Lassen Creek watershed 2011 summary report

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Heritage and Wild Trout Program

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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 federal Species of Special Concern (U.S. Fish and Wildlife Service), a U.S. Forest Service (USFS) Region 5 Management Indicator Species (Moyle, 2011) and a California Fish Species of Special Concern. The California Department of Fish and Game (CDFG) Heritage and Wild Trout Program (HWTP) conducted a Phase 2 candidate water assessment in the Lassen Creek drainage in 2011 to collect baseline fisheries and habitat data and evaluate whether it meets designation criteria 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.

Electrofish depletion and direct observation surveys were conducted in 2010 at various locations throughout Lassen and Cold creeks (Weaver and Mehalick 2010). Based on the 2010 assessments, the HWTP recommended pursuing Lassen Creek and tributaries for designation as a Heritage and Wild Trout Water through continued population-level monitoring and angler use assessments over a multi-year period. This watershed fits numerous criteria for designation, including the presence of self-sustaining trout populations with multiple size classes, no stocking of hatchery fish, suitable habitat, and public access.

In 2011, the HWTP assessment in the Lassen Creek watershed included:

- Replication of 2010 electrofishing depletion surveys in Lassen and Cold creeks to gather baseline population trend data in this system.

- Single-pass electrofishing survey in the lower portion of Lassen Creek to better understand species composition, trout size class structure, and habitat condition in the vicinity of Goose Lake proper.

- Installation, maintenance, and monitoring of an Angler Survey Box (ASB) at the Lassen Creek Campground to assess angler use, catch rates, catch sizes, preferences, and satisfaction ratings.

- Hook and line angling assessment in Lassen Creek to better understand catch rates and catch sizes over a variety of angler experience levels.

- Scale analysis of various size classes of Goose Lake redband trout using samples collected in 2010 to evaluate age class structure.

Methods

Angler surveys

Streamflow measured in Lassen Creek during the July, 2010 fisheries and habitat assessments was approximately five cubic feet per second (cfs). The HWTP conducted a site reconnaissance of Lassen and Cold creeks in June, 2011 to assess survey feasibility; streamflow in Lassen Creek was measured at 40 cfs and the HWTP determined that high flow and poor water visibility precluded the use of either electrofishing or direct observation methodology. On June 21, 2011, the HWTP conducted an angling assessment at various locations throughout Lassen Creek (Figures 2 and 3). Anglers used fly fishing gear and recorded their total effort (hrs) and locations fished using Global Positioning System (GPS) equipment (North American Datum 1983). All landed fish were identified to species. Using a calibrated landing net, total length of each fish to the nearest inch was measured. Catch per unit effort (CPUE; fish/hr) was calculated for each angler.

An ASB was installed at the Lassen Creek campground on May 17, 2011. An examination of voluntary angling data obtained at this ASB location provides further insight into this fishery from an angler perspective including catch rates, catch sizes, angler preferences and angler satisfaction. All completed forms received from this box in 2011 were examined. Forms missing pertinent information such as date or number of hours fished were removed from the analysis. CPUE was calculated for each form and was averaged across all forms analyzed in 2011.

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 in the same location and using the same methods, can be compared over time to study trends in the population. From October 25- 27, 2011, the HWTP conducted multiple-pass electrofishing surveys in Lassen Creek (four sections) and Cold Creek (one section); these sections were established in 2010 and were selected randomly (Weaver and Mehalick 2010). Site sketches, GPS equipment, and previous knowledge were used to relocate the 2010 section locations. Due to time constraints, the HWTP only replicated one section in Cold Creek; this section was randomly selected from the two sections established in 2010.

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 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; ºC) and conductivity (both specific and ambient; microsiemens). These factors were used to determine appropriate electrofisher 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. Geographic coordinates were recorded for both the upstream and downstream boundaries of the survey (North American datum 1983). 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 were 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 measured for total length (mm) and weight (g). 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 (ft) 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 (ft).

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 (cfs) were measured. Representative photographs of the section were taken.

Fish measurements were entered into the CDFW 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/acre; lbs/ac) and density (fish/mi) of each species.

Single-pass electrofishing

A single-pass electrofishing survey was conducted in the lower reach of Lassen Creek, on private property, on October 27, 2012 to better understand species composition, trout size class structure, and habitat condition in the portion of the system directly upstream of Goose Lake. The survey was conducted in an upstream direction using two Smith Root backpack electroshockers. Shallow-water habitat where water depth was conducive to backpack electrofishing was targeted; fish were captured opportunistically at accessible locations and surveyors did not attempt to collect all fish within the section. Captured fish were identified to species, measured for total length (mm) and weight (g), and released back into the section. An abbreviated habitat assessment was conducted concurrent to the single-pass electrofishing survey. The HWTP approximated section length (ft), recorded geographic coordinates of the section boundaries (North American datum 1983), measured water temperature (ºC), conductivity (microsiemens), and pH, and wrote a description of basic habitat attributes.

