# Lassen Creek Watershed 2010 Summary Report

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#### Introduction

Lassen Creek (Modoc County), tributary to Goose Lake, is located approximately 30 miles northeast of Alturas, CA (Figure 1) and is in the native range of Goose Lake redband trout (*Oncorhynchus mykiss* ssp.). Goose Lake redband trout are a federally listed species of special concern (United States Fish and Wildlife Service) and a US Forest Service Region 5 Management Indicator Species (Moyle, 2011). The California Department of Fish and Game (DFG) Heritage and Wild Trout Program (HWTP) conducted a Phase 2 candidate water assessment in the Lassen Creek drainage in 2010 to determine whether it meets the qualifications for designation as a Heritage and Wild Trout Water.

Wild Trout Waters are those that support self-sustaining (wild) populations of trout, are aesthetically pleasing and environmentally productive, provide adequate catch rates in terms of numbers or size of trout, and are open to public angling (Bloom and Weaver 2008). Wild Trout Waters may not be stocked with catchable-sized hatchery trout. Heritage Trout Waters are a sub-set of Wild Trout Waters and highlight wild populations of California's native trout that are found within their historic drainages. The HWTP utilizes a phased approach when evaluating waters for potential designation; Phase 2 assessments provide a comprehensive evaluation of the fishery, habitat, and angler use including information on species distribution, size class structure, and abundance. These assessments generally occur over a multi-year period.

The 2010 assessments included multiple-pass depletion and direct observation survey methods and occurred at various locations throughout Lassen and Cold creeks. Lassen Creek is one of the larger tributaries to Goose Lake in California and has been identified as one of the more important spawning and rearing streams for Goose Lake redband trout (Moyle et al. 2008). Cold Creek is a tributary to Lassen Creek and is considered to be the principal spawning area in the Lassen Creek drainage. Lassen Creek may also support an adfluvial life history pattern during periods of average or above-average water levels in Goose Lake (Goose Lake Fishes Conservation Strategy, 1996).

#### Methods

Multiple-pass electrofishing was used to generate population-level data including species composition, size and age class structure, and estimates of abundance. These data can be compared over time to study trends in the population. Surveys were conducted between July 8-12, 2010 in Lassen and Cold creeks by HWTP staff (from Headquarters and Northern Region). All multiple-pass electrofishing sections were newly established in 2010 and were selected by stratified random sampling technique. Lassen Creek (from the private property boundary located approximately one-half mile downstream of the Lassen Creek Campground upstream to the headwaters) and Cold Creek (entire length) were delineated into 300-foot intervals using Geographic Information System (GIS) software and each interval was sequentially numbered (Figures 2 and 3). Due to

private property access constraints and concerns about lack of suitable yearround habitat that would support resident fishes (specifically redband trout), the lower portion of Lassen Creek was excluded from the sample frame. Each creek was further stratified into reaches based on stream gradient and, using a random numbers table, one multiple-pass survey section was selected in each reach. Four reaches were identified on Lassen Creek (two low-gradient, one highgradient, and one medium-gradient) and two on Cold Creek (one low and one medium-gradient), yielding a total of six multiple-pass survey sections (Figures 4 and 5). Using Global Positioning System (GPS) equipment, HWTP staff navigated to each randomly selected point and determined survey feasibility. Specific section boundaries were chosen at areas where mesh block nets could effectively be installed and maintained throughout the survey effort. 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. The upstream boundary of each section was selected at a location conducive to net placement.

At each section boundary, nylon mesh block nets were installed across the wetted width, effectively closing the population within the section. Both sides of the nets were secured above bankful, heavy rocks were placed side by side along the bottom of the nets, and the nets were secured in such a way as to hold the top of the net out of the water. These nets were routinely monitored and inspected throughout the survey to ensure their integrity and to prevent fish from moving into or out of the section during the course of the survey.

