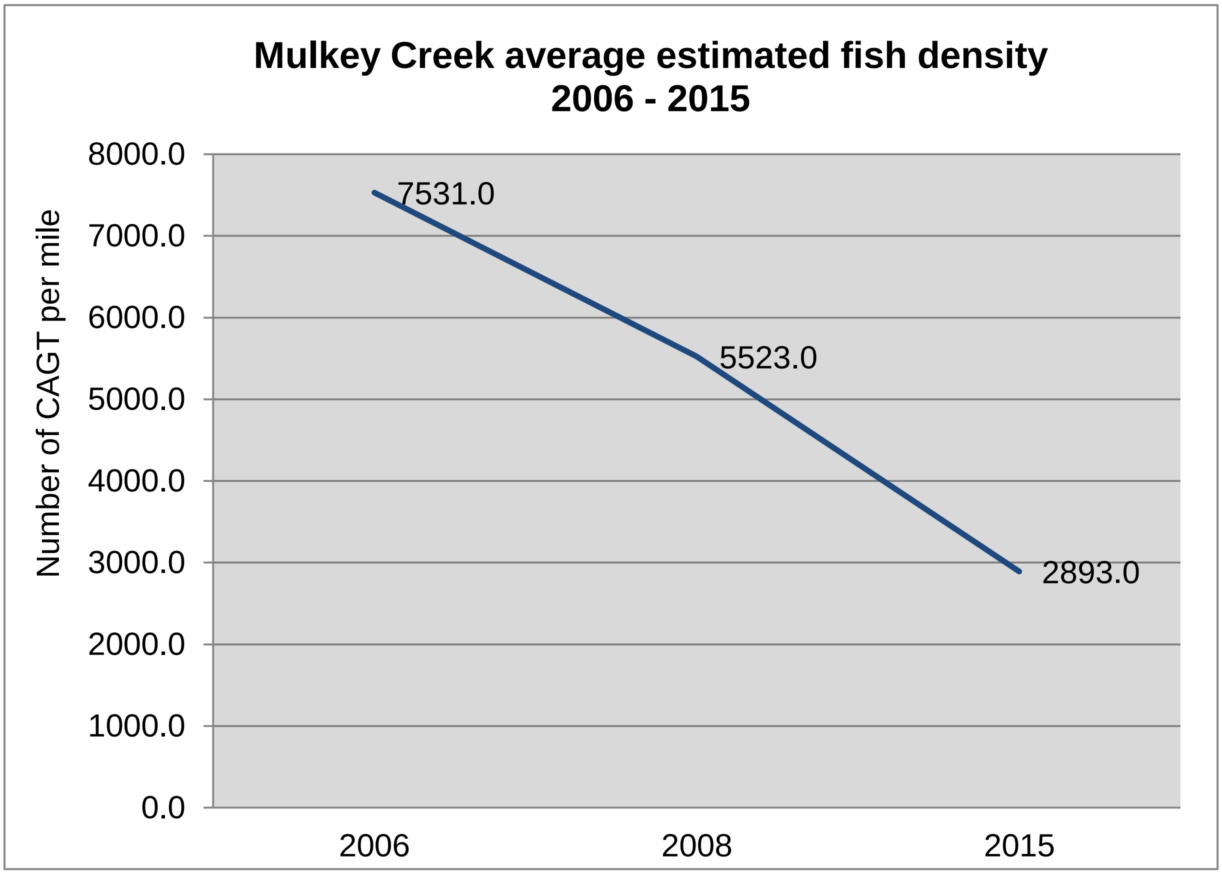


Table 1. Drought Response Implementation Plan and Rescue-Translocation Decision Model

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, <u>flow is not contiguous and is <.5 cfs</u>, 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, <u>pool habitat does not exist</u> 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 2. 2015 Mulkey Creek habitat data

Section	Section length (ft)	Air temperature (ºC)	Water temperature (ºC)	Riffle (%)	Riffle (ft)	Flatwater (%)	Flatwater (ft)	Pool (%)	Pool (ft)
84	513.0	19.0	8	0	0	90	461.7	10	51.3
120	439.4	12.0	11.9	0	0	90	395.46	10	43.94
136	575.0	21.0	10	0	0	90	517.5	10	57.5
150	726.0	26.0	10.3	0	0	85	617.1	15	108.9
Average	**-**	**19.5**	**10.1**	**-**	**-**	**-**	**-**	**-**	**-**
Total (ft)	2253.4	-	-	-	0.0	-	1991.8	-	261.6
Total (%)	-	-	-	-	0%	-	88%	-	12%

Section	Overall instream cover rating	Bankful erosion (%)	Active erosion (%)	Canopy closure (%)	Average wetted width (ft)	Average water depth (ft)	Streamflow (cfs)	Gradient (%)
84	good	15	40	15	5.0	0.7	0.70	5.2
120	good	25	5	10	12.4	0.4	0.47	3.1
136	good	80	30	0	9.2	0.7	0.47	2.2
150	good	85	5	10	10.6	0.6	0.27	2.6
Average	**-**	**51**	**20**	**9**	**9.3**	**0.6**	**0.48**	**3.3**

Table 3. 2015 Mulkey Creek substrate types by section

Section	**% Bedrock**	**% Boulder** (>10")	**% Cobble** (2.5"-10")	**% Gravel** (0.8"-2.5")	**% Sand** (<0.8")	**% Silt/fines**	**% Organic**
84	0	10	60	10	7	6	7
120	0	0	2	31	5	12	50
136	0	0	0	20	5	5	70
150	0	0	0	0	10	15	75
Total Percent	0.0	2.5	15.5	15.3	6.8	9.5	50.5

Table 4. 2015 Mulkey Creek instream cover types by section

Section	% Aquatic vegetation	% Boulder	% Large woody debris	% Water turbulence	% Overhanging vegetation	% Undercut banks	% Water depth
84	20	20	0	5	15	30	10
120	75	0	0	0	5	5	15
136	88	0	0	0	0	2	10
150	50	0	0	0	15	10	25
Total Percent	58.3	5.0	0.0	1.3	8.8	11.8	15.0

Table 5. 2006-2015 Mulkey Creek depletion electrofishing data: number of fish captured by species and section and estimated abundance

Year	Section	Section length (ft)	Total number CA GT captured	Estimated population	Estimated density (fish/mi)	Estimated biomass (lbs/acre)	Capture probability	95% Confidence interval
2015	84	513.0	151	157	1616	84.43	65.4%	150-164
2015	120	439.4	369	390	4686	83.74	51.5%	376-404
2015	136	575.0	340	367	3370	75.58	57.8%	349-385
2015	150	726.0	237	261	1898	49.75	44.7%	244-278
2008	50	300.0	209	322	5667	111.77	53.5%	269-311
2008	51	282.3	270	285	5330	195.64	62.1%	257-283
2008	52	558.0	562	589	5573	191.65	63.9%	574-604
2006	1	340.0	463	489	7594	179.56	62.2%	447-479
2006	2	316.0	440	447	7469	407.54	67.4%	429-451