Scale analysis

To better understand age class structure, scale samples were collected from 100 trout of various size classes across all sections surveyed in Lassen Creek in 2010. 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. Scale samples were mounted on glass slides, digitally imaged under 4x magnification using Image-Pro software, and analyzed independently by three readers to identify the age of each fish at the time of scale collection. Of the 100 mounted slides, scales from 90 fish were readable (scales that were regenerated, had indistinct annuli, were poorly mounted, or

which had debris obscuring annuli were removed from analysis). Discrepancies between the three readers were discussed until a consensus was reached. If a consensus was not reached by all three readers, then age was assigned based on a majority rule.

Results

Angler surveys

The Lassen Creek angling effort occurred at various locations upstream of the US Forest Service Lassen Creek Campground. Six individuals captured a total of 65 Goose Lake redband trout in 22.75 hours of effort (Table 1). Catch per unit effort ranged from 1.3 to 4.0 fish/hr with an average of 2.8 fish/hr. Size class distribution of captured Goose Lake redband trout was 58% small- and 42% medium-sized fish.

In 2011, a total of 12 voluntary ASB forms were evaluated with anglers reporting an effort of 35.5 hrs. A total of 71 Goose Lake redband trout were reported caught with CPUE ranging from zero to ten fish/hr with an average of 2.8 fish/hr. Size class distribution of the reported catch was 61% small- and 39% medium-size fish.

Multiple-pass electrofishing

Lassen Creek flows through both low-gradient meadow habitat and medium- to high-gradient forested reaches. In October, 2011 four sections were surveyed via multiple-pass depletion electrofishing, with a total survey length of 1731.3 feet. Among the four sections, average wetted width was 10.3 feet, average water depth was 0.6 feet, and average streamflow was 1.3 cfs. Habitat was dominated by flatwater (83%), with some pools (12%) and few riffles (5%); the latter were limited mostly to the medium-gradient reaches (Figures 4-7). Bankful erosion ranged from zero to 50% and was highest in the meadow sections due to cattle grazing. Cattle were actively grazing along the riparian corridor during the survey effort. Overall instream fish cover was mostly fair with water depth, undercut banks, and overhanging vegetation forming the dominant cover types. In Section 71, located in relatively high-gradient habitat (8%), instream fish cover was rated as excellent and was dominated by boulders, water turbulence, and water depth. Overall, substrate included cobble (29%), gravel (23%), silts/fines (22%), and boulders (18%). Silts/fines were much more prevalent in the meadow sections, whereas boulders and cobbles were dominant in higher-gradient habitat. In total, the HWTP captured 357 Goose Lake redband trout, 242 speckled dace (*Rhinichthys osculus*), 173 sculpin (*Cottus* spp.) and 174 lamprey (*Entosphenus* spp; Figure 8 and Table 2). Although sculpin were not identified to species, based on fish distribution, they were likely Pit sculpin (*C. pitensis*), a USFS Region 6 Sensitive Species. Native lamprey to the drainage include both Pit brook lamprey (*E. lethophagus*) and Goose Lake lamprey (*E.* sp.), the latter a CDFG Species of Special Concern. Captured lamprey included both larval and

adult forms. Lamprey and Goose Lake redband trout were captured in all four sections and relative abundance was estimated at 1207.6 redband trout/mi (86.32 lbs/ac) and 653.2 lamprey/mi (39.03 lbs/ac). Sculpin and speckled dace were only captured in Section 83, directly upstream of the Lassen Creek campground; abundance in this section was estimated at 388.5 sculpin/mi (4.97 lbs/ac) and 543.1 speckled dace/mi (3.52 lbs/ac). Captured Goose Lake redband trout ranged in total length from 45 to 283 mm (1.8 to 11.1 in), with a mean of 110 mm (4.3 in). A few speckled dace were observed with black spots on the body.

Cold Creek flows mainly through forested habitat, with some meadow areas in the lower portion directly upstream of the confluence with Lassen Creek (Figure 9). The 2011 depletion electrofish section included both forest and meadow lands and was comprised of 60% flatwater, 35% riffle, and 5% pool habitat. A total of 392.1 ft of stream was surveyed, with an average wetted width of 5.6 ft and average water depth of 0.2 ft. Streamflow was measured at 0.4 cfs. Water temperature was 2º C and air temperature was -1º C at 9:30 a.m. Anchor ice was present at the start of the survey and was removed to the greatest extent possible during the first pass of the electrofish effort. Substrate was cobble-dominated with some gravel. Overall instream fish cover was rated as good; boulders and water turbulence formed the major cover types. In four passes, a total of 109 Goose Lake redband trout, 16 sculpin, and two lamprey were captured. Relative abundance was estimated at 1589 Goose Lake redband trout/mi (40.25 lbs/ac), 228.9 sculpin/mi (8.03 lbs/ac), and 26.9 lamprey/mil (0.36 lbs/ac). Goose Lake redband trout ranged in total length from 36 to 167 mm (1.4 to 6.6 in) with a mean of 85 mm (3.3 in).