Prior to electrofishing, physical measurements of the stream and environmental conditions were taken, including air and water temperature (in the shade) and conductivity (both specific and ambient). These factors were used to determine appropriate electroshocker settings. Due to the low conductivity measured in Lassen Creek, salt was added in some locations to increase ambient conductivity and, presumably, fish capture probability. Salt was not available for all surveys. GPS coordinates were recorded for both the upstream and downstream boundaries of the survey. Current weather conditions were noted and the area was scouted for any species of concern prior to commencing the surveys.

Personnel needs were determined based on stream width, habitat complexity, and water visibility. For each of the surveys, individuals were assigned to shock, net, and tend live cars for the duration of the effort. Surveys were initiated at the lower block net and proceeded in an upstream direction, with netters capturing fish and placing them in live cars to be held until processed. Live cars are 32 gallon plastic trash bins perforated with holes to allow water circulation. Three to four passes were conducted within each section, with fish from each pass stored separately. Over the course of the survey, fish were handled carefully to minimize injury and stress. Fish were processed separately by pass number. Each fish was identified to species and total length (mm) and weight (g) were measured. To better understand age class structure, scale samples were collected from 100 trout from various size classes across all sections surveyed. These scales were collected midway between the dorsal fin and lateral line using a knife. Each scale sample was placed in a labeled envelope with a unique identification number that corresponded to the information recorded for individual fish on the datasheets. All samples were retained by HWTP biologists for internal processing. Fish were then recovered in live cars secured in the stream (with fresh flowing water) and released back into the section.

A habitat assessment was conducted in each section to document resource condition by collecting base-line data on 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. 1988). Section length was measured along the thalweg. 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.

Stream characteristics, including active erosion (erosion occurring in the present), erosion at bankful, and canopy closure were measured as percentages of either the total stream area (canopy cover) or bank area (erosion). Section percentages were defined for each habitat type (riffle, flatwater, and pool) following Level II protocols as defined by the CSSHRM. Using visual observation, substrate size classes and the percentage 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 cover available to fish and cover types were identified and defined as percentages of total instream cover. The change in water surface elevation (section gradient) and streamflow were measured. Representative photographs of the section were taken.

Fish measurements were entered into the DFG Fisheries Information Sharing Host (FISH) database and were extracted into MicroFish (MicroFish Software). Based on the capture rate (number of fish captured per pass) and probability of capture, a population estimate was determined for each species in each section. MicroFish also calculated the average weight of each species by section. These data were used to determine biomass (pounds per acre) and density (fish per mile) of each species.

The HWTP also conducted direct observation surveys at ten locations in Lassen Creek using snorkeling methods, an effective survey technique in many small streams and creeks in California and the Pacific Northwest (Hankin and Reeves 1988; Figure 2). The sample frame was based on the stream reaches and 300foot intervals described above for multiple-pass electrofishing surveys (except Cold Creek, which was not surveyed via direct observation) and a systematic sampling approach was used to determine section locations. One section was randomly selected in the lower portion of Lassen Creek and each eighth 300-foot interval was surveyed (sections were spaced approximately every 2400 hundred feet). Hand-held GPS units were used to locate each interval location and specific section boundaries were established at the nearest distinct break in habitat type and/or stream gradient. Surveys were conducted in an upstream direction with two divers; the number of divers per survey section was determined based on wetted width, water visibility, and habitat complexity.

Divers maintained an evenly spaced line perpendicular to the current and counted fish by species. All observed trout were further categorized by size class. 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 ( $\geq$  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 are generally between zero and three inches in total length. If a trout was observed to be less than six inches in total length but it 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.

Divers were instructed in both visual size class estimation and proper snorkel survey techniques prior to starting the survey (establishing a dominant side, determining the extent of their visual survey area, how and when to count (or not count) fish observed, safety considerations, etc.). For each section, surveyors measured section length along the thalweg, water and air temperature, average wetted width and water depth, and water visibility. Habitat type (flatwater, riffle, or pool) was identified following Level 2 protocol as defined in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1988). Representative photographs were taken and GPS coordinates were recorded for the section boundaries.



Figure 1. Vicinity map of 2010 survey location.

Figure 2. Map of Lassen Creek 300-foot delineations by reach.



30 300-foot intervals by reach Low-gradient • Medium-gradient 0 46030 0.5 \_\_\_Miles 0 0.25 31 800 M Ó D T 46 N T.45 M 2 2 00 6000 8900 6200 640 N A F R T I L  $\bigcirc$ O 45N41 25 0 45N41A 0 0 000 6 6 46130 36

Figure 3. Map of Cold Creek 300-foot delineations by reach.



Figure 4. Map of Lassen and Cold creek 2010 survey locations by survey type.

Figure 5. Aerial map of Lassen and Cold creek 2010 survey locations by survey type.



#### Results

Lassen Creek Section 14 was located in the medium-gradient reach in the upper portion of the watershed; however portions of this reach flowed through lowgradient meadow habitat and stream gradient in the section was less than 1% (Figure 6). The section was 335.7 feet in length with an average wetted width of 11.5 feet and an average water depth of 0.4 feet. There was approximately 15% erosion at bankful stage, 0% active erosion, and 14% canopy closure. Habitat was 60% riffle, 30% flatwater, and 10% pool. Overall instream fish cover was rated as poor and water turbulence provided the majority of instream cover (65%). Substrate was dominated by cobble (35%) and gravel (30%) with some silt/fines (15%) and boulder (15%). Streamflow was measured at 4.98 cubic feet per second (cfs). At 8:30 a.m., ambient conductivity was 40.2 microsiemens (µS), water temperature was 9.4 °C, and air temperature was 16 °C. In three passes, a total of 74 Goose Lake redband trout and 12 lamprey (Lampetra spp.) were captured (Table 1). Captured lamprey included both larval and adult forms and were not identified to species. Estimated fish abundance in Section 14 was 1195 Goose Lake redband trout per mile (47.07 pounds per acre) and 283 lamprey per mile (0.9 pounds per acre). Capture efficiency of lamprey was low (7%) which resulted in a high confidence interval (section population estimate of 18±571). Goose Lake redband trout captured in Section 14 ranged in size from 71 mm to 225 mm total length with a mean of 121 mm (average weight of 24.9 g). Captured lamprey ranged from 70 mm to 116 mm total length with a mean of 100 mm (average weight of 2.0 g). Salt was not available but is recommended for future surveys. Mussels (not identified to genus or species) were also observed in the section.

Lassen Creek Section 56 was located in a low-gradient meadow reach. Habitat was 88% flatwater and 12% pool. Stream gradient was measured at less than one percent. The section was 628.4 feet in length with an average wetted width of 14.3 feet and an average water depth of 1.0 feet. There was approximately 65% erosion at bankful stage, 25% active erosion, and 5% canopy cover. Instream fish cover was rated as poor; the majority of cover was composed of undercut banks (36%) and aquatic vegetation (32%). Substrate was graveldominated (60%). Streamflow was measured at 4.95 cfs. In the morning, the air temperature was 20 °C, water temperature was 10.7 °C, and ambient conductivity was 44.7 µS. Salt was added which increased the ambient conductivity to 56.5 µS. A total of 70 Goose Lake redband trout and 64 lamprey were captured in three passes (Table 1). Cattle were actively grazing in the vicinity of the survey section which increased sedimentation and active erosion. Captured lamprey included both larval and adult forms. Estimated fish abundance in Section 56 was 588 Goose Lake redband trout per mile (9.43 pounds per acre) and 807 lamprey per mile (2.77 pounds per acre). Capture efficiency of lamprey was low (0%); in addition to those measured, numerous smaller-sized lamprey (> 30) were captured that were too small to be retained by either the live cars or dip nets. Goose Lake redband trout ranged from 64 mm to 181 mm in total length with a mean of 100 mm (average weight of 12.6 g).

Measured lamprey were between 90 mm and 131 mm total length with a mean of 110 mm (average weight of 2.7 g).