Single-pass electrofishing

Approximately 430 ft of stream habitat was surveyed via single-pass electrofishing in the lower portion of Lassen Creek above Goose Lake (directly upstream of the railroad crossing). This portion of the creek was mainly flatwater, with good fish cover dominated by overhanging vegetation (Figure 10). Substrate consisted predominantly of gravel. A beaver dam was located within the section, which impeded backpack electrofishing; approximately 500 feet of creek habitat upstream of the beaver dam was too deep to effectively electroshock and surveyors did not sample this portion of the creek. The single-pass electrofish effort yielded a capture of five Goose Lake redband trout, 11 Goose Lake tui chub (*Gila bicolor thalassina*), 16 Goose Lake suckers (*Catostomus occidentalis zacusanserinus*), 21 speckled dace, and one lamprey (Table 3). HWTP staff visually examined the portion of the mouth of the creek and its connectivity to Goose Lake. Fish habitat in this lower-most portion was poor due to sandy substrate, shallow water, degraded streambanks, and little to no riparian vegetation, the majority of which can be attributed to fluctuating lake levels (Figure 11). In addition, cattle were actively grazing in the area.

Scale analysis

A total of 90 Goose Lake redband trout were analyzed for age. The results identified four age classes. The majority of fish sampled were in the 1+ age class (N=59) and consisted of fish ranging from 70 to 133 mm total length. Age 2+ were between 96 and 165mm (N=14). Age 3+ fish were between 142 and 225 mm (N=15). Two fish were aged at 4+ years and ranged in total length from 168 to 202 mm.

Discussion

Goose Lake redband trout appear to be the most abundant species in terms of both density and biomass in Lassen and Cold creeks and, along with lamprey, were captured in all sections surveyed in 2010 and 2011. Greater species diversity was observed lower in the system. Goose Lake suckers and Goose Lake tui chub were only captured in Section 111 and the upstream extent of their distribution is currently unknown. Speckled dace were only captured in meadow habitat directly upstream of the Lassen Creek campground (Lassen Creek Section 83 and Cold Creek Section 48). Speckled dace and some redband trout captured in 2010 had black speckles on the body, possibly from black spot disease (Weaver and Mehalick 2010). In 2011, only a few speckled dace were observed with black spots.

The results of the 2011 multiple-pass depletion electrofishing effort in Lassen and Cold creeks indicate that Goose Lake redband trout densities were relatively similar among all sections surveyed. Estimated biomass was also similar in four of the sections, with the exception of Section 14 (upstream-most section) which had an estimated biomass four to six times higher than that observed elsewhere. Section 14 also had the highest estimated abundance of all sections sampled in 2010 (Weaver and Mehalick 2010). In Lassen and Cold creeks, mean estimated abundance increased in all sections from 2010 numbers (Figure 12 and Table 4).

A size class distribution comparison of Goose Lake redband in Lassen Creek between angling (hook and line and ASB combined) and electrofishing for 2011 showed similar result, including a higher percentage of smaller-sized fish (<6 in; 58% and 81%, respectively; Figure 13). A comparison of redband sizes captured in Lassen versus Cold creeks in 2011 indicated that Cold Creek had a higher percentage of smaller-sized trout (97%). No trout larger than the medium-size class (12 in) was captured or reported caught in 2011.

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 (rest-rotation grazing and fencing; Goose Lake Fishes Conservation Strategy 1996). Landownership and administration of the Lassen Creek watershed includes a mixture of US Forest Service (Modoc National Forest), Bureau of Land

Management, and private parcels. Agricultural practices, particularly livestock grazing and water diversions, are potential stressors to Lassen Creek, impacting channel shape and sinuosity, decreasing instream flows, increasing water temperatures, erosion, and siltation.

Conclusion

Lassen Creek and tributaries contain wild populations of Goose Lake redband trout within their native range. 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). Lassen Creek supports an adfluvial life history pattern during periods of average or above-average water levels in Goose Lake (Goose Lake Fishes Conservation Strategy, 1996), in which large (>18”), lake-dwelling redband adults utilize the stream for spawning. Juveniles likely rear in Cold and Lassen creeks and, provided subsequent high water years occur, outmigrate to the lake to utilize this super food-rich habitat. Lassen Creek, among other tributaries in both California and Oregon, undoubtedly provide critical habitat that sustains the redband population (and other fishes) during periods when Goose Lake dries entirely (e.g., 1926, 1992, 2010-present).

Lassen Creek is open to fishing from the Saturday preceding Memorial Day through November 15; only artificial lures with barbless hooks may be used with a zero-bag limit.