Lassen Creek Section 71 was located in the high-gradient forested reach; stream gradient within the section was measured at eight percent. The section was 225 feet in length with an average wetted width of 12.8 feet and average water depth of 0.6 feet. Habitat consisted of 27% riffle, 5% flatwater, and 68% pools. Overall instream fish cover was rated as excellent and included water turbulence (30%), water depth (25%), boulders (25%), and overhanging vegetation (15%). There was approximately four percent erosion at bankful stage, zero percent active erosion, and 75% canopy closure. Substrate was dominated by boulder (60%) with some cobble (20%) and gravel (15%). Streamflow was measured at 3.34 cfs. At 11:00 a.m., the air temperature was 22 °C, water temperature was 14 °C, and ambient conductivity was 48.5 µS; salt was added which increased the ambient conductivity to 92.9 µS. In four passes, a total of 40 Goose Lake redband trout and 4 lamprey were captured (Table 1). Two of these lamprey escaped before measurements could be taken. Weather conditions changed during the fourth pass and it appeared that thunderstorms were developing, thus the fourth pass was conducted at a more rapid rate. Estimated fish abundance in Section 71 was 962 Goose Lake redband trout per mile (30.90 pounds per ace) and 94 lamprey per mile (0.59 pounds per acre). Goose Lake redband trout ranged in size from 71 mm to 204 mm total length with a mean of 120 mm (average weight of 22.6 g). The two lamprey both measured 121 mm total length (average weight of 4.4 g).

Lassen Creek Section 83 was located in a low-gradient meadow reach and was directly upstream of the Lassen Creek Campground and confluence with Cold Creek. The section was 667.8 feet in length with an average wetted width of 14.0 feet and an average water depth of 0.4 feet. Stream gradient was less than one percent and streamflow was measured at 5.30 cfs. There was approximately 60% erosion at bankful stage, 20% active erosion, and 35% canopy cover. Cattle were actively grazing in the adjacent meadow and crossing the stream during the survey effort. There was evidence of past habitat restoration efforts in this area which included streambank stabilization utilizing boulders, rebar, and woody debris. The section consisted of 96% flatwater and 4% pool habitat with overall instream fish cover rated as fair. Overhanging vegetation accounted for the majority of fish cover in Section 83 (approximately 50%). Substrate was dominated by gravel (40%) and cobble (35%). At 9:00 a.m., the air temperature was 24 °C, water temperature was 12.5 °C, and ambient conductivity was 47.7 µS. Salt was added which increased the ambient conductivity to 59.1 µS. A total of 23 Goose Lake redband trout, 17 lamprey, 99 speckled dace (Rhinichthys osculus), and 99 sculpin (Cottus sp.) were captured in four passes (Table 1). Captured lamprey included both larval and adult forms; smaller-sized lamprey may have escaped capture. Two garter snakes (Thamnophis spp.) were also observed in the section. Captured speckled dace and some redband trout had black speckles on the body, possibly from black spot disease (Figure 7). Estimated fish abundance in Section 83 was 182 Goose Lake redband trout per

mile (6.57 pounds per acre), 150 lamprey per mile (0.66 pounds per acre), 878 sculpin per mile (7.53 pounds per acre), and 1004 speckled dace per mile (4.96 pounds per acre). Capture probability of lamprey, sculpin, and speckled dace were each less than 50%. Goose Lake redband trout ranged in size from 80 mm to 235 mm total length with a mean of 129 mm (average weight of 27.8 g). Lamprey ranged in size from 102 mm to 128 mm total length with a mean of 117 mm (average weight of 3.4 g). Sculpin ranged in size from 43 mm to 109 mm total length with a mean of 73 mm (average weight of 6.6 g). Speckled dace ranged in size from 37 mm to 99 mm total length with a mean of 69 mm (average weight of 3.8 g).

Cold Creek Section 31 was located in medium-gradient forested habitat (Figure 8). The section was 212.0 feet in length with an average wetted width of 5.2 feet and average water depth of 0.3 feet. There was approximately 70% erosion at bankful stage, 10% active erosion, and 70% canopy closure. Cattle were actively grazing in the riparian zone during the electrofishing effort. Habitat was entirely flatwater with excellent fish cover: the major fish cover types present were overhanging vegetation (35%), water turbulence (30%), and aquatic vegetation (20%). Substrate was dominated by cobble (35%), gravel (25%), and silt/fines (20%). Streamflow was not measured in Section 31 but was likely similar to that measured in Section 48 (0.92 cfs). Stream gradient was approximately two percent. At 10:00 a.m., the air temperature was 21 °C, water temperature was 12.8 °C, and ambient conductivity was 36.5 µS. Salt was not available but is recommended for future surveys. In three passes, a total of 29 Goose Lake redband trout were captured (Table 1); these ranged in size from 62 mm to 203 mm total length with a mean of 103 mm (average weight of 16.0 g). Three lamprey and a garter snake were also observed. The estimated abundance of Goose Lake redband trout in Section 31 was 722 fish per mile (38.22 pounds per acre).

Cold Creek Section 48 was located in the low-gradient meadow reach; stream gradient was measured at approximately one percent. The section was 411.0 feet in length with an average wetted width of 5.8 feet and average water depth of 0.3 feet. There was approximately 15% erosion at bankful stage, zero percent active erosion, and 30% canopy closure. Cattle were actively grazing in the surrounding meadow. Habitat consisted of 65% riffle, 30% flatwater, and 5% pool. Overall instream fish cover was rated as poor; nearly half of the cover was from aquatic vegetation. Substrate was dominated by cobble (35%), boulder (30%), and gravel (20%). In the morning, the air temperature was 19 °C, water temperature was 11.4 °C, and ambient conductivity was 37.6 µS. Salt was unavailable but is recommended for future surveys. Streamflow was measured at 0.92 cfs. In three passes, a total of 39 Goose Lake redband trout, four lamprey, and 18 sculpin were captured (Table 1). Goose Lake redband trout ranged in size from 59 mm to 180 mm total length with a mean of 96 mm (average weight of 11.6 g). Lamprey were measured between 81 mm and 101 mm total length with a mean of 90 mm (average weight of 1.4 g). Sculpin ranged from 63 mm to 119 mm with a mean total length of 72 mm (average weight of 5.8 g). Estimated

fish abundance in Section 48 was 501 Goose Lake redband trout per mile (18.23 pounds per acre), 77 lamprey per mile (0.34 pounds per acre), and 385 sculpin per mile (7.01 pounds per acre). The capture efficiencies of both lamprey and sculpin were less than 50%.

Table 1. 2010 Lassen and Cold Creek multiple-pass electrofishing data (Goose Lake redband trout: RB-GL; lamprey: LP; sculpin: SC; speckled dace: DC).

Water	Section	Section length (ft)	Species	Total number captured	Estimated population	Estimated density (fish/mile)	Estimated biomass (lbs/acre)	Capture probability
Lassen Creek	14	335.7	RB-GL	74	76	1195	47.07	67.9%
			LP	12	18	283	0.9	7.0%
	56	628.4	RB-GL	70	70	588	9.43	77.8%
			LP	64	96	807	2.77	0.0%
	71	225	RB-GL	40	41	962	30.9	54.8%
			LP	4	4	94	0.59	66.7%
	83	667.8	RB-GL	23	23	182	6.57	57.5%
			LP	17	19	150	0.66	40.5%
			SC	99	111	878	7.53	42.1%
			DC	99	127	1004	4.96	31.2%
Cold Creek	31	212	RB-GL	29	29	722	38.22	85.3%
	48	411.0	RB-GL	39	39	501	18.23	81.3%
			LP	4	6	77	0.34	0.0%
			SC	18	30	385	7.01	25.7%

Figure 6. 2010 Lassen Creek site photographs.



Figure 7. Photograph of speckled dace captured in Lassen Creek Section 83 with black body spots.



Figure 8. 2010 Cold Creek site photographs.