Based on the results of these assessments, the HWTP recommends proposing to the California Fish and Game Commission that Lassen Creek and tributaries upstream of the Lassen Creek campground be designated as a Heritage and Wild Trout Water. In addition, the HWTP recommends:

Maintain and monitor ASBs.

Verify presence or absence of black spot disease.

Monitor surrounding land use practices and potential effects on the wild trout fishery and habitat.

Collaborate with local landowners, the Goose Lake Fishes Working Group, and other stakeholders to inform them of the proposed designation of Lassen Creek and what that entails.

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

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Rosgen, D.L., 1994. A classification of natural rivers. Catena Vol. 22 169-199.

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Figure 1. Vicinity map of 2011 survey location

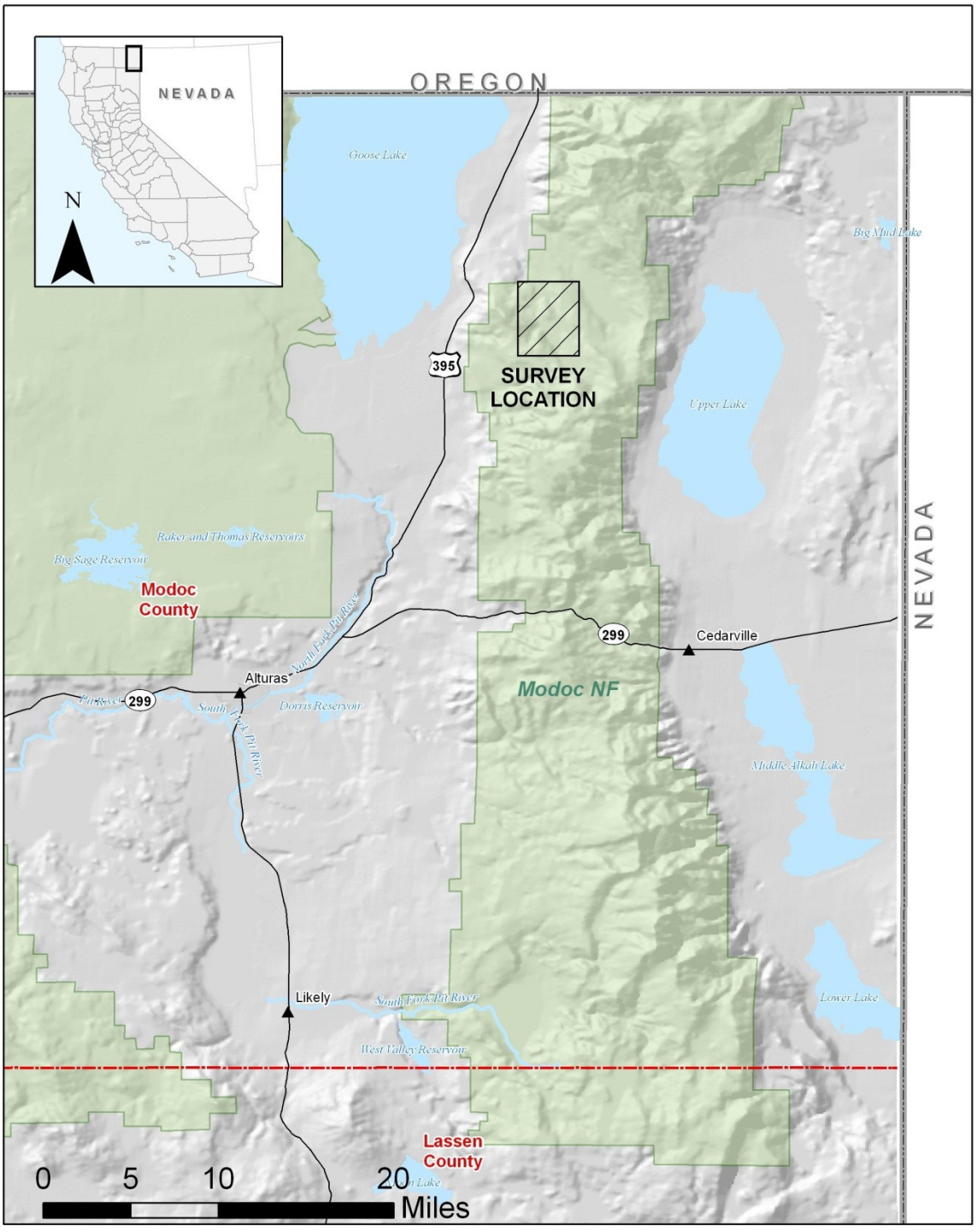

Figure 2. Map of Lassen and Cold creek 2011 survey locations by survey type

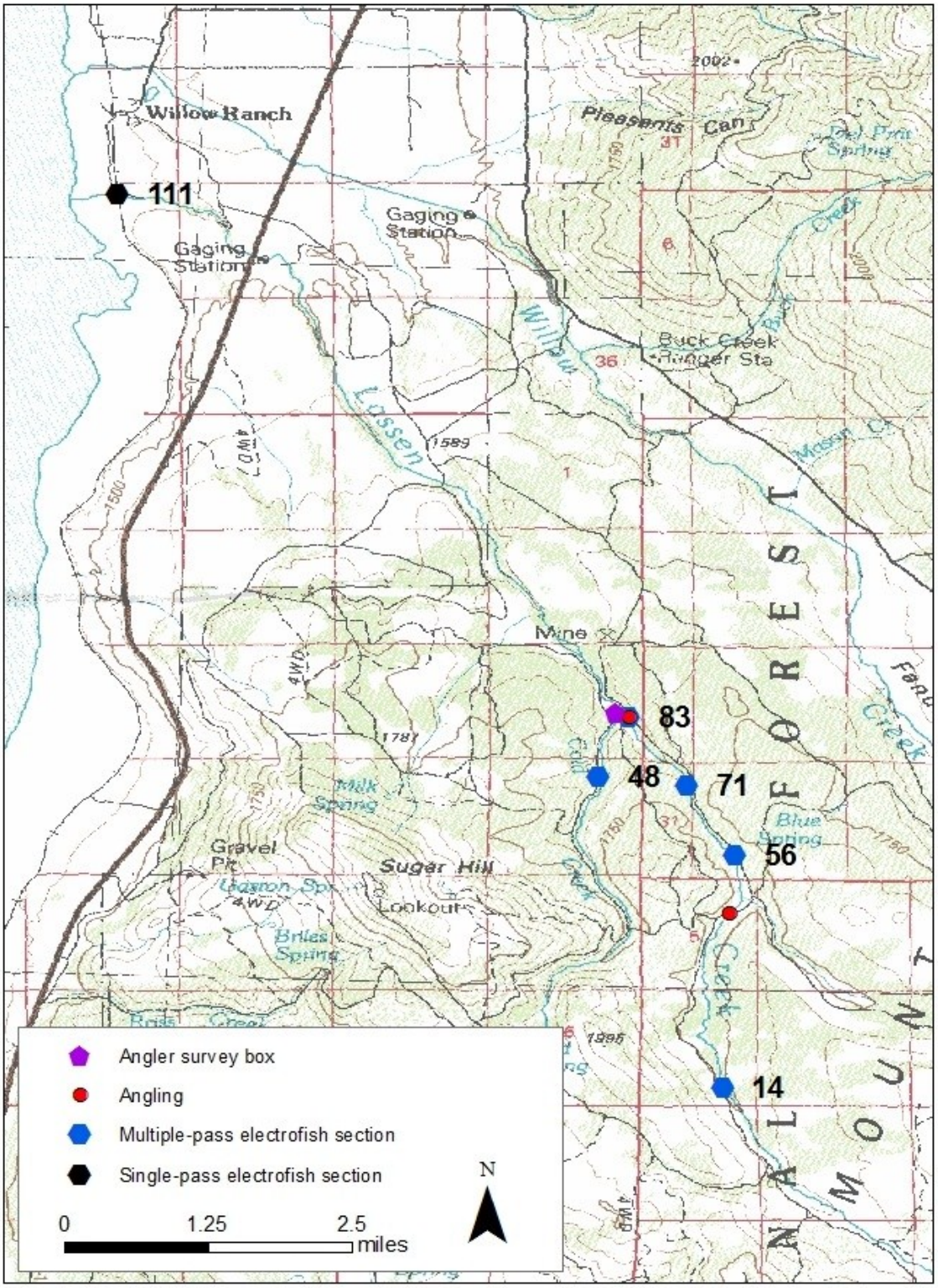

Figure 3. Aerial map of Lassen and Cold creek 2011 survey locations by survey type