A total of 1759.0 feet of stream habitat was surveyed in Lassen Creek via direct observation snorkel survey, with an average wetted width of 11.2 feet and an average water depth 1.0 feet (ten sections combined; Table 2). Surveyed habitat was composed of 86% flatwater, five percent riffle, and nine percent pool. Water temperatures ranged from 15 °C to 21 °C and air temperatures were between 20 °C and 31 °C. A total of 108 Goose Lake redband trout and one lamprey were observed (Table 3). Estimated fish densities were 324 Goose Lake redband trout per mile and three lamprey per mile. The size class distribution of observed trout was one percent YOY, 90% small, and 9% medium-sized fish.

	Section length (ft)	Habit	at type perce	Average wetted	Average water	
Section		Riffle	Flatwater	Pool	width (ft)	depth (ft)
7	149.4	65%	35%	0%	10.3	0.4
15	83.0	0%	100%	0%	12.9	0.4
23	189.2	0%	100%	0%	8.1	2.7
31	235.0	0%	80%	20%	13.7	1.4
39	254.2	0%	80%	20%	10.2	1.1
47	188.7	0%	100%	0%	10.4	0.6
55	162.0	0%	65%	35%	11.8	1.1
63	213.0	0%	100%	0%	11.1	1.0
82	206.1	0%	100%	0%	10.3	0.8
90	78.4	0%	100%	0%	12.8	0.8
		Average	)		11.2	1.0

Table 2. Lassen Creek direct observation habitat data 2010.

	Section	Numbe	Estimated			
Section	length (ft)	YOY	Small < 5.9"	Medium 6" - 11.9"	Total	density (fish/mi)
7	149.4	0	9	0		318
15	83.0	0	0 17 0		17	1081
23	189.2	0	0 23 6		29	809
31	235.0	0 14		0	14	315
39	254.2	1 4		1	6	125
47	188.7	0	10	2	12	336
55	162.0	0	0 3		4	130
63	213.0	0 11		0	11	273
82	206.1	0	6	0	6	154
90	78.4	0	0	0	0	0
Total	1759.0	1	97	10	108	324

Table 3. 2010 Lassen Creek direct observation survey data.

### Discussion

The results of the 2010 electrofishing effort on Lassen Creek show Goose Lake redband trout densities ranging from 182 fish per mile to 1195 fish per mile with an average of 732 fish per mile. It appeared densities were lowest in the low-gradient flatwater-dominated meadow sections and highest in higher-gradient forested habitat. There was greater species diversity lower down in the system in the vicinity of the Lassen Creek Campground (Section 83; low-gradient meadow). Capture efficiency of speckled dace, sculpin, and lamprey was poor and the latter two were not identified to species. Approximately 79% of Goose Lake redband trout captured during the electrofishing effort were in the small-sized class (less than 6 inches or 152 mm). The largest redband captured was approximately nine inches in total length (235 mm). Average abundance of Goose Lake redband trout in Cold Creek was approximately 612 fish per mile. Goose Lake redband trout abundance (both density and biomass) and size class distribution was similar in both Lassen and Cold creeks.

Direct observation results showed a range of Goose Lake redband trout densities in Lassen Creek between zero fish per mile and 1081 fish per mile with an average of 324 fish per mile. Fish detection via direct observation in Lassen Creek appeared low; few lamprey and neither sculpin nor speckled dace were observed in any of the direct observation sections. Ninety percent of Goose Lake redband trout observed in Lassen Creek during the direct observation effort were in the small-size class. Previous electrofishing surveys were conducted in Lassen Creek by the HWTP in 1986 and 1999. For both years, estimated abundance of Goose Lake redband trout was much higher than that observed in 2010 (Table 4) and size class distribution was similar for all three years. In 1999, section lengths were estimated and not measured, habitat data including wetted widths were not collected (preventing calculation of biomass estimates), and, in some sections, capture probability was low (leading to high confidence intervals). Given that section lengths were estimated in 1999, abundance estimates may or may not be accurate for this year.