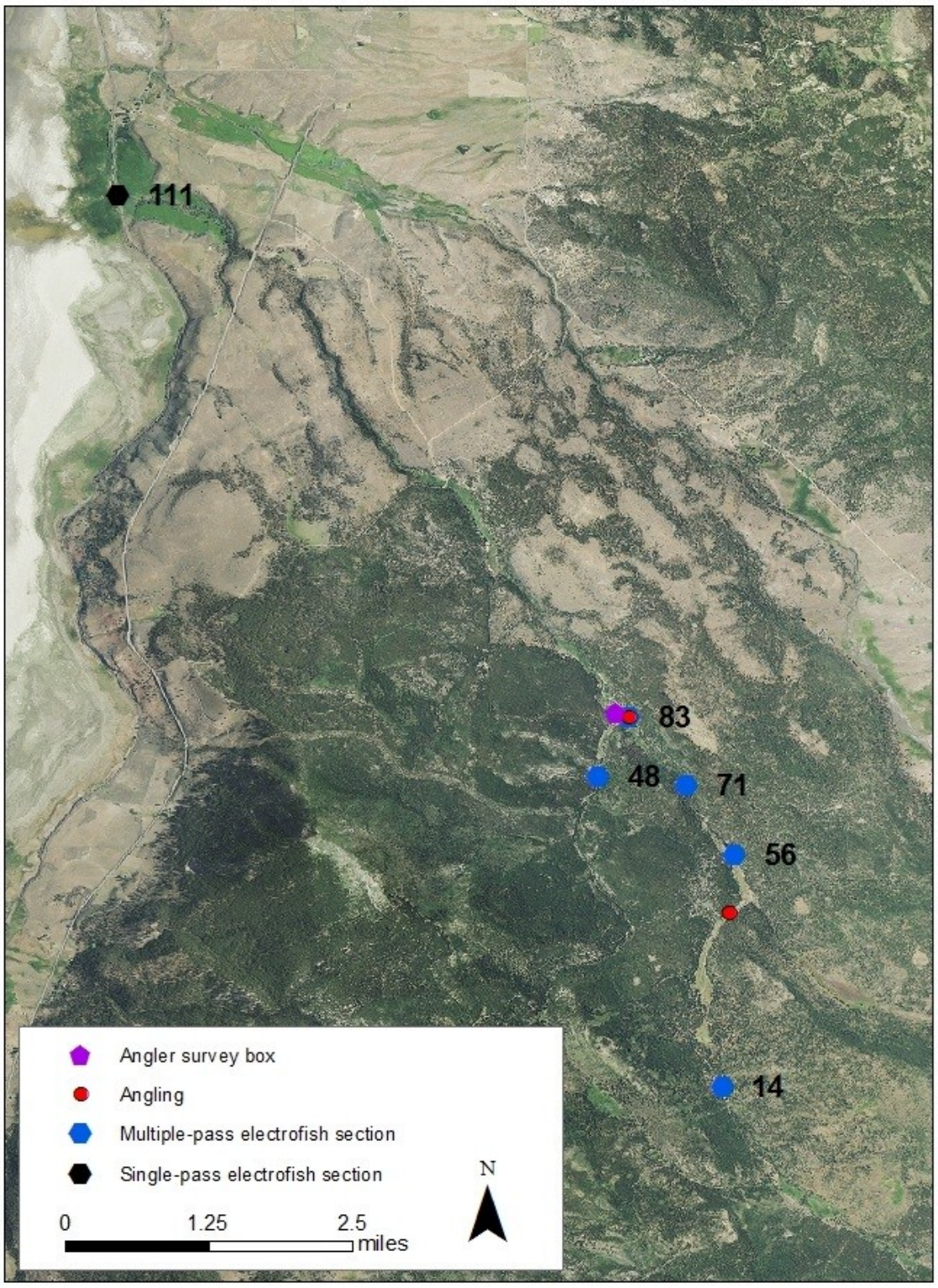

Figure 4. Lassen Creek Section 14 site photographs

Figure 5. Lassen Creek Section 56 site photographs

Figure 6. Lassen Creek Section 71 site photographs

Figure 7. Lassen Creek Section 83 site photographs

Figure 8. Photographs of fish captured in Lassen Creek in 2011

Figure 9. Cold Creek Section 31 site photographs

Figure 10. Lassen Creek Section 111 site photographs

Figure 11. Photographs of the lower reach of Lassen Creek directly upstream of Goose Lake in 2011

Figure 12. Comparison of 2010 and 2011 multiple-pass depletion electrofishing data for Goose Lake redband trout from Lassen and Cold creeks by section