Table 4. Lassen Creek multiple-pass electrofishing data from 1986 and 1999 (Goose Lake redband trout: RB-GL; lamprey: LP; sculpin: SC).

Section	Location description	Survey date	Species	Estimated density (fish/mi)	Estimated biomass (Ibs/acre)	Capture probability
1	unknown	6/18/1986	RB-GL	1107	31.8	86%
	UTIKITOWIT		LP	207	0.2	33%
2	unknown	6/18/1986	RB-GL	1447	43.8	50%
3	Confluence with Bear	6/23/1986	RB-GL	1250	28.6	73%
	Valley Creek		LP	14	0.1	50%
4	unknown	6/23/1986	RB-GL	645	24.0	45%
	UNKNOWN		LP	156	0.7	100%
5	1 mile downstream of		RB-GL	1825	n/a **	69%
	Lassen Creek Campground	8/10/1999	SC-Pit	952	n/a **	78%
6	Confluence with Cold	9/10/1000	RB-GL	2957	n/a **	21%
	Creek	0/10/1999	SC	1144	n/a **	62%
7	Deer Camp above gorge	8/10/1999	RB-GL	4101	n/a **	20%
8	Confluence with Bear Valley Creek	8/11/1999	RB-GL	2675	n/a **	62%

Habitat restoration efforts have occurred throughout the Lassen Creek watershed including bank stabilization (juniper revetment, boulders, and weirs), fish passage improvement (culvert baffles, fish screens on irrigation ditches, and removal of debris jams and beaver dams), and changes in agricultural practices (restrotation grazing and fencing; Figure 9; Goose Lake Fishes Conservation Strategy 1996). Landownership and administration of the Lassen Creek watershed includes a mixture of the US Forest Service (Modoc National Forest), Bureau of Land Management, and private parcels. Agricultural practices, specifically livestock grazing and diversions, are potential stressors to Lassen Creek, impacting channel shape and sinuosity and increasing erosion, water temperatures, and siltation. Figure 9. Photographs of in-channel habitat improvement efforts.



## Conclusion

Lassen Creek and tributaries contain wild populations of Goose Lake redband trout within their native range. This watershed fits numerous criteria for

designation as a Heritage Trout Water including the presence of self-sustaining (wild) trout populations with multiple age classes, no stocking of hatchery fish, suitable habitat, and public access. Lassen Creek is open to fishing from the Saturday preceding Memorial Day through November 15; only artificial lures with barbless hooks may be used and there is a zero-bag limit. The HWTP recommends pursuing Lassen Creek and tributaries for designation as a Heritage Trout Water through continued population-level monitoring and angler use assessments over a multi-year period. For future assessments, the HWTP recommends:

- 1. Gather trend data on population structure and abundance through continued multiple-pass electrofishing surveys.
- 2. Assess angler use, pressure, and catch rates through the installation of Angler Survey Boxes.
- 3. Delineate upstream distribution of sculpin and speckled dace.
- 4. Verify presence or absence of black spot disease.
- 5. Monitor surrounding land use practices and potential effects on the wild trout fishery and habitat.
- 6. Collaborate with local landowners, the Goose Lake Fishes Working Group, and other stakeholders to inform them of proposed designation of Lassen Creek.
- 7. Increase knowledge of adfluvial life-history pattern of Goose Lake redband trout and spawning utilization of both Lassen and Cold creeks by adult lake-form trout.

#### References

Bloom, R., and J. Weaver. 2008. The California Heritage and Wild Trout Program Handbook (Draft). State of California Natural Resources Agency. Department of Fish and Game. Heritage and Wild Trout Program.

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

Hankin D.G., and G.H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Sciences. 45:834-844.

Moyle, P., J. Israel, and S. Purdy. 2008. Salmon, Steelhead, and Trout in California. Status of an Emblematic Species. Center for Watershed Sciences; University of California, Davis. Davis, California.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena Vol. 22 169-199.

Goose Lake Fishes Working Group. 1996. Goose Lake Fishes Conservation Strategy, OR.