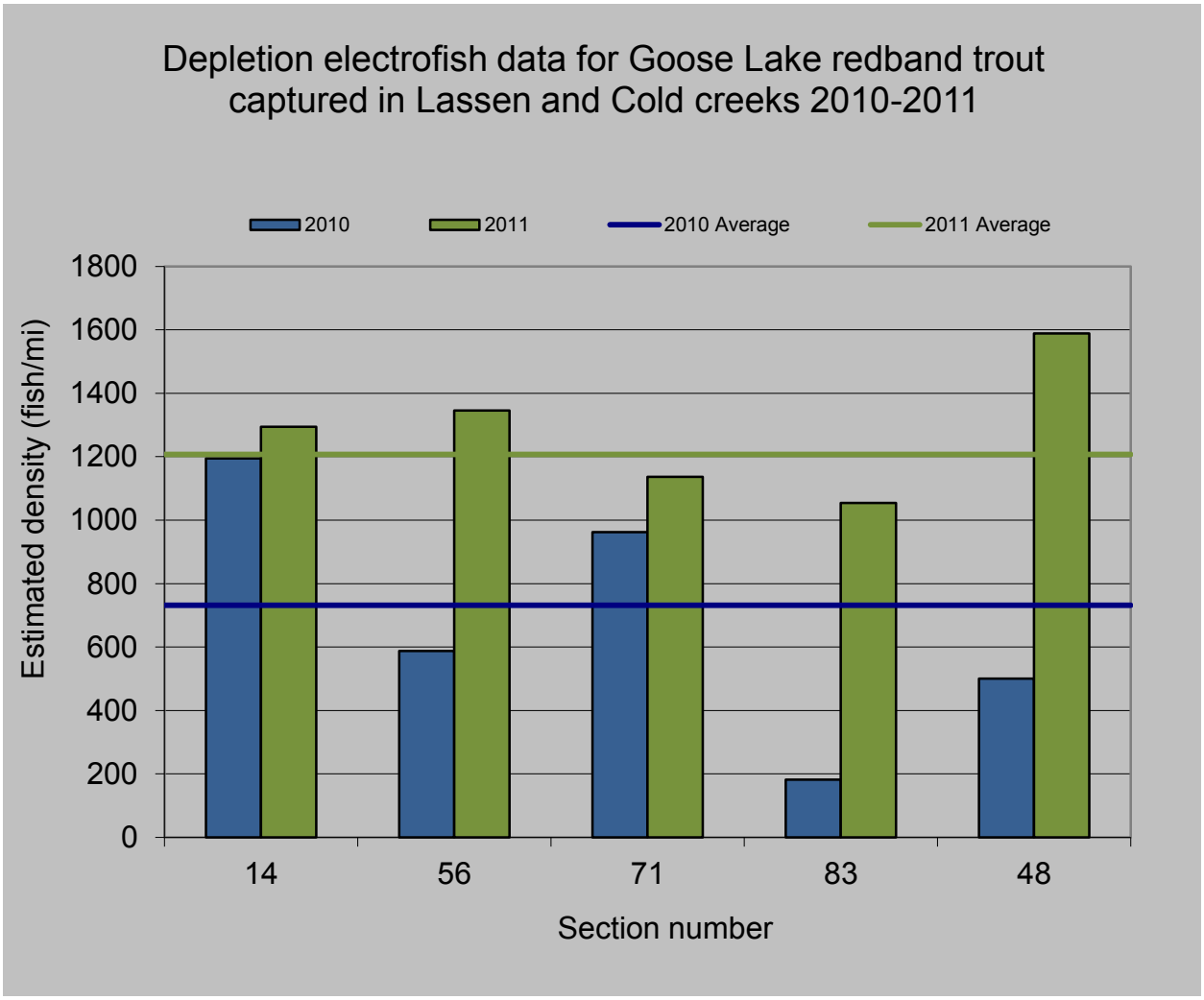

Figure 13. Comparison of size class distribution observed or reported by survey type in Lassen and Cold creeks in 2011

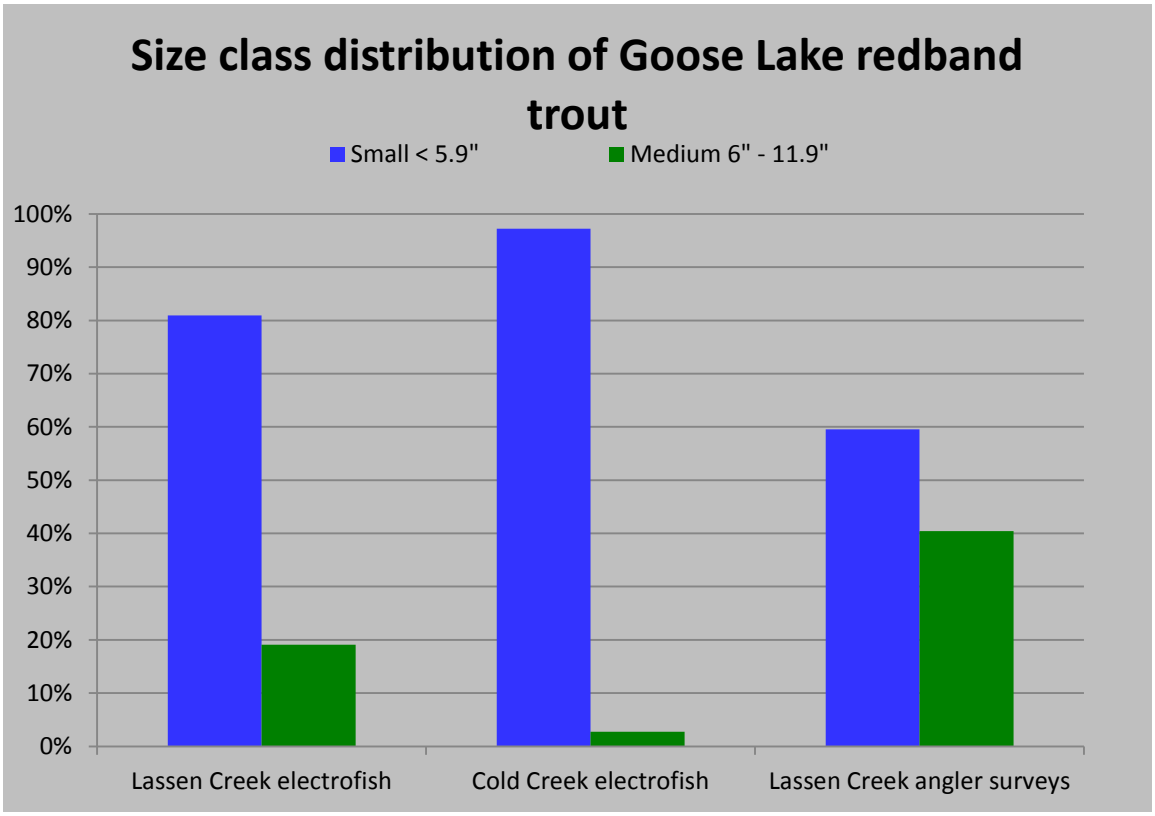

Table 1. Lassen Creek 2011 angling data

Angler	Effort (hrs)	Number of Goose Lake redband trout captured			CPUE (fish/hr)
		Small	Medium	Total	
		< 5.9"	6" - 11.9"		
Drummond	4.00	4	6	10	2.5
Pini	3.75	4	1	5	1.3
Rizza	4.25	5	9	14	3.3
Silva	3.75	12	1	13	3.5
Wassmund	3.00	6	1	7	2.3
Zuber	4.00	7	9	16	4.0
Total	**22.75**	**38**	**27**	**65**	**-**

Table 2. Lassen and Cold creek 2011 multiple-pass depletion electrofishing data by section (Goose Lake redband trout: RB-GL; lamprey: LP; sculpin: SC; speckled dace: DC)

Water	Section	Section length (ft)	Species	Total number captured	Estimated section population	Mean weight (g)	Estimated density (fish/mi)	Estimated biomass (lbs/ac)	Capture probability
Lassen Creek	14	289.8	RB-GL	70	71	90.7	1294	29.3	60.9%
			LP	39	42	3.06	765	4.1	46.4%
	56	557.2	RB-GL	137	142	20.6	1346	45.8	66.5%
			LP	62	102	3.2	967	5.1	26.6%
	71	218.3	RB-GL	45	47	25.5	1137	57.9	63.4%
			LP	3	3	3.9	73	0.6	50.0%
	83	666.0	RB-GL	105	133	22.5	1054	36.3	57.7%
			DC	242	274	3.6	2172	14.1	50.9%
			SC	157	196	7.1	1554	19.9	41.4%
			LP	68	102	3.4	809	5.0	7.1%
Cold Creek	48	392.1	RB-GL	109	118	7.8	1589	40.3	47.0%
			SC	16	17	10.8	229	8.0	45.7%
			LP	2	2	4.1	27	0.4	50.0%

Table 3. Lassen Creek 2011 Section 111 single-pass electrofishing data (Goose Lake redband trout: RB-GL; lamprey: LP; speckled dace: DC)

Section	Section length (ft)	Species	Total number captured
111	430.0	RB-GL	5
		Goose Lake tui chub	11
		Goose Lake sucker	16
		DC	21
		LP	1

Table 4. Lassen and Cold creek 2010 multiple-pass depletion electrofish data by section (Goose Lake redband trout: RB-GL; lamprey: LP; sculpin: SC; speckled dace: DC)

Water	Section	Section length (ft)	Species	Total number captured	Estimated section population	Mean weight (g)	Estimated density (fish/mi)	Estimated biomass (lbs/acre)	Capture probability
Lassen Creek	14	335.7	RB-GL	74	76	24.9	1195	47.07	67.9%
			LP	12	18	2.0	283	0.9	7.0%
	56	628.4	RB-GL	70	70	12.6	588	9.43	77.8%
			LP	64	96	2.7	807	2.77	0.0%
	71	225	RB-GL	40	41	22.6	962	30.9	54.8%
			LP	4	4	4.4	94	0.59	66.7%
	83	667.8	RB-GL	23	23	27.9	182	6.57	57.5%
			LP	17	19	3.4	150	0.66	40.5%
			SC	99	111	6.6	878	7.53	42.1%
			DC	99	127	3.8	1004	4.96	31.2%
Cold Creek	31	212	RB-GL	29	29	16.0	722	38.22	85.3%
	48	411.0	RB-GL	39	39	11.6	501	18.23	81.3%
			LP	4	6	1.4	77	0.34	0.0%
			SC	18	30	5.8	385	7.01	25.7%